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## The New Power Station of the Lindell Railway Company, St. Louis.

The Lindell Railway company of St. Louis was a pioneer in electric railway work in the West. In 1887 the Julien storage battery was tried. One car was operated quite successfully during a period of some four months. The results were of such a satisfactory nature that an order was given for more batteries. The second lot was constructed of lighter material, however, and the working results were such that the company became discouraged and discontinued the work entirely.

In 1889 the Sprague Electric Railway company had achieved success in the East, and the management of the Lindell company ventured again in the electric railway field.

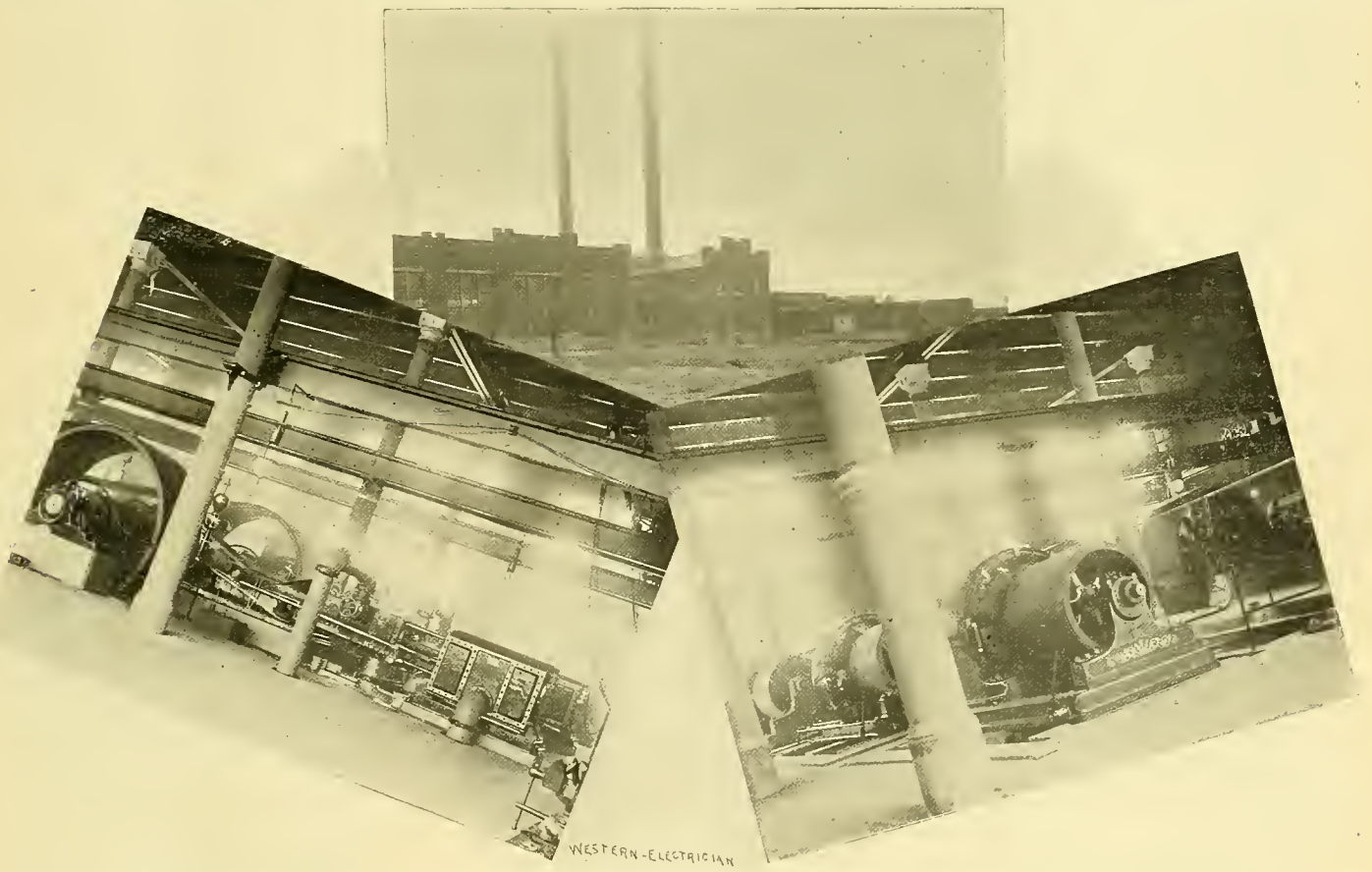


Fig. 5. One of the Engines.

Fig. 1. General Exterior View.

Fig. 6. The Three Generators.

THE NEW POWER STATION OF THE LINDELL RAILWAY COMPANY, ST. LOUIS.

A small power plant was erected, supplying power for the west end of the Chouteau avenue division. This was followed immediately by the enlargement of the plant to a capacity sufficient to operate the entire road. New lines and extensions were then taken up and more machinery was added to the power house. Extensions of lines and power continued, and some eighteen months ago it became apparent that a new power station was necessary. The old power station, having a nominal output of 3,000 amperes, was frequently forced up to 4,500 amperes, and new lines were yet to be constructed.

### THE NEW POWER STATION.

The new station is located at Vandeventer and Park avenues, on a tract of ground embracing some fourteen acres. In Fig. 1 is given a general exterior view of the new station, showing the power house, coal shed, coal track and water tank. In the left center is shown the greater part of the engine and generator room, and on the right or south side is the boiler house, and between the two the pump house can be seen.

The building is a substantial structure of brick and stone, covering a ground space 168 feet long with 104 feet minimum width and 154 feet maximum width, and is fireproof throughout, the roof and flooring being of iron, slate and concrete. No insurance is carried.

### WATER SERVICE.

Near the southern boundary of the premises is a natural spring flowing out at the surface at a rate of 70 gallons per minute. This is piped into a cistern of 18,000 gallons capacity situated at a slightly lower level, and from this in turn the water is piped by means of a siphon into the main cistern of 40,000 gallons capacity, situated just west of the power house. From this cistern the surplus water overflows into a sewer. There is also a smaller cistern of 12,000 gallons capacity, which accumulates water from a number of small springs in the vicinity. This connects directly to the cold water service pump. An elevated tank having a capacity of 15,000 gallons is kept full by a pump operated by an electric motor and supplies water to the car shed and other parts of the premises. A small tank on the roof of the pump house supplies the cold water service.

### COAL SUPPLY.

Adjoining the boiler room on the south is the coal shed, 154 feet long, 80 feet wide and 21 feet high, into which is laid a spur track connecting with the St. Louis and San Francisco railroad at a distance of some 1,300 feet. The shed has a capacity for storing 125 carloads of coal. The main floor of the coal shed is elevated some five feet above the floor of the boiler room, and at a distance of some 10 feet from the main wall of the boiler room it slants down to a level with the floor of the boiler room. Twenty-three openings three by three feet in dimension permit the coal to pass into the boiler room as needed. The floor space in the boiler room between the furnace fronts and the main wall is only nine feet wide. Coal is shoveled directly from the openings into the furnaces. No surplus coal is stored in the boiler room.

### BOILER ROOM.

The boiler room, in the south end of the building, has a length of 154 feet, a width of 40 feet and is 35 feet high. The roof is constructed of slate and has a monitor skylight two-thirds its entire length. Almost the entire floor space is occupied by the boilers, only a space of nine feet intervening between the furnace fronts and the coal chute openings in the main south wall.

The entire boiler plant has been erected and is sufficient to supply two additional power units which will ultimately be erected in the engine room. It consists of four batteries of Stirling water-tube boilers, 660 horse power each. Each battery is composed of two 330 horse power boilers. The furnaces are fitted up with the Hawley down-draft device. The draft is supplied by two stacks 160 feet high and 90 inches in diameter, constructed of ¼ and 3-16 inch steel and plainly shown in Fig. 1. A Tingley ash conveyor operated by an electric motor removes the ashes to an ashpit outside the building. On top of each battery is mounted a Hooper live steam feed water purifier with cleaning pans. A view of the boiler room taken during construction is shown in Fig. 2.

### PUMP ROOM.

The pump room, Fig. 3, located between the boiler room and the engine room, is 104 feet long, 24 feet wide and 20 feet high. The roof is constructed of iron, with concrete arches, and it has a ventilating skylight in the center and is also well lighted by large windows in each end. In this room are located two 1,000 horse power Excelsior feed water heaters. The cold water service is supplied by a Worthington pump, 7½ by 8½ by 10 inches, taking water directly from the main cistern and also from the smaller cistern. Connection with the city water main is also provided for emergencies. Two Worthington pumps, 12 by 8 by 18 inches, and 12 by 8 by 10 inches, supply feed water. These three pumps are fitted with automatic regulating devices by means of which they are shut down whenever the pressure reaches a certain limit.

Two small Worthington pumps, shown in Fig. 4, are used for pumping oil. One is used for the engine oil, which is pumped into an elevated tank, from which it flows

by gravity to the engine bearings. After passing through the bearings the oil is collected and piped back to the basement of the pump room and is discharged into a water filter, which in turn discharges into a tank from which the oil is again pumped up into the elevated tank and again passes to the engine bearings. The other small pump is used for pumping the cylinder oil from a tank in the basement directly into the cylinder of the Ashton lubricators. With this system all carrying of oil, both engine and cylinder, is entirely avoided, with the consequent saving of labor and oil.

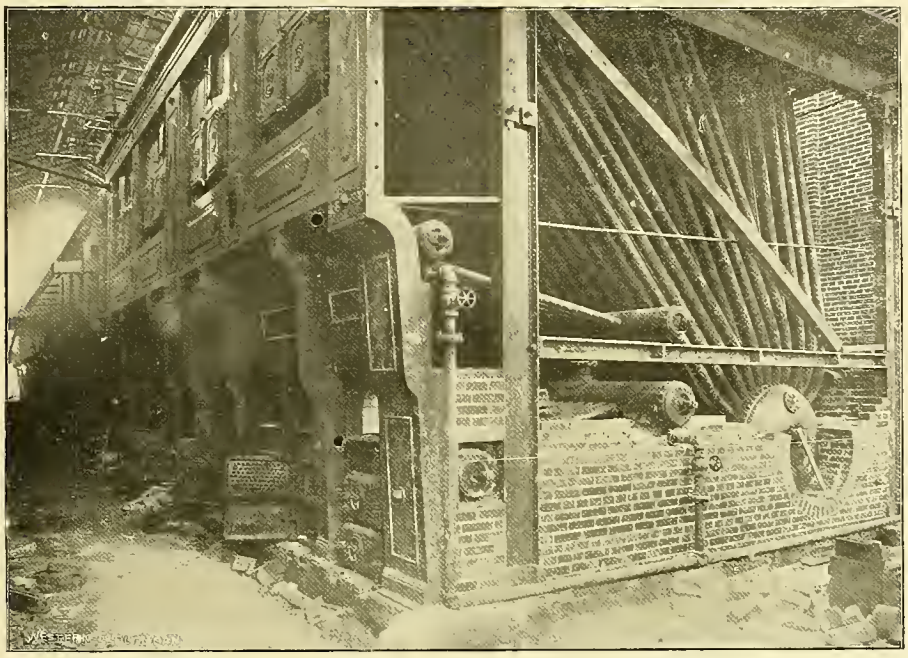

FIG. 2. THE NEW POWER STATION OF THE LINDELL RAILWAY COMPANY, ST. LOUIS.—BOILER ROOM.

In this department is also located a bath room, lavatory, water closet and lockers for the employes of the station.

STEAM DISTRIBUTION.

All steam piping is carried through the basements of the pump and engine rooms, the pump room having a basement throughout its entire area for this purpose. The boilers are connected by four 14 inch pipes to a 16 inch equalizing header located in the rear of the boilers. From this header three 10 inch pipes lead down to the pump room basement, and thence into the basement passageways under the engine room, where they pass through separators and thence up to the engines.

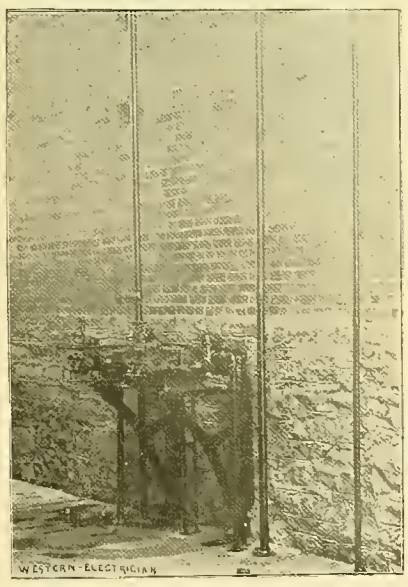


FIG. 4. THE NEW POWER STATION OF THE LINDELL RAILWAY COMPANY, ST. LOUIS.—OIL PUMPS.

The exhaust pipes connect to a 30 inch exhaust header located in the basement of the engine room, and from this two 18 inch pipes lead into the basement of the pump room and thence up to the two 1,000 horse power Excelsior heaters in the pump room, and these are connected to a 30 inch exhaust pipe leading up the exhaust head. A hot well of ,000 gallons capacity is located in the pump room basement, also an automatic receiver, in which the condensed water from the separators and exhaust header is collected and pumped back direct to the boilers.

ENGINE ROOM.

The engine room, shown in Figs. 5 and 6, is 104 by 104 feet and 25 feet high, and is well lighted by large windows on the east and west sides. As will be noted in the views, it has a most spacious and substantial appearance. The roof is double, the upper or main roof being of the usual four-ply composition, while the lower roof is composed of iron with concrete arches with a granite dressing on top. This double roof is supported by twelve steel columns, which also sustain three sets of I beams for three 15 ton traveling cranes from the Whitney Foundry & Equipment company.

ENGINES AND GENERATORS.

The present installation consists of three units, each composed of a tandem compound Southwark Foundry engine, 22 by 38 by 36, running at a speed of 140 revolutions per minute, with direct belt connection to a 750 horse power Westinghouse generator. Two other units will be ultimately added, floor space being provided for that purpose. The generators are of the Westinghouse standard four-pole medium speed type and are over-compounded for a variation of 10 per cent. in pressure on line. Fig. 5 shows one of the engines and Fig. 6 the three generators.

SUBWAYS.

The engines and dynamos are set on concrete foundations. The engine foundations have basement passageways on three sides and these join a transverse passageway leading eastward to the main east wall, from which a subway leads northward and then westward just north of the generators, and then northward to the basement of the wire tower. The generator mains, equalizers and regulating wires are carried through this subway from the generators to the wire tower and thence up to the generator switchboard. The supporting cleats are made of wood boiled in paraffine oil.

These subways are of concrete throughout, seven feet high and four feet wide and are well lighted. They are kept well dried by means of the warm air from the steam pipes in the basement of the engine room. The wire tower supplies sufficient draft for this purpose.

SWITCHBOARD.

The switchboard, one-half of which is shown in Fig. 7, is located at the base of the wire tower in the north end of the room. It is a very handsome structure of white marble panels with brass finish, supported in an iron frame 60 feet in length and 11 feet high. It is set about two feet from the face of the main north wall of the building. Behind the board is the well lighted wire tower, giving a floor space 60 by 9 feet, in which all connections of generator feed wires, bus-bars, etc., are made.

The right-hand part is the generator switchboard, on which are mounted three main dynamo switches, three main automatic circuit breakers and three ammeters reading up to 1,200 amperes each. The automatic circuit breaker not only breaks the two generator mains, but also the equalizer circuit, and thus leaves the generator entirely dead. On this section of the board is also mounted the main or totalizing ammeter, which is of the new Weston shunt type reading up to 7,000 amperes, also a Westinghouse potential indicator. Portable voltmeters are also supplied for ordinary use.

The left-hand part of the switchboard is the feeder board and is subdivided into 20 feeder sections, each section having from one to eight feeders connected. Each feeder section is provided with a single-pole bus-bar switch, an automatic circuit breaker, an ammeter reading up to 500 amperes, and a single-pole switch for each feeder. There are 60 No. 0000 feeders leading out of the feeder board.

WIRE TOWER.

The wire tower, which was designed especially for the purpose, is located at the north end of the building, is 60 feet long, 9 feet wide and 25 feet high. The roof is of slate. The feeders are led through the main wall at a height of 20 feet. Sixty iron tubes were laid into the brick work, and 60 wooden tubes, previously treated by boiling in paraffine oil and then being turned down to gauge, were driven into the iron tubes. The feeders are led through these wooden tubes. The feeders land on a well-strutted landing rack planted about 12 feet from the wire tower.

MULTIPLE WORKING OF THE TWO POWER STATIONS.

An interior view of the old power house is shown in Fig. 8. The building is located on the line of the Missouri Pacific Railroad, at the corner of Papin street and Compton avenue, and the plant has a nominal output of 3,000 amperes. This station will be worked in multiple with the new one. Each feeder section of the switchboard in the new house is duplicated in the old plant, and each feeder leading out of the new house is run to the old feeder lines at the nearest or most convenient point, and there connects by means of a half-connection to a corresponding feeder from the old house. The load can thus be shifted from one power house to the other on any feeder section, or both houses can work in multiple on any one or all feeder sections. Direct telephone connection between the two stations enables them to operate in perfect harmony under all conditions of load and other requirements. After midnight the new station is shut down and the old station then carries the owl car load until morning.

CAR SHEDS.

In the rear of the new power house is located the car shed, not visible in the view. The shed at present is 400 feet long, 65 feet wide and 22 feet high, and has a storage capacity for 60 forty-foot cars. There is ample ground space for additions to car sheds and power house. Aside from the car sheds at the new station there is also a larger shed at Newstead and Fairfax avenues, having a storage capacity for 150 forty-eight-foot cars. At Vandeventer and Finney avenues there is a small shed and repair shop, while the general repair shop is on Chouteau avenue, near Jefferson avenue.

The rolling stock equipment consists of 110 long cars, 60 sixteen-foot cars and 30 trail cars. The total mileage of the system is 56 miles of single track.

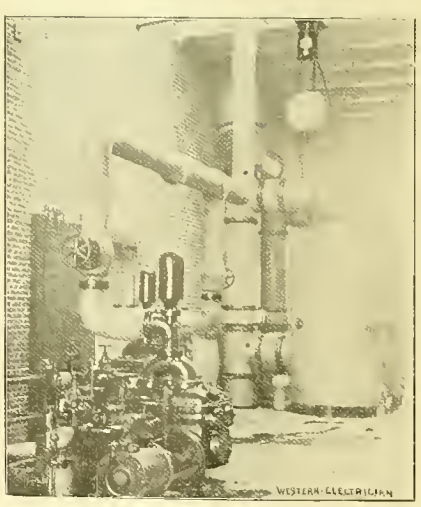


FIG. 3. THE NEW POWER STATION OF THE LINDELL RAILWAY COMPANY, ST. LOUIS.—PUMP ROOM.

IN GENERAL.

Many details of the water and steam service have been omitted in this condensed description. The main object kept in view in designing the station was to secure economy and stability of operation in every detail, and to provide ample means for cleaning, repairs, alterations and all possible emergencies. As a whole the new station is an excellent illustration of a well planned, well constructed street railway power station, and reflects much credit on the management.

The officers of the company are: President, Edwards Whitaker; vice-president, Chas. D. McLure; secretary and

treasurer, Jas. Adkinson; superintendent, G.W. Baumhoff; electrical engineer, A. W. Morrell. Under the direction of these gentlemen the station was planned and constructed.

## Rumored Down-town Trolley Line for Chicago.

There is a possibility of a trolley road being built on State street, Chicago, for a distance of one block. The present plans of the West Chicago street railroad people contemplate bringing electric cars from several of their West Side lines down Lake street, under the Lake Street Elevated, from Halsted to State street, and then turning south on State street, running to Randolph street, and stopping there. It is said that the necessary consent of property owners has been obtained, and there is practically nothing in the way of the construction of the trolley line on these down-town streets. The plans for the line on State street contemplate a single row of poles in the center of the street with arms holding the trolley wires. It is claimed that the road can be run in the block from Lake street to Randolph street without putting more than three poles in the street. It is by the aid of this down-town outlet for their electric lines that the West Side people hope to meet the competition of the Metropolitan Elevated. The electric lines which will compete directly with the Metropolitan Elevated will be brought down over this route, and it is claimed that the advantage of landing passengers in front of Marshall Field's will offset the rapid transit of the elevated road so long as it has no better terminal than it has at present.

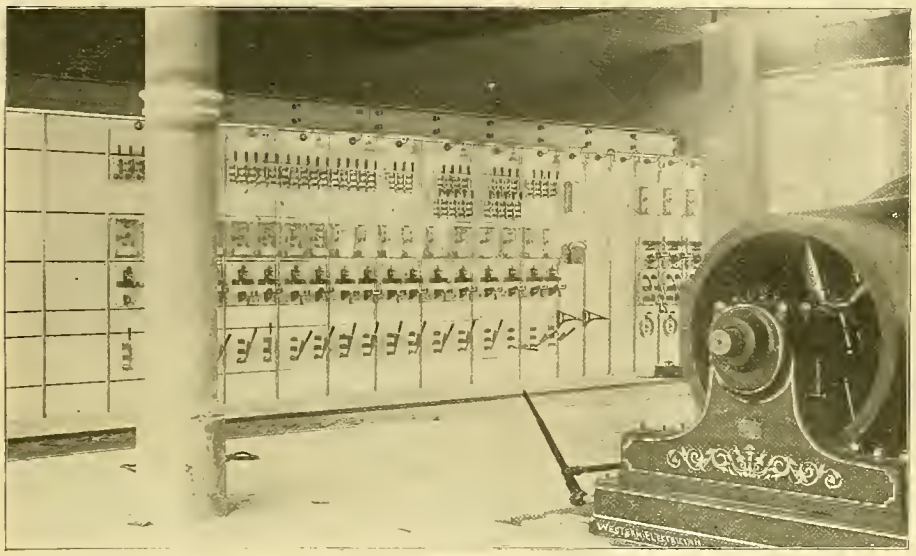

FIG. 7. THE NEW POWER STATION OF THE LINDELL RAILWAY COMPANY, ST. LOUIS.—SWITCHBOARD.

## O'Hara—Hickey.

To one member of the WESTERN ELECTRICIAN staff the holiday season of 1894-95 will always have a peculiar and delightful significance, for on December 27th John B. O'Hara, the managing editor of this journal, was united in marriage at Rochester, N. Y., to Miss Margaret A. Hickey, daughter of the late Jeremiah Hickey, who was for many years a prominent resident of the pleasant city in which the ceremony took place. The marriage service was conducted by the Rev. Felix O'Hanlon, in the Convent of Mercy, and Mr. and Mrs. O'Hara are now enjoying an extended wedding trip in the East and South. Mr. O'Hara's associates cannot deny themselves the pleasure of making allusion to the warm sentiment of esteem in which they congratulate him on his happy marriage. In doing this they but echo the expression of good wishes from a large number of friends in the electrical field.

## Union College and the General Electric Company.

At the recent annual banquet of the alumni of old Union College of Schenectady, N. Y., held in the city of New York, President Raymond said that it was his privilege to announce for the first time the introduction of an electrical engineering course in connection with the works of the General Electric company at Schenectady. A plan of co-operative work had been adopted, which, for range and thoroughness of instruction, he said, was without a superior, if not without a rival in this country. The students in this course would have two months each year of practical work under direction in the shops of the General Electric company, with a supplementary year for those who showed the greatest proficiency.

## Thermal Storage.

BY NELSON W. PERRY, E. M.

The laying up of stores in times of abundance for use in times of scarcity, while practiced by some of the lower of God's creation, finds its highest development in civilized man, and increases so rapidly with the degree of the civilization as to form a not uncertain index of that civilization. Thus do we not only store up material substances—foods, for instance, during times of harvest, for consumption during the times of drought and winter—but we store up that less tangible something called energy, for utilization at times of extreme demand. The universe itself is in fact one vast storehouse of energy, of which our luminary, the sun, is but a minute outlet, through which radiant energy has through countless ages been finding its way to the various members of the solar system, there to be partly dissipated, partly stored again as potential energy in the form of clouds, converted into kinetic energy in the form of rain, again into potential energy in the growth of plant life, into kinetic energy by the fall of the plants, and finally again into potential energy in the form of coal, which is now the chief source from which we supply the energy that turns our wheels and makes nations great. Each of these transformations has involved perhaps æons of time—a single unit of time contributing but little to the following potential, and involving immense losses, but in the aggregate, taking coal as the last clearing-house of nature's banking system, leaving still enough for the draughts of ages to come.

But man, though he have this deposit in bank, cannot draw upon it without the expenditure of a close equivalent, and in the succeeding transformations, which in one sense may be said to be of his own making, he has learned the necessity of economy. The energy of the raging torrent of to-day, largely in excess of his present demands, must be stored up for the drought of to-morrow, when there will be, without his aid, no energy from that source; the rivulet, insufficient for continuous use, is conserved for intermittent use at greater or less intervals. So reservoirs are built which store up in time of superabundance for those of scarcity. Thus the Egyptians confined the waters of the flooding Nile for times when little water flowed; or the municipal gas companies store up in immense holders the product of the day, to assist in the supply of an excessive demand at night.

At convenient times we wind up a weight with our superfluous energy, which is thus doled out in small quantities as needed, to keep our clocks running during times when our energies are otherwise directed. And so in many ways art has followed nature, equalizing the expenditure of energy, either by storing up a surplus at one moment for utilization through more extended time at a rate more suitable to our purpose, or by storing up through an extended time, to permit of use through a shorter period at a rate increased over that of the natural supply.

Thus man has been impelled to devise many ways of storing energy—by the compression of a spring, by the pumping of water or raising a weight to a higher level, by the making of chemical salts which by their mutual reactions give out again the energy absorbed in their formation, etc., etc.—these operations going on continuously, but the energy stored being used intermittently at convenient times and rates.

With the advent of the steam engine, and even before, came into use another method of storage, viz., the flywheel. This through its mass resisted change of state as regards rest or motion. When stationary it required the expenditure of considerable energy to bring it to a given speed. It required an equal expenditure of energy to bring it to rest again. In other words, the engine which set it in motion performed work in doing so, just as it would in pumping water, and the flywheel performed work while being retarded, just as does the water when falling on a turbine attached to a train of machinery. The amount of energy stored up in a flywheel is represented by one-half its mass (weight) multiplied by the square of its velocity. Any change of velocity, therefore, represents the absorption or giving out of considerable amounts of energy, and the flywheel has become one of the most useful adjuncts to single acting engines and to others where they are subjected to momentary strains, as in rolling mills, etc., or where extreme regularity of motion is essential.

But the steam engine is subject to much greater fluctuations in load than those that can be taken care of by the flywheel, and therein lies the greatest lack of economy in steam practice. With the introduction of the electric light these sources of loss became more pronounced than ever, and the demand for a more efficient storage of energy the more imperative. This is illustrated by the fact that under ordinary conditions of working in a central station the maximum load of a day is from three to four times the mean, and the range of variation not unfrequently between zero and a very large maximum, and the maximum load will last, at most, but three or four hours out of the twenty-four. If the boilers and engines be sufficient to meet the maximum demand, they must be working very uneconomically during at least twenty out of the twenty-four hours. Some of the difficulty can be and is obviated by shutting down engine after engine as the load decreases, but this does not affect the boilers except to a minor extent, for these must be kept in condition for instant use the moment they are required.

Prof. George Forbes is authority for the statement that "It is an ordinary condition of working in the most carefully

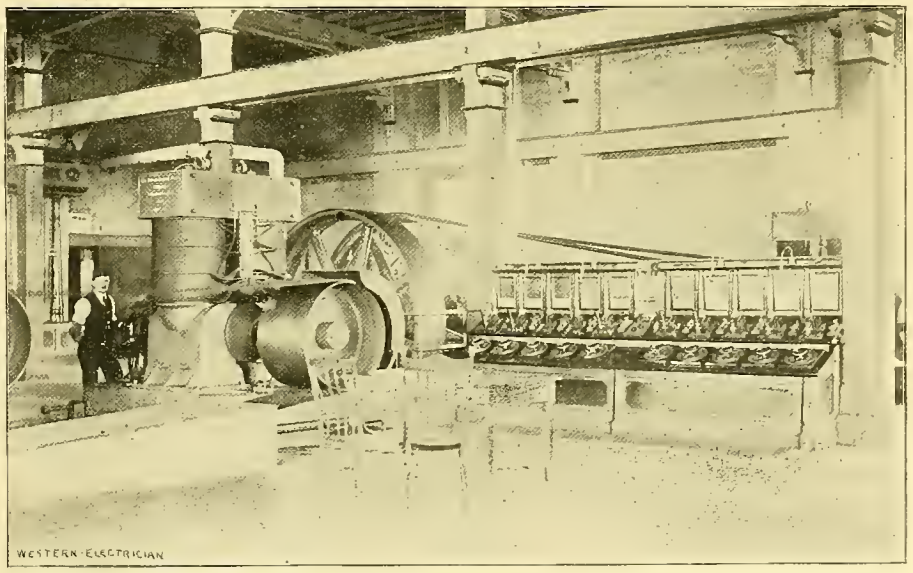


FIG. 8. THE NEW POWER STATION OF THE LINDELL RAILWAY COMPANY, ST. LOUIS.—OLD PLANT.

worked central stations that the amount of extra fuel used, owing to the irregularity of demand upon the boilers, is 43 per cent. in excess of what would be required if this cause of loss were abolished. This may easily amount to a loss of $50,000 a year in a central station of no extravagant dimensions." Many other illustrations could be cited to show that for the economical production and distribution of electricity for light and power some efficient means of storage of energy is a prime requisite. The distribution of gas in large quantities over large areas and at cheap rates is possible only through the readiness with which it can be stored in gas holders, permitting the use of producing plants which need only be sufficient to meet the much smaller average demand. The possession of gas storage makes it possible to keep this smaller plant at work continuously and therefore with the greatest economy.

Figures are not wanting, nor experience either, to show that a system of storage of some kind is equally necessary for the economical generation and distribution of electricity. It is an easily demonstrable fact that light can be produced more cheaply by electrical means than from gas direct, even if we have to buy the gas at retail rates as fuel for our gas engines. It is equally capable of demonstration that electricity, once produced, can be distributed at less cost than can gas. It remains therefore only to find some means of storage for electrical stations as efficient as the gas holder is for the gas station, to bring the cost of production of the former down below that of the latter.

But the question is, What shall be stored? Chemical storage, as exemplified in the storage battery, means in the first place an additional outlay nearly if not quite equal to that of the generating plant, a loss in conversion at once and under the most favorable conditions of 20 per cent. of the energy stored, and a depreciation charge on the cost of the plant which no one will estimate at less than 10 per cent. and which in practice has often been found to exceed 20 per cent. It also means a limitation of the principle of storage to electrical plants, which is by no means the only application to which it commends itself.

Prof. Unwin, who has studied the subject with great thoroughness, states that the system of storage which I am about to describe would cost for installation about £1.64 per brake horse power, with condensing engines, or £2.24 with non-condensing engines, while for battery storage a plant would cost £8 per brake horse power. This estimate agrees so well with those made by Prof. George Forbes, W. Worby Beaumont and others, that it seems that we must consider the storage battery entirely out of the question.

What then? Druitt Halpin of England has elaborated a plan for the storage of energy in the form of heat, which, as the latest development in the line of storage of energy, has attracted very wide attention abroad and is of especial interest just now from the fact that it is to be applied quite shortly in England on a somewhat extensive scale. Strange to say, there has been published on this side of the Atlantic but little concerning this most promising method, that little being confined, so far as the writer is aware, to the reports of a paper on the subject read by Prof. George Forbes before the National Electric Light association at St. Louis in the spring of 1893. His remarks at the time were given very wide circulation through the technical press, as their importance deserved, for there is no question which concerns steam users in general more vitally at the present day than that of the storage of energy, whereby the load of an intermittent demand may be met by a constant supply of energy produced at a uniform rate.

Since the date of Prof. Forbes' lecture considerable advance has been made in Mr. Halpin's plans, so that while what he gave fairly represented the development of the plans up to that time, there remains much to be told that has not found its way into print on this side of the Atlantic, at least. Nor has Prof. Unwin in his new book "On the Development and Transmission of Power" (Longmans, Green & Co., 1894) brought the story down to later date. It is thought therefore that it will prove not uninteresting to follow the later developments, and it is for the purpose of presenting these that the present paper is undertaken.

We all know that a boiler of small capacity, if used intermittently, will for short intervals immediately succeeding those of comparative rest give forth, if called upon to do so, an amount of energy greatly exceeding its real steaming capacity. There has been stored up during the period of rest a certain amount of energy which it is capable of giving out again when it is called for, but this store of energy, where the boiler is small, is very soon exhausted and the output very soon drops down to the steaming capacity o the boiler. The storage which takes place is not a storage of steam, as some might suppose, but of heat, and will be practically proportional to the rise of temperature which takes place in the boiler during this interval of rest.

It is well known that the temperature at which water will boil is dependent upon its pressure. With the pressure of the atmosphere at the sea level, this temperature is 212° Fahrenheit. If this pressure be relieved in any way, as by ascending above the earth's surface or by removing some of it under the receiver of an air pump, the water will boil at a lower temperature. Conversely, if we increase the pressure in any way we must impart more heat to the water before it will go off into steam, and this additional heat that has been added represents the available energy stored, for upon relieving the pressure the water will give off steam without further additions of heat until so much of this heat has been absorbed or become latent as to have cooled the remaining water down to its normal boiling point. A most convenient way

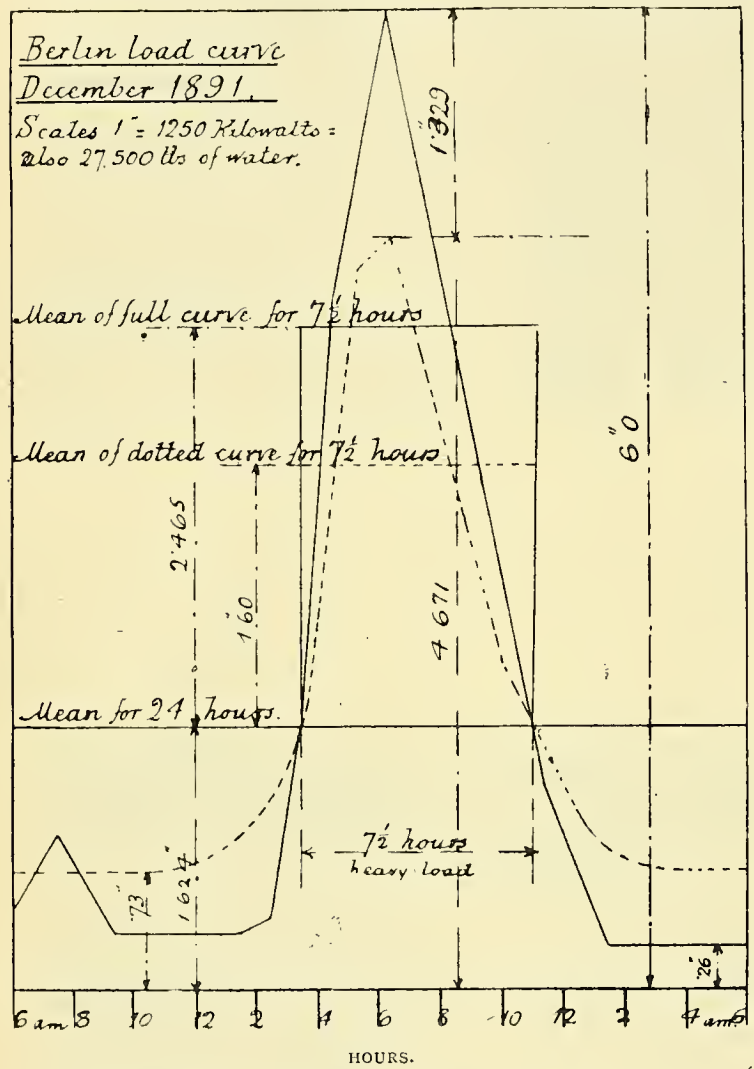


FIG. 1. THERMAL STORAGE.—COMPARISON AT BERLIN.

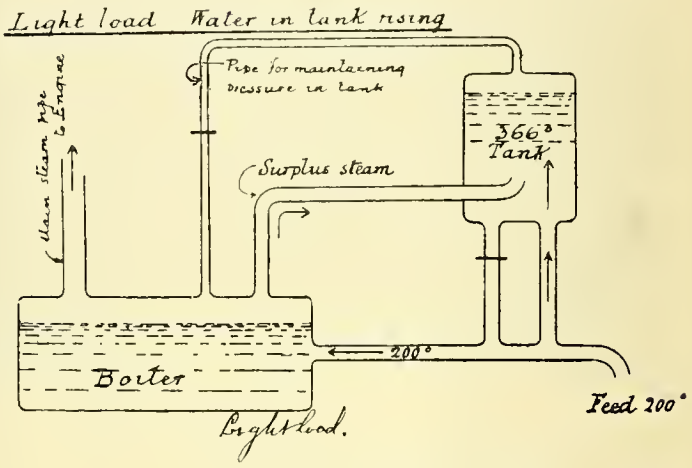


FIG. 2. THERMAL STORAGE.—COMPARISON AT BERLIN.

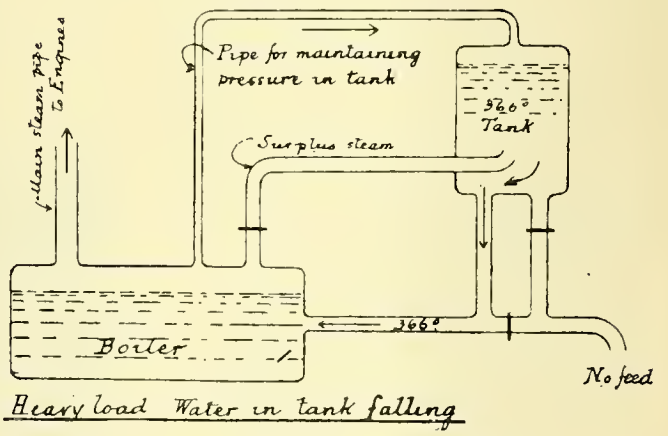


FIG. 3. THERMAL STORAGE.—COMPARISON AT BERLIN.

To confine the water in a closed vessel and then apply heat. As the temperature of the water rises above its normal boiling point it will create its own pressure, which continually increases *pari passu* with the temperature, so that at whatever temperature the water may be the pressure will be such as to maintain it in the liquid state, and this may continue up to such pressures as it is practicable to confine within our boilers.

Now if we should heat our water thus confined to a temperature of say 400 degrees, which would correspond to a pressure of about 250 pounds per square inch, and we should wish to use steam in our engine at a pressure of say 115 pounds pressure, or 130 pounds absolute, corresponding to about 347 degrees Fahrenheit, we would have an available store of energy to draw upon represented by the fall of temperature of the water from 400 degrees to 347 degrees. It will be near enough the truth to assume that one pound of water in falling from 400 degrees to 347 degrees will give off 60 units of heat. The heat required to evaporate one pound of water at 347 degrees being 868.8 units, it will take $\frac{868.8}{60}$ = 14.48 pounds of water at 406 degrees to produce one pound of steam at 130 pounds pressure and 347 degrees in temperature. The amount of energy stored, therefore, that will be

available under these conditions will be equal to

$$\frac{\text{weight of water in the tank}}{1448} = \text{pounds of steam}$$

at a pressure of 130 pounds per square inch.

Now in our ordinary steam practice the temperatures employed are low and the quantity of water is small, so that the capacity of our boilers for thermal storage is small. Boilers also are costly apparatus, liable to rapid deterioration through contact with the flame, and would for these reasons, if employed for purposes of thermal storage, largely defeat the very object for which they were erected.

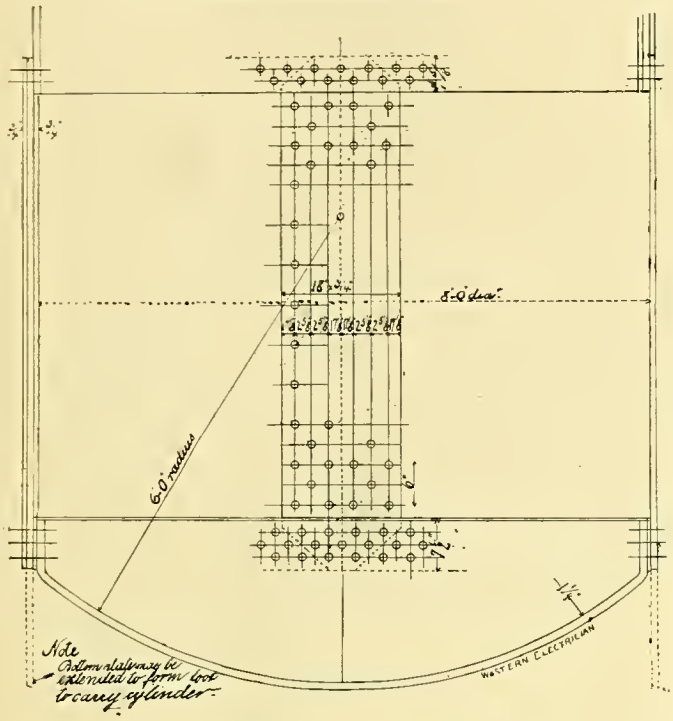


FIG. 6. THERMAL STORAGE.—END VIEW OF CYLINDER.

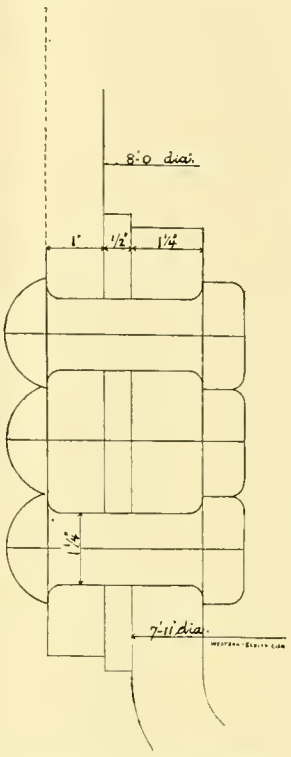


FIG. 7. THERMAL STORAGE.—DETAIL OF CYLINDER JOINTING.

Druitt Halpin has devised a plan by which only sufficient boiler capacity is required to supply the mean load. Large and comparatively cheap iron tanks entirely distinct from the boilers, and having no contact with the fire, constitute his real storage tanks. These are nearly filled with water, and into these the small boilers are constantly discharging their steam, thus eventually raising their contents to the temperature of the boiler. As the temperature of the water in these storage tanks rises so does the pressure, so that so long as the latter is confined the contents of the tanks remains in the liquid form, but ready to give off steam at any rate of supply desired upon the opening of the throttle or valve to the engine. The boilers are kept in constant operation throughout the twenty-four hours, storing up heat in the tanks during the hours of minimum demand for utilization during the few hours of maximum demand.

In this system the water consumed as steam during the hours of maximum load is replenished, cold, if desired, during the hours of small demand.

In the tanks it has ample time to settle, so that the feed water to the boilers, taken from the storage tanks, may not only be perfectly free from scaling qualities, but also be of a temperature but slightly less than the steaming temperature of the boiler itself.

Another incidental advantage of this plan is that the priming in the boiler, if it occur, causes no inconvenience, since the steam is supplied to the engines from the reservoirs alone. This will permit of harder driving of the boilers than would be permissible if priming were objectionable.

William Schonbeyder, a thoroughly reliable steam engineer, taking the case of the Berlin electric station, of which he had the load curve for December, 1891 (Fig. 1), has calculated out the relative economy of present practice and thermal storage. I quote from his report. The scale of the diagram is 1,250 kilowatts per inch and the water consumption is taken at 22 pounds per kilowatt hour, which is believed to be a fair estimate under the proposed conditions of working. Using storage tanks eight feet in diameter this would give a scale for water consumption of 1 inch to 27,500 pounds per hour. The report goes on to state:

"First—In the station as existing (December, 1891) the maximum load is 7,500 kilowatts, requiring say 10,000 electrical horse power, the cost of which for boiler plant may fairly be taken for water-tube boilers at £3 per electrical horse power, making the cost of plant £30,000. The minimum load according to the curve is 320 kilowatts, nd the proportion of the maximum to minimum work required from the boilers will therefore be about as 7,500 to 320, or as 23.4 to 1, causing the great and well known waste of fuel from so irregular a mode of working; and of course (in general) the whole of the impurities contained in the feed water will be deposited in the boiler.

"Second—Considering now the station with the addition of feed storage tanks, the existing boilers, or as many of them as are required, working at the present pressure of 115 pounds per square inch or 130 pounds absolute, and the initial feed temperature being taken at 100° Fahrenheit, we may apprehend the conditions as follows:

"According to this system (approximately) the whole of the feed water required or the twenty-four hours is pumped into the feed tanks during the time of light loads; so much of it as the boilers require during this time is supplied from the tanks, and the rest (which will be that wanted during the heavy load time) is retained in the tanks and heated up by the surplus steam during the said light load time up to or nearly to, the temperature of the steam in the boiler, viz., 347°, and is used as boiler feed during the heavy load.

"By this method of working, the duty required from the boilers will be considerably lessened, for, while during the time of maximum load they will still be required to supply steam at the rate of 6 inches × 27,500 = 165,000 pounds per hour, the total heat which they have to gather from the fuel and impart to the water will be lessened by the increase in temperature of feed from 100° to 347°, a gain of 247°. The total heat of 130 pounds absolute steam being 1,219°, we have the maximum heat to be supplied by the boilers at present = 165,000 × (1,219° — 100°) = 165,000 × 1,119 = 184,635,000 units of heat hourly. Whereas with the feed storage the maximum required = 165,000 × (1,219° — 347°) = only 143,880,000 units. In other words $\frac{1}{4}\frac{3}{5}\frac{9}{3}$ of the maximum work of the boilers is avoided and a corresponding number can therefore be laid off.

"During every stage of the heavy load, with 347° feed, the same proportion of boiler work is saved, and and this is illustrated on the diagram by the dotted curve and figures, 4.67 inches representing the maximum required work with feed storage, against 6 inches without, equal to a gain of 1.329, which is $\frac{1}{4\cdot53}$ of 6.11, or 22 per cent.

"The dotted curve of required boiler duty—during the 7½ hours under the new conditions—is therefore quite definite as to form and therefore also as to area enclosed by it. The dotted curve during the remaining 16½ hours of light load must be such that the deficiency in work during these hours equals the excess of work during the heavy load time, and the area it encloses is therefore quite definite, while its form depends upon the rates of working both as to firing and to feeding, and this form can with moderate care be made to assume that shown, which will give a maximum amount of work measuring 0.73 inch, so that the ratio of maximum to minimum becomes 6 to 1, viz., $\frac{4\cdot67}{\cdot73}$ instead of the present 23.4 to 1—a reduction of irregularity of working which must necessarily be beneficial to the general working of the boilers and must effect a considerable saving of fuel.

"The required tank capacity is easily estimated, being the total of water evaporated for 7½ hours, viz., (1.624 + 2.465) × 27,500 pounds × 7½ = 843,150 pounds. Taking the size of tanks proposed by Mr. Halpin of 8 feet diameter by 30 feet in height and allowing for their not being emptied within some three feet of the bottom, so as to leave room for deposited mud, etc., they may each be taken as containing a working quantity of 75,000 pounds of water, so that full 11 of them would be wanted, viz., $\frac{8\,4\,3\,1\,5\,0}{7\,5\,0\,0\,0}$ = 11.24.

"The cost of these, including fittings and coverings, I will take at £500, which I believe to be a liberal estimate.

[Continued on page 7.]

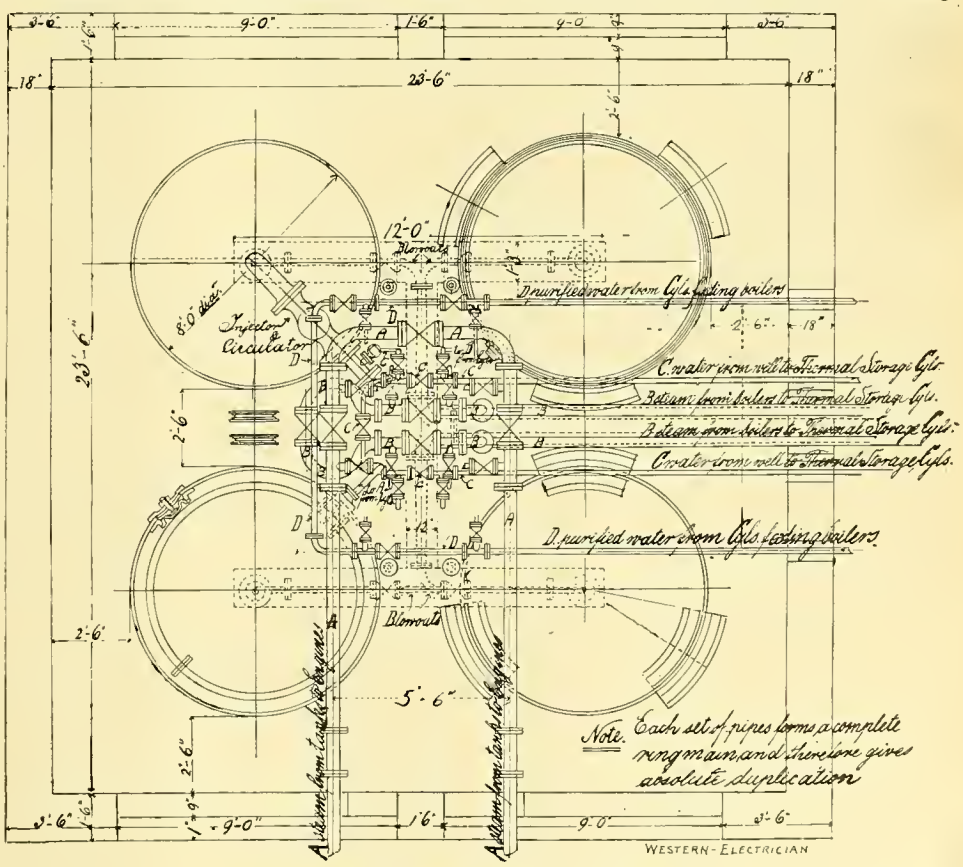


FIG. 5. THERMAL STORAGE.—PLAN OF CYLINDERS.

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IN wishing all its subscribers and friends a very Happy New Year, the WESTERN ELECTRICIAN takes occasion to make assurance that it will exert every effort in 1895 to surpass its own record for enterprise and progress. Our friends know what that record is. Never was the circulation so large, never was the WESTERN ELECTRICIAN so firmly entrenched in the favor of the electrical fraternity of the vast and growing West, as now. We propose to improve the old features of the paper, if possible, and to introduce new ones. Our subscribers will not be disappointed if they watch the WESTERN ELECTRICIAN closely during the present year.

IN reviewing the facts presented in the opinion of Judge Carpenter in annulling the Berliner patent, the *Post-Express* of Rochester says: "There was collusion between the Patent Office and the telephone company;" and it concludes: "It seems to us, therefore, that Congress ought to make an immediate investigation of the Patent Office." That is the point; let it not be forgotten. Investigate the Patent Office! This is a cry that may be well impressed on the attention of the congressional representatives of the members of the electrical fraternity.

WE commend to the thoughtful consideration of all power station managers the carefully prepared article by Mr. Perry, on "Thermal Storage," presented in this issue. There can be no doubt that there is great waste in our present methods of utilizing the forces of nature in steam and electrical plants. Whether the elaborate Halpin system described by Mr. Perry offers the best economy at present attainable is a question that is open to debate. Our friends of the storage battery industry will have something to say on this point. Practical experience will afford the only real test, and we are fortunate in being able to inspect the working drawings of an English thermal storage plant, which Mr. Perry lays before us. The subject is obviously of the first importance, and the results obtained at the London municipal electric lighting station will be awaited with much interest. In the meantime it will be wise for all central station men to post themselves on the Halpin system of thermal storage, for we shall hear more of it in the new year that is now upon us.

THE Pacific cable project continues to excite the interest of technical journals on the other side of the Atlantic. Our English cousins realize the political and commercial advantages of such a link between Asia and the western coast of North America, and their industrious exploitation of a Canadian-Australian cable contrasts strongly with the indifference with which the proposal for an American line has been received in the United States. In reporting on the British colonial plan the Earl of Jersey says: "The difficulty will be to repair the cable. It is a serious operation in even 2,000 fathoms; but cables have been repaired in greater depths than 2,000 fathoms, and it cannot be said that they could not be repaired in more than 3,000 fathoms, although it would certainly be difficult and might involve the abandonment of very large pieces of the cable and the laying of corresponding new sections." This does not strike the London *Electrical Review* as an insuperable objection, and it says: "We have little doubt that a cable can be designed and manufactured to meet the necessary requirements, but before finally adopting any one of the various types that may be proposed, it would be very desirable to have a practical demonstration of its suitability for the purpose by the repairing of an imaginary fault in an experimental length laid expressly for this object in the deepest water of the Bay of Biscay—about 2,800 fathoms." It is unfortunate that America has to depend upon European manufacturers for deep-sea cables, but so long as this state of affairs exists it is well to profit by the experience of the foreign cable-laying companies.

FROM a saffron-hued contemporary in New York we glean some interesting particulars of the manner of doing things in the happy family of electrical journalism in the eastern metropolis. Our contemporary, as will be seen below, uses a chromatic designation, which leads very naturally to the reflection that whereas the *Saffron*, the *Chicory* and the *Sickly Green* are endeavoring to delude the unwary in New York with their sophistries and their gaudy colors, the only TRUE BLUE—the modest yet sturdy exemplar of all that is good, true and beautiful in the electrical industry, particularly in the central and western portion of these United States—is right here in Chicago. The great West, serene and sincere in its size and strength, likes not the Machiavelian tricks and tortuous expedients that only too often, alas! characterize the conduct of our eastern contemporaries. It is partly for the purpose of rebuking a piece of duplicity on the part of one of these contemporaries and partly because of the intrinsic interest of the subject that we quote as follows from the *Electrical Review* of December 26th:

> The *Electrical Review* was the only electrical journal that appeared on time last week with the announcement of the Berliner telephone decision, besides giving comment, names of attorneys, opinion of officials, etc. The usual methods of our slow-going contemporaries prevailed.
>
> The *Electrical World*, by delaying some 36 hours and disappointing (?) the few readers who really do pay for it, managed to get in 15 lines, in which was the astonishing statement that the decision affected the telephone interests and the Patent Office.
>
> Our chicory tinted contemporary, the *Electrical Engineer*, realizing that haste makes waste, thought it over for two days and nights, and meanwhile held numerous councils to discover if the question was really an important one. Finally it took the bull by the horns and published the opinion without a word of comment, although an able editorial in the same issue was devoted to "Increased Speed in Ocean Telegraphy." But not a word about increased speed in Boston telephone decisions!

Assuming that the *Review* is correct as to the *World* and the *Engineer*—and who is to pick and chose between 'em?—it may be bluntly stated that the WESTERN ELECTRICIAN, of which our contemporary discreetly makes no mention, had more real news of the Berliner decision than the *Review* in the issue corresponding to the one to which our boastful contemporary alludes. And this news was printed in the body of the paper, not on a single sheet loosely laid between the leaves as a "supplement." This was accomplished without delaying the issue five minutes in delivery to subscribers, and in face of the further adverse fact that the publication office of this journal is nine hundred miles farther from Boston, from which the news was sent, than the offices of the New York papers. The news of the decision was received in Chicago late on the day on which the WESTERN ELECTRICIAN goes to press. Nevertheless the forms were "unlocked" and changed to secure the insertion of a brief résumé of the grounds of the decision, together with a short but interesting interview with ex-Solicitor-general Aldrich and a paragraph of comment calling attention to the importance of the decision. This was done with all speed, without holding back the paper, and as a matter of course, and reference to it would not now be made had not the *Review* itself raised the issue by falsely claiming to be "the only electrical journal that appeared on time last week with the announcement of the Berliner telephone decision." The only information printed by the *Review* which was not in the WESTERN ELECTRICIAN was the names of some of the attorneys, really of little importance to the electrical fraternity, and this was more than counterbalanced by the views of Charles H. Aldrich, who, as solicitor-general at the time the suit was brought, advised the government to vigorously contest the validity of the Berliner patent.

All of which goes to show, first, that the journalistic representative of the West in the electrical field spares no pains to keep its readers informed of all movements and events that are of interest to the entire fraternity, no matter where they originate; and, second, that the *Electrical Review* should be less sweeping in generalizations intended to confound its "slow-going contemporaries."

IT was pointed out by this journal some time ago, when the project of carrying mail matter on electric cars in cities was first considered, that one very important feature of the innovation lay in the fact that in case of a strike the men would probably hesitate before bringing themselves in conflict with the government by interfering with the operation of cars carrying the United States mails. Since then the practice of transporting the mails on electric railway lines has been adopted in several cities, and the point referred to is now looming up as an important factor in a labor trouble that seems impending.

Brooklyn is the scene of the dispute, and negotiations for the renewal of the contracts between the various trolley railroad companies and their employes for another year are now under way. It is expected that there will be considerable friction before a satisfactory settlement is reached. The motormen and conductors demand $2.25 a day, which is 25 cents more than they are at present receiving, while the men engaged in the electrical department want a uniform increase of 20 per cent. in their wages. In addition to the matter of wages there are other disputed points which are coming up for consideration. The officers of the companies have already announced that the men will have to be satisfied with their present wages for another year. There is a very determined feeling among the motormen and conductors to insist on the demand for the 25 cent increase, and there is much talk of a probable general "tie-up," as the companies are strongly disinclined to make concessions.

The relation of a street railway strike in Brooklyn to the mail service would be due to the fact that trolley mail cars are already in operation on the Atlantic avenue line and are to be also run over the Flatbush avenue route of the City Railroad company on and after January 7th. If there were a general strike, and these lines were "tied up," what attitude would the government take? This is a question of much importance, not alone in Brooklyn, but to all electric railway men in the larger cities of the country who may possibly enter into mail contract relations with the Post-office Department. Postmaster Sullivan of Brooklyn answers it as follows: "The companies will be responsible for seeing that the mails go through all right. If there is a strike, it will be the duty of the companies to see that their lines are not blockaded, and I suppose the United States marshals might be used for that purpose. But I do not think they would be called upon to act until it was shown that municipal and state aid had failed. The strikers would not be allowed under any circumstances to interfere with the United States mails. The men who run the mail cars are sworn agents of the government. The companies will be compelled to keep their lines open all the time and in order to do so they must utilize their men instead of throwing up their hands in case of a strike and saying they can do nothing. If the companies should use the fact that they are carrying the mails to coerce the men in any way, I would cancel the contract on thirty days' notice."

Mr. Sullivan does not make himself entirely clear. In saying that "the men who run the mail cars are sworn agents of the government," does he mean that the motormen and conductors of the cars in question are such sworn agents, or does he include the men who operate the engines and generators at the power house as well? If he had the former only in mind, as seems likely, of what use will their services be if no current come over the wires? The car will stand idle and will be of about as much service to the government as "a painted ship upon a painted ocean."

We presume, however, that the government would endeavor to pursue a course as nearly analagous as possible to the precedents laid down in the case of steam railroads—that is, to prevent actual interference with the running of the mail cars (this would necessarily include interference at the power house as well as along the line), but in no other way attempt to influence the outcome of the strike.

## Thermal Storage.

[*Continued from page 5.*]

so that if we allow for a reduced number of boilers according to the reduced maximum work required from them, we shall have the cost of boiler plant on this system:

Boilers.....$\frac{1.671}{8}\times$£30,000=£23,360
Tanks.....11 24 × £500=£ 5,620

Total.....£28,980

"These figures, show that far a less first cost than that of the existing plant, you con have an easier working installation with greater economy of fuel and the still further advantage of practically clean boilers."

The plan discussed above by Mr. Schonbeyder is a departure from and a later development of the plans as described by Prof. Forbes in his St. Louis lecture and by Prof. Unwin in his new book, and differs from them in this, that the original plans do not contemplate the taking of steam direct from the boiler at all. This plan is called the "feed storage" system to distinguish it from the original plan, which has been called the "steam storage" system. In the latter the sole function of the boiler was to furnish heat, which was stored up in a large number of tanks, from which steam was drawn direct to the engine as needed. The original plan involved a larger number of storage tanks and was more cumbersome, although thermodynamically it was dependent upon the same principles.

In estimating for the steam storage system, the extra quantity of steam wanted during the 7½ hours, and which has to be produced from the water in the tanks, is represented by the area inside the full line curve, Fig. 1, and the straight mean line for 24 hours. The boilers and tanks will, under this system, have to work at 250 pounds gauge pressure, equal to 265 pounds absolute for a large portion of the twenty-four hours. This extra steam, then, is 2.465×27,500 pounds×7½ hours=508,200 pounds at 130 pounds absolute pressure as required by the engines, and this is equal to an expenditure of 508,200×(1219°—376°)=428,413,000 heat units—376° being the mean temperature of the water from which the steam is produced, viz., 406° at beginning of heavy load and 347° at the finish; 1219° is the total heat of 130 pounds steam. Since the water in the tanks in producing this steam cools from 406° to 347° it gives up, say, 59 heat units per pound, and we shall therefore require $\frac{428,413,000}{59}$=7,261,000 pounds water in the tanks. Taking the tanks, as before, as holding an available (steam room required at top) 75,000 pounds each, we want $\frac{7,261,000}{75,000}$ =97 tanks.

The neceseary boiler power, compared to that of the present installation, will be in the proportion of 1.624 to 6, and allowing, say, 5 per cent. extra cost for the increase in pressure, we get the cost of boiler plant with steam storage tanks equal to

Boilers——$\frac{1.624}{6}\times$£30,000×1.05= £8,526
Tanks..... .97×£500×1.05= 50,925

Total.....£59,451

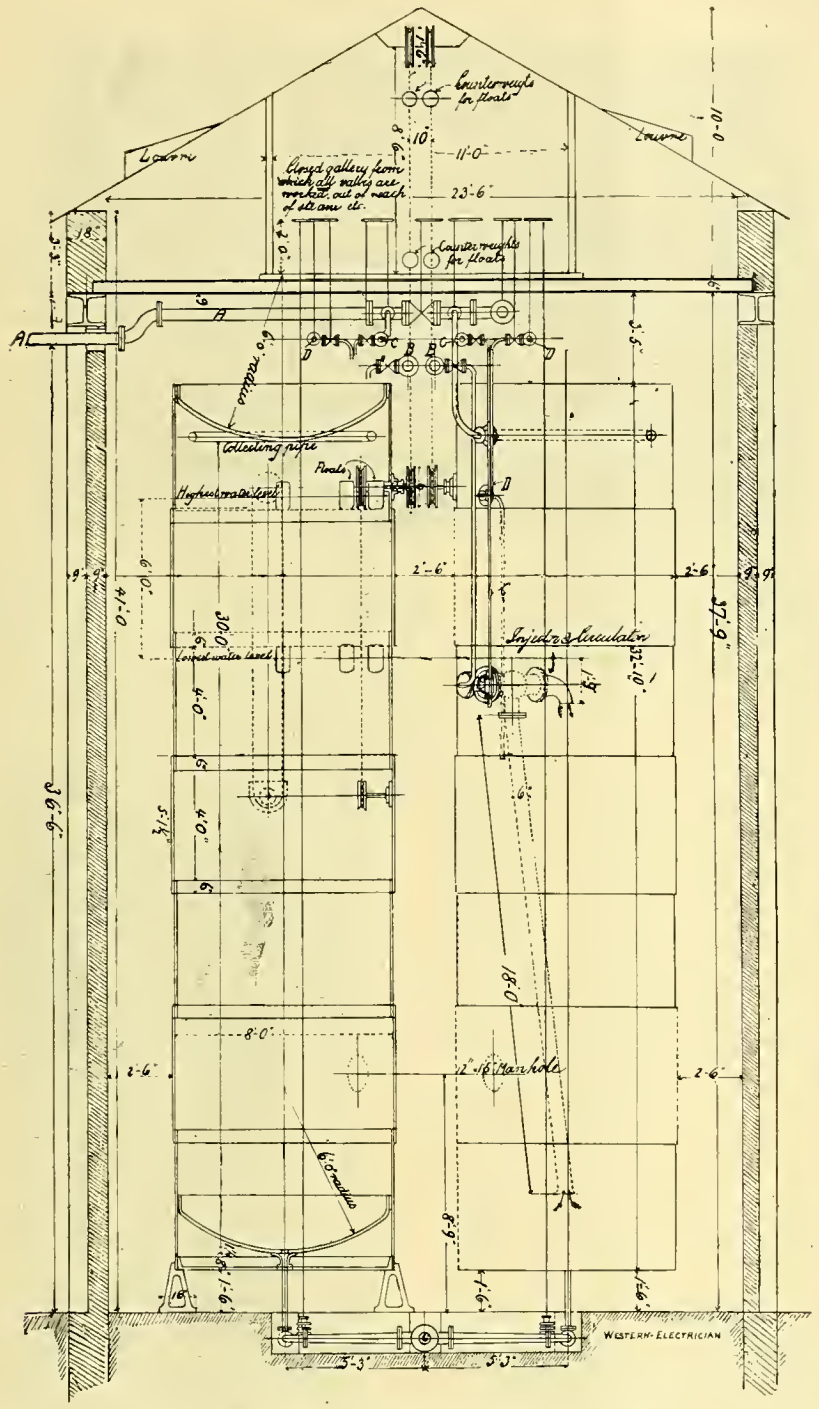



FIG. 4. THERMAL STORAGE.—VERTICAL SECTION OF CYLINDERS.

"This is nearly double the cost of present plant, but the saving in fuel and wear and tear of boilers, to be obtained in so large a station by a uniform rate of working the boilers, should pay a handsome dividend on the extra outlay."

There is still a third method of thermal storage, which is a combination of these two, known as the combined feed and steam storage system. This is well illustrated in Figs. 2 and 3 (page 4). The same authority gives the following estimate of cost of this as follows: The saving of boiler duty, due to the feed storage only, is the same as for the previously taken case of feed storage, and is represented by the area enclosed between the full and the dotted curves during the 7½ hours of heavy work, and the extra steam to be produced is represented by the area enclosed between the dotted curves during the 7½ hours and the straight mean lines for 24 hours. This extra steam will amount to 1.60×27,500 pounds×7½ hours=330,000 pounds requiring 330,000×(1219°—376°)=278,190,000 heat units. The water in tanks giving us, as before, 59 heat units per pound in cooling, we shall want $\frac{278,190,000}{59}$ =4,715,100 pounds of water, which will require 63 tanks. Add tanks for feed storage as before=11=total of 74.

The boilers will cost as for steam storage £ 8,526
The tanks will cost 74×£500×1.05= 38,850

Total cost.....£47,376

This is over 20 per cent. less cost than for the steam storage alone. It is not more complicated, since the feed and the steam may be stored in the same tanks; and it has the additional advantage of supplying nearly clean water to the boilers, as has the simple feed storage system, and the work on the boilers is uniform for the twenty-four hours, which will necessarily produce a considerable economy of fuel:

Comparing now the above four modes of working the boiler plant of such an installation as the Berlin electric station and tabulating Mr. Schonbeyder's results, we have the following tabular view:

| | Present System. | With Feed Storage. | With Steam Storage | With Feed and Steam Stora'e |
|---|---|---|---|---|
| Steam pressure .. | 115 lbs. | 115 lbs. | 115 to 250 lbs | 115 to 250 lbs. |
| Feed temperature. | 100° | 100° to 347° | 100° | 100° to 347° |
| Rate of working .. | 23.4 to 1 | 6 to 1 | Uniform. | Uniform. |
| Feed water ..... | Dirty. | Clean | Clean. | Clean. |
| Cost of boilers | £30,000 | £23,360 | £8,526 | £8,526 |
| Cost of tanks..... | ..... | £5,620 | £50,925 | £38,850 |
| Tot l cost . .. | £30,000 | £28,980 | £59,451 | £47,376 |

From the tabulated results, which are approximately correct, it will be seen that with feed storage the cost of installation is less than by present methods and the ratio between the maximum and minumum load on the boilers, which with present methods is as 23.4 to 1, is reduced to 6 to 1. This is certainly a great gain. With combined feed and steam storage and with simple steam storage, while the cost of installation is greater, absolute uniformity of load throughout the 24 hours is attained, and the economies resulting from this state of affairs will greatly overbalance a considerably greater cost of installation.

While the advantages of thermal storage are particularly emphasized where the load is of such a variable character as is uniformly the case in electric lighting stations, an even more favorable application is found where by present methods the heat is now absolutely thrown away, as in the cremation of town refuse. In England, of late, a great deal of attention has been paid to this method of getting rid of garbage, and it is a living question with us to-day. This refuse has a fuel value far in excess of that generally supposed, but the attempt to make use of it by present methods would involve an outlay in boilers far in excess of that warranted by its commercial value.

Prof. George Forbes, who has made a close study of this question, states that the ordinary house refuse of any town, consisting of ashes, coal, wood, paper, old boots, crockery, tin cans, iron pots, etc., without sorting, has a fuel value sufficient to supply one 16 candle power lamp per head of population for two hours every night in the year, and if utilized for such purpose will save a municipality of 100,000 inhabitants from $10,000 to $20,000 per annum in the cost of removal of house refuse. But some system of storage is necessary whereby the energy of the combustion of this refuse for twenty-four hours may be stored up for use during one or two hours.

Another similar application mentioned by Prof. Unwin is the following: In the production of illuminating gas about 312 pounds of coke is burned per ton of coal carbonized, and about 6,240 pounds of furnace gases escapes from the retort bank at a temperature of 1,200° Fahrenheit per ton of coal carbonized. The heat in these products of combustion is now entirely thrown away. If they were taken through the flues of a boiler they might be reduced to 600° Fahrenheit before escaping. They would furnish about 759 pounds of steam per ton of coal carbonized, or about 25 effective horse power hours. He further points out that although the gas industry is a very extensive one, and the aggregate waste of heat is enormous, the present chief diffi-

culty in utilizing it is that there is no continuous work requiring to be done, but that if the heat can be stored and used when wanted the case would be very different.

The accompanying working drawings, Figs. 4 to 9 (pp. 5, 7, 8), show the design prepared by Mr. Halpin for the London municipal electric lighting station in combination with refuse cremation furnaces. In this particular case only four thermal storage cylinders are shown, but six may be used. The details, however, would not be altered in any way by such change. For other installations the general arrangement only would have to be varied to suit the requirements

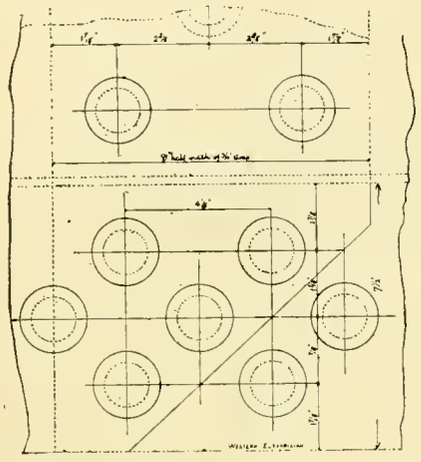


FIG. 8. THERMAL STORAGE.—DETAIL OF CYLINDER RIVETING.

of the various sites available for the reception of the plant.

A side elevation and vertical section are shown in Fig. 4, and a plan in Fig. 5. Fig. 6 shows an enlarged view of one end of the thermal storage cylinder, and Fig. 7 a detail of jointing. Figs. 8 and 9 are details of riveting. It will be observed that the ends have been arranged so that every rivet in the whole of the storage cylinder may be put in by a

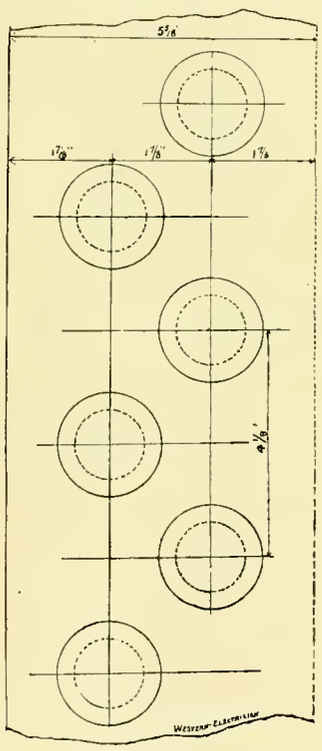


FIG. 9. THERMAL STORAGE.—DETAIL OF CYLINDER RIVETING.

riveting machine. This was considered necessary on account of the high pressure used. By dishing the ends the necessity of all staying is avoided and the cylinders are left perfectly free for expansion. The plates of all belts are in one piece so as to have but one joint, the details of which are clearly shown. The vertical joints are double strapped and the horizontal joints are lapped inside and outside and double riveted. The bottom plate can be extended down to rest on three or four cast-iron saddles, as also shown, and solid welded-up rings are placed between the top and bottom plates and the small plates, so as to allow the necessary facilities for caulking. These cylinders are to work at a pressure of 250 pounds and will be tested to 350 pounds.

As these four cylinders are arranged, only one-quarter of the outside surface radiates heat toward the building, the other three-quarters of each cylinder radiating heat toward the other cylinders; or in other words, only one tank in four is doing useless work in radiation. But in spite of this the cylinders will each be covered with three or four inches of good boiler composition, filling up the whole hollow space at the top and also covering the bottom.

In the buildings, panels have been placed in the walls with straight joints, so that the brickwork can be taken down to get the cylinders out if desired, a rolled wrought-iron beam being built in, as shown in cross-section, to permit of this arrangement. On top of these iron beams lighter H irons cross the building, and in the center these light beams carry an inclosed wooden structure, the floor of which forms a platform through which all handles are brought for working the apparatus. This has been done so as to place the men in charge of the station quite out of danger in case any pipe should burst or joint leak, all steam passing off escaping through the roof.

The cylinders shown are adapted for the combined system of feed and steam storage already described. According to these plans the range of water level provided for is six feet. The impossibility of working with gauge glasses of this length at such pressures necessitated the provision of other apparatus to serve the same purpose. This consists of a hollow bracket riveted onto the side of the cylinder carrying a spindle with stuffing box, which spindle carries a chain wheel at each end of it. There is a float inside the cylinder, divided into halves and connected by a bar so as to allow it to come up to nearly half the diameter of the wheel, and this float is on an endless chain which passes around a semi-circular guide at the bottom, which prevents the chain from kinking. On the outside, chains are led up over pulleys as shown, and the float is counterbalanced by weights. As both inside and outside chains are endless the system is in perfect balance in all positions. The counterbalance weights in the top gallery carry an arrow which works close to a scale marking the various heights of water level, which can be seen from a distance at a glance.

In the drawings the pipes marked *A* take the steam from the thermal storage cylinders to the engines. Those marked *B* bring the steam from the boilers to the thermal storage cylinders. The pipes marked *C* carry the water brought from the well and passed through the pumps into the storage cylinders, and those marked *D* lead the water which has been purified in the storage cylinders back to the boilers.

It will be noticed that the steam supply from the boilers and the water supply to the storage cylinders from the well join together after the fashion of an injector, and the resultant products from this injector are utilized to produce an induced current in the six-inch pipe feeding from the bottom of the cylinder and delivering its water slightly below the lowest water level. By this means circulation will be promoted in the cylinder, which is necessary to prevent the colder water from lodging at the bottom. The deposit of lime, etc., is caught in the lower circular bottom, and can be dealt with by the blowout in the ordinary way.

The arrangement of valves, as shown on the steam pipes, permits any one cylinder being shut off at any time, and thrown out of action in case it requires repairs.

Health Commissioner Homan of St. Louis gave a dinner at the Union Station Cafe on the evening of December 27th to celebrate the inauguration of the electric ambulance car service of the St. Louis health department, which was recently described in this journal.

## Armour Institute as an Engineering Center.

The Armour Institute, at Thirty-third street and Armour avenue, Chicago, is rapidly taking a position of importance in the engineering activities of this city. The meetings of the Chicago branch of the American Institute of Electrical Engineers have been held there for some time, and now an arrangement has been consummated by which, during 1895, the monthly meetings of the Western Society of Engineers will be held alternately in the business part of the city and at the Armour Institute. This was brought about by a cordial invitation from the directors and faculty of Armour Institute through Prof. Hatch, to the society, to hold all its future meetings at that institution.

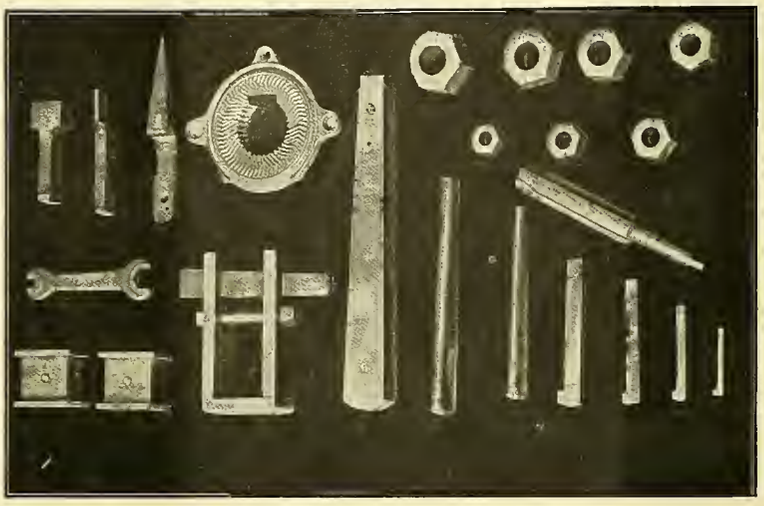


FIG. 3. NOVEL GRINDING MACHINES.

## Novel Grinding Machines.

The accompanying cuts, Figs. 1 and 2, illustrate two sizes of the new Gardner grinder which is being placed on the market by Charles H. Besly & Co., Chicago.

This machine will be of interest to electrical and other

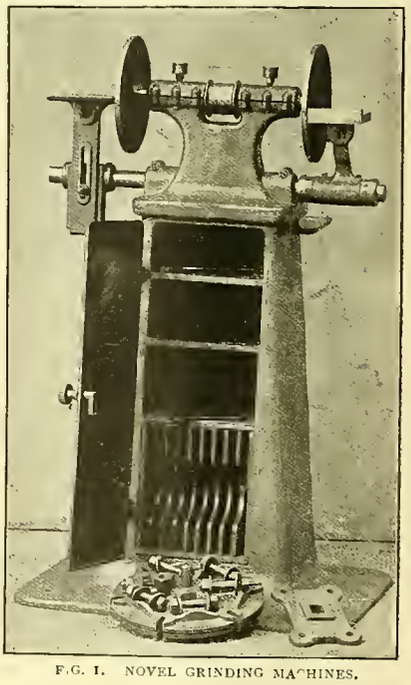


FIG. 1. NOVEL GRINDING MACHINES.

machine manufacturers, as its construction embodies a number of novel features, and its designers claim that it will grind a great deal faster than a solid wheel, and as the wheel surface is always flat the work produced will always be true and flat.

The steel disk or wheel is the principal feature of the machine. It has a spiral groove running from the center to the circumference on each side. This groove holds the glue which fastens the emery paper or cloth grinding faces to each side of the steel disk. The grinding faces are pressed into the spiral groove, thus forming a clearance for particles of emery or metal to fall in and not roll between the cutting surface of the disk and the work. It is this feature, its designers claim, which causes the Gardner grinder to cut many times faster than a solid wheel. The steel disk being always

true and in perfect balance, enables true and flat surfaces to be readily ground; the fixtures furnished with the machine enabling them to be readily produced at right angles to each other when required.

At the base of the machines is shown the device by which the emery cloth or paper is pressed onto the disk and held until cold, and as both sides are covered, it is necessary only to reverse the disk on the spindle to get a new surface. As will be perceived, the machines are very neat in design, have very large spindle bearings, and the columns are fitted up as cupboards for holding disks and appliances.

In the smaller or No. 2 machine the right-hand rest swings across the face of the disk and is so formed that pieces of work laid upon it have two of their sides held at

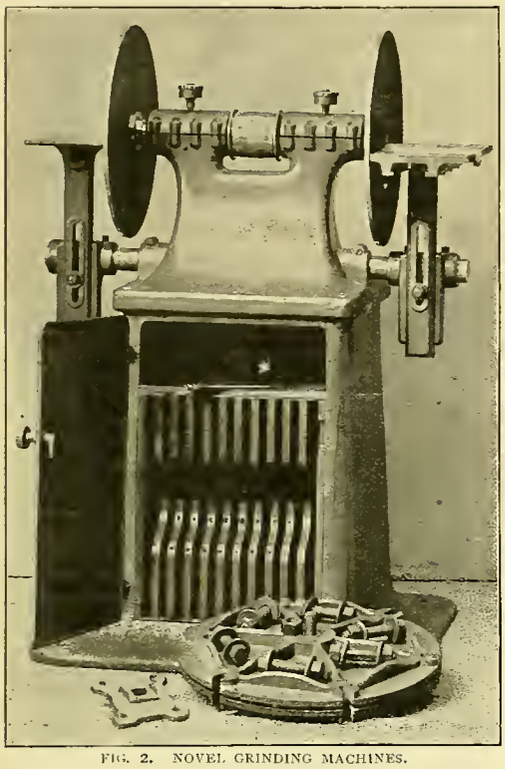


FIG. 2. NOVEL GRINDING MACHINES.

exact right angles to the face of the disk. The other rest is adjustable vertically and to any desired angle.

In the larger machine the left-hand rest is the same, but the right-hand one slides across the face of the disk upon covered ways.

The boxes are lined with adjustable cast-iron sleeves, and the spindles have endwise adjustment. The belt tension can be readily adjusted by means of the countershaft, which can be set for this purpose. The machines are designed to do a large class of work usually done by files, and the illustrations, Figs. 3 and 4, show the class of work which may be finished on them.

## Great Western Company's Affairs.

The Minneapolis correspondent of the WESTERN ELECTRICIAN writes as follows of the affairs of the Great Western Manufacturing company, which recently confessed judgment:

The court has decided that a receiver is necessary for the Great Western Manufacturing company of Duluth, Minn., which will precipitate a legal contest. The First National Bank of Chicago has a bill of sale for the personal property of the company, and is in possession of the stock at Chicago. The bill was given to secure large indebtedness to the bank. The United States Court in Chicago also appointed E. H. Fowle receiver for all other property, and he is in possession of the Duluth plant. The officials executed a deed of the company's property to him. The bank claims that its possession of the personal property does not constitute a preference, and the Chicago receiver claims that the deed executed to him by the officers does not constitute a preference, and cannot be set aside. The First National Bank of Chicago and Receiver Fowle have both given orders that if a receiver is appointed in Duluth he be refused admission to the plant. Under the circumstances the local receiver will be unable to take possession of the property as required, and the prospects are for a long fight.

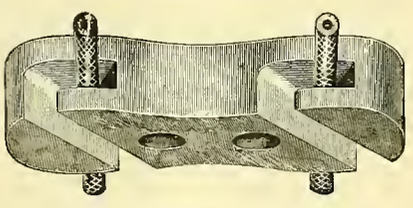
A later communication from the same source is as follows:

Judge Lewis of the District Court of Duluth has appointed H. B. Moore receiver for the Duluth branch of the Great Western Manufacturing company, with orders to convert all property into money within four months, and satisfy the claims of creditors *pro rata*. He also orders the company, R. S. Munger, vice-president, or any other officer of the company, to file a schedule of debts and properties. In the Supreme Court in Boston the Eastern Electric Cable company is granted an injunction restraining the American Loan & Trust company from disposing of the proceeds of a sale of $20,000 worth of Great Western bonds which it holds. The rest of the issue, $80,000 worth, has already been disposed of. The whole issue is secured by a mortgage on the real estate in Duluth. The Cable company holds notes of the insolvent company for $8,961. The same court denies a preliminary injunction in an action brought by the Merchants' National Bank of St. Paul to compel the American Loan & Trust company to mark the remaining $20,000 bonds now unsold, to notify *bona fide* purchasers of them of the bank's attachment, it holding $10,000 worth of the Great Western commercial paper. In Duluth the Marshall-Wells Hardware company, which holds a judgment for $623.96, has garnisheed George Watson, who is ordered to state what funds belonging to the insolvent company he controls, in the District Court, January 12th. The Duluth receiver, H. B. Moore, has brought suit against the Great Western, the American Loan & Trust company of Boston and the Boston Electric company to annul the trust deed to the Loan & Trust company, for which $100,000 in bonds was issued, on the ground of being illegally issued, and without authority of the officers of the Great Western company, and for the purpose of defrauding creditors. Eighty of the bonds have been sold and he asks that the Boston Electric company be restrained from negotiating them, the Loan & Trust company from issuing the 20 unsold and that the whole issue be turned over to him.

## The Nashold Self-locking Cleat.

The fact that porcelain is now employed to such a great extent in the manufacture of electrical fixtures, and that its use has met with the approval of the fire underwriters, has stimulated inventors to the production of various ingenious improvements. The value of porcelain as an insulator has been firmly established for some time, and of late designers have been vying with one another to present "the best" cleat.

The accompanying cut will therefore be of interest in that it illustrates one of the latest novelties in porcelain cleats. The construction of the Nashold self-locking cleat, manufactured by the Nashold Cleat company, 934 Monadnock block, Chicago, is easily understood. There is a full



THE NASHOLD SELF-LOCKING CLEAT.

half-inch of porcelain between the point of contact of wire and ceiling, thus bringing the device within the requirements of underwriters, whose indorsement it has received after severe and exhaustive tests. One of the chief features claimed for the cleat is that it retains no moisture. The base of the holding point forms a ridge at the apex of which the wire crosses, and any moisture that might be in the surrounding atmosphere would have no more chance to collect than is unavoidable with any other section of the line. In installing, all that is required is to push the wire through the opening, then pull it straight, and it is held as strongly as in a vise. It enters and emerges from its anchorage on exactly the same lines, so that its appearance is as though it were pulled through a straight hole.

Frank E. Snow of Detroit has been appointed receiver of the Adrian, Mich., Electric Street Railway company. The road was bonded for $50,000 and defaulted in interest.

## The E. S. Greeley & Co.'s Fire.

Early on the morning of December 23d fire was discovered in the building at 5 and 7 Dey street, New York, occupied in part by The E. S. Greeley & Co., manufacturers and dealers in railway and electrical supplies. The fire started in a hallway on the second floor, and is supposed to have been caused by a carelessly disposed cigar tip. The flames worked down to the company's stock and salesrooms on the ground floor and then shot upward to the work rooms on the sixth floor, burning a hole 40 feet in diameter from the bottom to the top of the double building. Prompt work on the part of the firemen stayed the flames at this point, but the deluge of water that was necessary to accomplish this result inundated the stock from one end to the other and rained through the store floor and basement, accumulating in the sub-cellar to a depth of two or three feet, submerging the entire stock deposited in this part of the building and flooding the electrical test rooms and zinc casting departments located in adjoining premises. The damage to the property of the corporation is confined entirely to the stock, fixtures and building, all the books and papers being preserved intact. Business was resumed a few hours after the fire had occurred, the company drawing upon its large reserve stock from adjacent warehouses to fill orders without delay. No removal from the burnt premises is contemplated. The loss in stock, fixtures and machinery will probably not exceed $25,000 to $30,000, and that on the building about $5,000, all of which is amply covered by insurance.

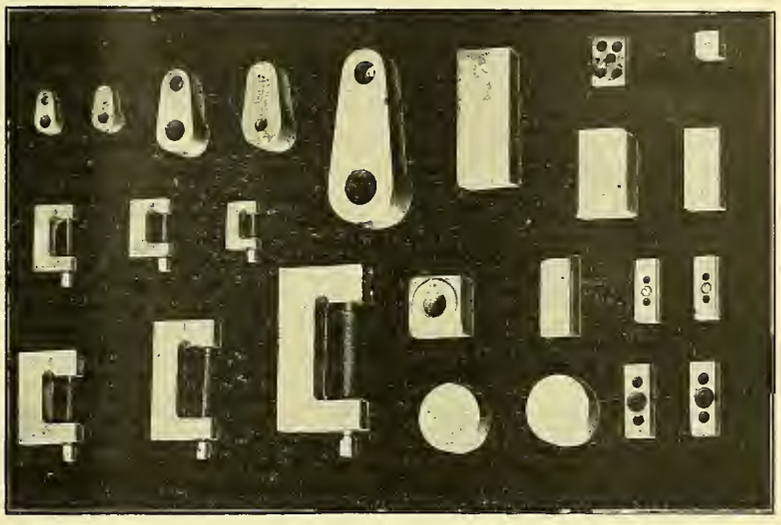


FIG. 4. NOVEL GRINDING MACHINES.

## The Sunbeam Lamp Company's Injunction Dissolved.

The following communication was received on Monday from Secretary F. S. Terry of the Sunbeam Incandescent Lamp company, Chicago:

"The injunction against our companies was dissolved on Friday, December 28th, by Judge Seaman, because of the expiration of the Canadian patent. We appeared before Judge Seaman just after the Canadian patent expired and he then refused to dissolve the injunction, but the matter was so placed before him this time that he felt compelled to decide in our favor. Our case was argued by ex-Solicitor-general Chas. H. Aldrich."

## The Great Electro-magnet at Willett's Point.

Considerable incredulity has naturally been expressed over the stories told of Lieut.-Col. King's big magnet at Willett's Point, N. Y., in which the cores were said to be discarded cannon. From the following circumstantial account in the New York *Sun*, it will be seen, however, that these narratives are not fairy tales, but have a very substantial foundation of fact:

As a matter of fact Col. King is not constructing an engine of war to rudely tear small arms out of the hands of an approaching foe or deflect the compasses of a hostile fleet six miles away, so that their pilots may steer them on the rocks. There is no such possibility in the electro-magnet so far as the experiments have shown. They are purely in the interest of science.

Col. King began his experiments by using two old Rodman 15 inch guns. They weighed 50,000 pounds each. These guns were of cast-iron, and their barrels made excellent arms for a great magnet when they were circled by an electrical current. It was awkward making experiments with the two, however, and one of the Rodmans was wheeled aside. The other Rodman was turned into a "club-footed" magnet. Many tons of heavy iron platform plates were placed on the iron gun carriage right under the barrel of the gun. Around this barrel has been wound fourteen miles of old torpedo cable that of course is insulated. Forty amperes may be transmitted through this cable, though Col King has thus far used only twenty or twenty-five in making his experiments. The electricity is furnished by

two dynamos that are about 200 feet away. The armature for this powerful magnet consists of six platform plates bolted together. The greatest strain ever applied to this armature previous to the test on Friday (December 21st) was 23,500 pounds, and then the chain broke without having drawn it from the magnet or even stirred it.

The armature was raised to the muzzle of the gun by a derrick on Friday and then the electric current was turned on. The gun at once became an electro-magnet, and it drew the armature against the muzzle and held it there. Around this armature was fastened a heavy iron chain, which was then reeved through large double blocks and attached to a capstan. Stalwart engineers manned the capstan bars and applied a strain, by Col. King's calculations, of 44,800 pounds, when, as in the other experiment, the chain broke. The armature had not been stirred. As soon as the electric current was turned off it dropped.

Five 325 pound cannon balls were suspended like a chain from the muzzle of the gun by the force of its magnetism. The power of this force can more easily be comprehended when one considers how small is the point of contact when two spheres touch. These five projectiles represented a downward pull of 1,625 pounds. When the first one was hoisted within control of the magnet it sprang to the gun with a thump. As each cannon ball was moved toward the one above it, it sprang up and clung so fast that it could not be pulled away. Theoretically the area of surface in contact can be merely a point. For convenience in lifting these heavy weights within the influence of the magnet an iron pulley with a quarter-inch chain was used at first. It was found, however, that when the gun was magnetic the chain and pulley were of no use. The chain became as rigid as if it had been a bar of solid steel and was riveted to the gun.

Another interesting experiment that has been made with this magnet seems even more wonderful to the layman than the grip on the armature. A soldier standing three or four feet from the gun, with his back toward it, places an iron spike against his breast, and it stands out as straight as if the man himself were a magnet. The man then covers his chest with iron spikes until he looks like a porcupine. He feels no effect from it, and he simply has to resist the pushing of the iron spikes, which are very anxious to reach the gun. When the current is on, the whole gun carriage, which is also of iron, is charged.

The soldiers who have assisted Colonel King in these experiments have had a little fun out of it. When a green man happens to join them they place an ordinary iron crowbar against the gun and ask him carelessly to hand it to them. The greenhorn grasps the bar and finds that he can't budge it, though he strain with all his might. It requires the efforts of two men, with a sudden jerk, to pull away a 25 pound bar from the gun when it is magnetic.

Col. King has plotted out the lines of force from the muzzle of this gun. A table was placed in front of the gun and on this were placed a number of small pieces of wire. When the gun was magnetized he found the general direction of the curves of the magnetic force from the way in which the wires pointed.

From this Col. King has made several rough charts. Every electro-magnet has its neutral point. This is a certain point where the magnet exhibits no force. Col. King found the neutral point in his electro-magnet near the muzzle. While other parts of the gun were so charged with magnetism that they would hold heavy iron plates, at this particular point, there was no evidence of magnetism. A tack placed against the gun at this point dropped to the ground.

With its carriage this Rodman gun weighs about 80,000 pounds, and when it was all magnetic there was a good deal of speculation as to the radius of its appreciable influence. Col. King settled speculation on this subject on Friday. He placed light compasses at various distances from the gun before it was magnetic. They were set with the indicator pointing to zero. The electrical current was then turned on, and the big gun became a magnet. Its power was indicated by the compasses. Col. King found that at a distance of 71 feet the magnetism of the gun equaled that of the earth, and that the indicator was deflected 45 degrees.

At a distance of 200 feet the needle was deflected only three degrees. This should set at rest the fears of foreigners that compasses on vessels six miles away could be disarranged. When Col. King shall have completed his experiments it is said he will have some new facts about the electro-magnet.

## A Scotch Estimate of Edison.

In considering a caustic article in the *Saturday Review* of London on "The Electrical Barnum," the *Engineer and Iron Trades Advertiser* of Glasgow advances its view of Edison's status as an inventor and electrician. There is a remarkable diversity of opinion on this point, both at home and abroad, and the discussion shows that at any rate Edison occupies a commanding position in the eyes of civilized mankind, however men differ as to his merits. The views of the Scotch journal, which follow, are of interest:

It is just possible that a man may become too big for the age in which he lives and moves; his immediate admirers may, perchance, exaggerate his mental qualities and raise him to a niche amongst his contemporaries to which he is not justly entitled. This, according to this Saturday Reviewer, is what has happened in the case of Edison, and we must confess there is a grain of truth in the allegation. A careful perusal of the article in question leaves no room for doubt on that point. Still, we are not among those who would seek to belittle a name of which Americans are justly proud. On the contrary, we consider him a truly eminent, nay, the most eminent amongst living American inventors. Edison has made a reputation (particularly in connection with the development of electrical appliances) which is certain to carry his name down to posterity. It is not fair, nevertheless, to give him credit for more than what he has actually accomplished. That, it appears, is what has been done by some of his over-zealous disciples. The *Saturday Review* article will therefore come as a sort of corrective influence at the present hour, when the reading world is asked anew to form an estimation of the value of this man's life work. Neither it nor half-a-dozen such articles can dispel the belief, very generally held in both the old and the new world, that Thomas Alva Edison is a most unique personage, or that he is a born inventor, or again, that he is an indefatigable worker in the prosecution of that wonderful science which he has done so much to expound.

## Dissolution of Partnership.

Cushing & Morse, general western agents for Day's Kerite insulated wires and cables, 225 Dearborn street Chicago, dissolved partnership on January 1st. Mr. Morse, it is understood, has bought out Mr. Cushing's interest in the business and will continue the agency at the same address, the firm name being S. F. B. Morse & Co. The firm has been a popular and successful one, and by wide-awake business energy made Kerite a household word among the electrical interests of the West. In retiring from the firm Mr. Cushing takes with him the best wishes and esteem of the fraternity, in which he has a host of warm friends, while Mr Morse, who succeeds to the goodwill of the business, will undoubtedly well maintain the high standard of popularity enjoyed by the firm, and keep Kerite ever in the minds of the electrical public and in the foremost ranks of all that is best in high-grade insulation.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, December 28.—There is a possibility of a general strike on the Brooklyn trolley lines. The motormen and conductors want the 1895 scale of wages arranged so that they will receive $2.25 per day—an increase of 25 cents. The power house employes also want an increase of wages. The companies have so far resisted the demand, and as the men are all members of the district assembly of the Knights of Labor, there is prospect of trouble.

The daily papers contain accounts of the electroplating of an ocean-going tug in Jersey City by the Ship Copper Plating company, which claims to have a process by which the hulls of iron or steel vessels can be electroplated with copper, by which means copper sheathing and the expensive dockings to remove barnacles are both avoided. The process is thus described:

After having purchased the tug the first thing to do was to dry dock her and clean her absolutely. This is said to be the most difficult part of the new process. An acid bath was given to the tug, and then she was washed clean and every bit of paint that clung to the indentations in the hull had to be picked out. It was necessary that the hull should be free from every kind of impurity, or the copper would not stick. If the slightest place should not be covered by the copper, the salt water would cause galvanic action, and the hull would be destroyed in time. Having cleaned the hull thoroughly, an electric plant was set up on the land just alongside the dry dock, to use in the electroplating. Several dynamos were put in operation to secure the necessary electricity for the process of plating and the electric lights that are in constant use day and night.

The next thing to do was to apply the copper. All electroplating is done by giving the object to be plated a bath in copper sulphate, with the assistance of electricity. The electricity causes the copper in solution to become deposited on the object to be plated by passing a current through the bath and the object under treatment. This is the same process that is applied to the hull of the tug Assistance, only the baths are applied to the hull of the vessel in a slanting or upright position, as may be necessary. A box about a foot deep, water tight, and five feet square is made and fitted to the side of the hull in the particular spot which is to be operated upon, and then it is shored against the side of the hull. The copper anodes are put in the top of the box, which remains open. The sides of the box are carefully calked to prevent any leakage, and the current of electricity is turned on. The four anodes in each box constitute the positive pole, and the vessel itself constitutes the negative pole, and the current goes through the solution to the hull, back to the dynamo, and then through the solution again to the hull, and slowly but surely a thin coating is deposited on the hull. This is kept up for twenty-four hours and then the sulphate bath is applied in the same way for forty-eight hours. At the conclusion of this it has been found that the copper is deposited on the vessel to the thickness of one-sixteenth of an inch and so firmly that it can be removed only by a cold chisel and a hammer.

It has been found that the weight of the plating is only 2.85 pounds to the square foot. First-class paint would weigh nearly two pounds to the square foot, so that the extra weight added to a vessel is of little consequence. The cost, too, it is said, will be scarcely more than two or three times that of the paint, and it is estimated that the plating will last at least ten years, so that it will be seen easily wherein the practical utility and profit of the invention lies.

The *New York Herald* establishment has one of the finest electric plants in the city, consisting of four dynamos, of an aggregate capacity of 3,000 incandescent lights, and several motors for various kinds of work. Perhaps the most attractive feature of the whole electric plant is the artistic arc lamps in the press room. This is the only newspaper in America that exhibits its entire printing press plant where the public can stand upon the sidewalk and see the paper enter the press and come out printed and folded ready for delivery. For this establishment, it will be seen, the question of light is an important feature. Over nine months ago the *Herald* people began experimenting with arc lamps from incandescent circuits. All the makers of arc lamps were given an opportunity to place their lamps on trial in the press room, and many availed themselves of the invitation. After nine months of trial the Clark Electric company's lamps were selected. The Clark company had a special fixture made for the purpose, which comprises a combination of electric arc light and gas, the gas to be used when electricity is not needed. The new *Herald* building is at Sixth avenue, Thirty-fifth and Thirty-sixth streets.

In a suit for $20,000 damages brought in the name of Mr. and Mrs. B. F. Squire of Monroe, Conn., all the wires, poles and other property of the long-distance telephone company in Connecticut were attached. The corporation is organized under the laws of the state of New York, and its principal offices are at 18 Cortlandt street, this city. The line extends across the state, running through the counties of Fairfield, New Haven and Hartford. The claim for damages is based upon the alleged negligence of the servants of the defendant in leaving a large pile of old wires that had been removed from the poles near the highway in the town of Monroe, at which the horse which Mrs. Squire was driving on her way to church one Sunday in November last took fright and ran away. She and her daughter were thrown out of the carriage, both narrowly escaping death. Mrs. Squire, it is claimed, is injured permanently. W. F. O.

## St. Louis, Mo.

ST. LOUIS, December 28.—The State Supreme Court has issued an alternative writ of mandamus against the street commissioner of St. Louis to require him to issue to the Laclede Gaslight company a permit to excavate along the east side of Broadway from Ashley street southward, for the purpose of laying electric conduits. The writ is returnable January 14, 1895. This is taken as being favorable to the gas company. Under its old state charter of 1857 it is claimed by the Laclede Gas company that it not only has a right to use electricity in place of gas, but that it also has authority to construct and operate underground electric conduits without permission from the Board of Public Improvements and furthermore that it is authorized to sublet its ducts to other wire-using companies—in brief, that it is authorized to go into business as a common carrier of underground electric current.

The city counselor has advised the Board of Public Improvements that the Missouri Electric Light & Power company and the Edison Illuminating company can be granted permits to construct underground conduits, and the board has accordingly granted permision jointly to these two companies to construct and operate underground conduits in the central part of the city, between Franklin avenue and Clark avenue, north and south, and Twelfth street and the river, west and east. The privilege of placing their wires underground was given to these two companies in their city lighting contracts. In brief, it now seems that the subway scheme of the city is virtually dead and that each company will be permitted to construct and operate its own subways. However, the city may yet become the owner of a subway system. The contracts with the two lighting companies, the Missouri and the Edison, provide that the city may purchase their entire plants at the termination of the contracts in 1900.

The Board of Public Improvements has granted a permit to the St. Louis Underground Service company to extend its subway system on the north side of Chestnut street from Broadway to Third street. This extension will enable the Postal Telegraph-cable company to extend its wires to the Merchants' Exchange and the *Republic* building.

Since the Postal Telegraph-cable company placed its wires in the conduits of the St. Louis Underground Service company it has been contented that it had no right to do so without having first attained a franchise for that purpose. Counselor Marshall decides that it is not necessary to have a franchise in order to put wires in the ducts of the St Louis Underground Service company; that that company is a common carrier, and that any wire-using company can put its wires in the company's conduit without a franchise.

It has leaked out lately that under the ordinances by which the St. Louis Underground Service company succeeded to the rights and privileges of the National Subway company, it is not required to provide ducts free of charge for the city fire alarm and telephone wires. The original ordinance provided for free ducts for city wires, but this provision was omitted through some oversight in drawing up the latter ordinances. The time of the franchise was also extended from 35 to 50 years.

Judge Valliant in the Circuit Court of St. Louis has given a final decree in the injunction case of the St. Louis & Suburban Railway company against the Bell Telephone company. The former temporary injunction is made permanent and enjoins the Bell company from erecting poles between the tracks of the Suburban Railway company on Union avenue.

In the case of Ralph E. Rust, receiver of the National Electrical company of Eau Claire, Wis., against the Western

Electric Supply company of St. Louis, Judge Valliant decided in substance that a receiver appointed in one state has no power to come into another state and collect assets for distribution elsewhere. R. J. H.

## Northwestern Notations.

MINNEAPOLIS, December 27.—The plant of the defunct Neihart Electric company, of Neihart, Mont., has passed into the hands of the Neihart Water company, which will operate it with water power forced into a seven-foot turbine wheel from its own mains.

The ordinance committee of the Davenport, Ia., city council is in favor of granting a franchise to the Harrison Telephone company. The company will furnish the city with 10 telephones free and charge $15 each per annum for 18 patrol boxes. It will charge $30 for telephones in business houses and $20 for residences.

A new telephone company is soliciting subscribers in Burlington, Ia. It proposes to run a line from Burlington to Columbus Junction, via Wapello, and northward to connect with toll lines from Cedar Rapids. It had been waiting for a decision on the validity of the Berliner patent, but after investigating the matter decided that the decision would be against the Bell company, and began actual work a few days before the decision was rendered.

The Polar Star Electric company of Faribault, Minn., is setting poles, stringing wires, etc., and will begin operating its plant with a patronage of 2,200 lights and 30 horse power in motors. Cannon Lake will furnish the power. The prospects seem bright for the new company.

Lee Bros. of the Peerless Coal company, Mystic, Ia., offer to furnish the town with 160 lights at 50 cents per month each, in connection with their electrical mining machinery.

The poles are being set for the Austin, Minn., telephone exchange, and the manager hopes to have the exchange in operation by January 1st.

The Iowa City, Ia., improvement committees offer $5,000 bonus to any company that will build and operate an electric street railway.

Wire Inspector W. E. J. Deming of Minneapolis reports three electric fires in Minneapolis in the year ending October 1st, doing $3,228.64 damage.

The Winona, Minn., council has contracted with the Winona General Electric company for arc lights all night at $87.50 per annum, for three years, on the moonlight schedule.

The electric companies of Minneapolis have asked the city council to reconsider the resolution passed some time since to cut all overhead wires in the subway district as being against the business interests of the city. The wire inspector had notified the companies that the wires would be cut December 17th. The council referred the petition to a committee.

The Minnesota Legislature, which is noted for regulating things terrestrial and celestial, may consider a bill at its coming session fixing maximum tolls for telephone companies. Such a bill has already been formulated.

The Shawano, Wis., council has decided to put in electric lights and now awaits proposals to put in the plant. M.

## PERSONAL.

C. J. Bishop, late president of the Ashton Valve company of Boston, died recently.

Pauline H., wife of Frank C. Perkins, the electrical engineer of Buffalo, N. Y., died on December 24th at the residence of J. W. Perkins, Dunkirk, N. Y.

Prof. H. S. Carhart, the head of the electrical engineering department of the University of Michigan, spent a portion of his holiday vacation in Chicago and vicinity.

## ELECTRIC LIGHTING.

The new lighting plant at Valparaiso, Ind., has a capacity of 135 arc lamps of 2,000 candle power and 2,500 incandescent lights of 16 candle power. C. A. Sweet and E. C. Noe are the proprietors of the plant. Mr. Noe is the well-known engineer of the Chicago office of the General Electric company.

There are in the new Reichstag Building, Berlin, which has just been completed, 5,500 incandescent lamps of various candle power and 67 arc lamps of from 1,000 candle power to 4,200 candle power, the total amounting to 180,000 candle power. The work has been carried out by the Berliner Elektricitatswerke, and the arrangement of the lamps has proved very satisfactory.

It is learned through the *Times* of Chester, Pa., that "Electric light men can't monkey with Toughkenamon. A year ago the electric light men wired the town, and electric light made Toughkenamon shine for a year. This time, in renewing the contract, the electric light men raised the rates, and coal oil lamps were put up and the electric light people told to go to Halifax or Camden."

There has been this season a great addition to the display of signs with letters formed of incandescent electric lights; and such signs are now seen not only in Broadway, but in various other parts of the town, says the *Sun* of New York. They are displayed where signs would ordinarily be placed and they are seen high in the air on lofty buildings. Indeed, there has never been a time when artificial light generally was so lavishly used as now.

At the Calais, France, electric lighting station, which is being run bytwo 80 horse power Niel gas engines, with two cylinders each, the engines work so satisfactorily that full load can, it is said, be suddenly taken off each without the engine running away; and the engineer has been ingenious enough to make the engines practically self-starting, by getting one piston to stop in the position of compression, the other in that of explosion. Both cylinders are filled with the gas mixture; then the explosion in one cylinder gives rise to compression of gas in the other, and causes ignition at the tube, so that the cycle of operations begins.

## ELECTRIC RAILWAYS.

The People's and Philadelphia Traction companies of Philadelphia will heat their cars by electricity.

The North Highlands Electric Railway company and the Columbus Street Railway company of Columbus, Ga., have been consolidated. The lines of both companies are to be extended.

The Taunton, Mass., Electric Railway company held a meeting in New York recently, and the result is a petition to the legislature to allow the Taunton company to change its name to the Bristol County Electric Railway company; to allow it to increase its capital, mortgage its property and to absorb the Globe Street Railway company of Fall River and any others in that section which it may desire to secure possession of. This is taken to mean that all the electric roads in southeastern Massachusetts are to be run under one head; that vast extensions are to be made, connecting Fall River and Newport and Providence and Taunton and Boston, and the so-called Taunton and Fall River company will be completely shut out by this combination.

## TELEGRAPH.

W. C. Sterling & Son of Monroe, Mich., have received and are preparing for shipment an order for telegraph poles to go to Buenos Ayres, South America. The order was placed through W. S. Peaks & Co. of New York city, and will go to New York by car, then to London, England, by steamer, where it is transferred to a South American steamer, which will deliver the poles at Buenos Ayres This is a trial shipment, and if the poles go through safely and are satisfactory, the Monroe company is promised some large orders. The poles are inspected at Monroe and paid for, less the freight, on arrival at New York.

It is said that at first the Chinese were very bitter against the telegraph, as it was reported that the foreigners cut out the tongues of children and suspended them on the insulators to transmit the message from pole to pole. Then, again, the wires disturbed the graves of the "Fingshin," the spirit of wind and water. The telegraph instruments used are mostly of London make. The system of telegraphing in Chinese is very simple. There are about 8,000 characters in the Chinese language. These are all numbered from one up, and so printed in book form. It is therefore only necessary to telegraph the numbers. This system is used in the government dispatches.

The Postal Telegraph-Cable company, has completed an additional route to the Pacific coast and has opened offices at Trinidad, Las Vagas, Albuquerque, Mojave and other important points in the far Southwest. This new all-copper line will enable the company to handle its increasing business with its accustomed promptness, and to improve its service to San Francisco and Pacific coast points. Direct communication between New York and the Pacific coast is accomplished by means of continuous copper wires from Chicago to San Francisco to connect with those already in operation by the Postal between Chicago and New York. The route taken by this new system was carefully chosen with respect to climatic conditions, and it is believed nothing short of an unprecedented storm can interrupt these wires for any length of time. All natural storm centers have been carefully avoided, and covered wires are used on that portion of the route passing through the lowlands of California where fogs and rain would be likely to cause trouble.

Referring to Sir John Pender's public statement that the Atlantic cables do not earn adequate returns, and that this ought to be a warning to governments in the case of the Pacific cable, the *Montreal Gazette* says that those who know the facts are in no way surprised that some of the Atlantic companies do not pay good dividends considering the extent to which their stock is watered. Sir John will not be able to get the Commercial-Cable company's statement that Atlantic cables are not a profitable investment, as this company has kept out of the ring with which he is associated. Sir John characterizes the Pacific cable as a foolish project, but he has of late repeatedly evinced great anxiety in carrying it out. The warning which he gives may, however, have its use in a way he does not intend in determining the governments to take such steps as will render it impossible for the Pacific cable to get into the category of water-logged companies, like so many other companies with which Sir John is familiar.

## MISCELLANEOUS.

The employment of electric power, with an overhead trolley system, on the Miami and Erie canal, in Ohio, is rumored.

It is understood that the annual report of State Engineer Adams, of New York, will contain a recommendation that electric power be used as a method of propulsion for canal boats on state canals. It is reported that further tests will be made with electric boats on the Erie canal, between Buffalo and Tonawanda, next spring.

The report of the Railroad and Warehouse Commission of Illinois, for the year ended June 30, 1894, will show a large increase in the railroad passenger business. This is due chiefly to the fact that the Chicago elevated railroad companies are now required to make reports as railroads. The Lake Street Elevated reports for the four months from March 1st to June 30th the total number of passengers carried, 3,494,951; persons injured, 3; and the revenue, $174,733. The Alley "L" reports for the year the total number of passengers carried to be 25,122,087; persons killed, 5; persons injured, 6; total revenue, $1,256,104.

C. A. Bodwell, superintendent of the Monsam River railroad, has purchased the land on both sides of the Old Falls in the Monsam River, Maine. It is estimated that the available horse power is 800. Mr. Bodwell's object in purchasing the property, is to develop and utilize the power there. As soon as practicable, Mr. Bodwell will take measures to form a stock company. Early in the spring it is proposed to erect a plant for the purpose of generating electricity, the power to be transmitted to Sanford, Me., and used for manufacturing purposes. The company will also supply light and heat. It is believed that the power from this source can be supplied so cheaply that electric motors will supplant every steam engine in the vicinity. It is already understood that the Sanford Mills will adopt this power in place of steam.

According to the Glasgow newspapers two young Scottish workmen, sons of a mechanic employed in the Singer sewing machine works on the Clyde, have invented a battery which, it is asserted, will revolutionize electrical work, and Lord Kelvin is reported to think so highly of it that he offered to buy the patent rights for $50,000. The inventors, aged 21 and 18 years, have, it is said, made a primary battery "in which, while the decomposition of the zinc plates is rendered enormously slower, and the chemicals used are of trivial value, the strength of the battery thus formed is very greatly increased." The battery has been put to some severe tests, and is said to have stood them triumphantly. It is thought that these lads have made some sort of a discovery which may possibly bring them fortune, but general expert opinion discredits the idea of anything approaching an electrial revolution.

Secretary Herbert of the Navy decided on December 22d to enter into a contract for the construction of a submarine torpedo boat of the Holland type. The question of building such a vessel was referred some time ago to the Board of Construction, which reported in favor of the proposition. In view of experiments concerning the effect of explosives under water, the secretary decided to look into the matter more carefully, and referred it to the Bureaus of Steam Engineering and Construction and Repair, requesting them to decide if it were not advisable, in view of the experiments, to increase the thickness of the plating on the vessel, and if $150,000 was a reasonable price for such a vessel. The bureaus, after a careful consideration, reported in favor of increasing the thickness of the plating from three-eighths of an inch to half an inch at the belt, tapering to three-eighths of an inch at the ends. The boat will be contracted for with these modifications, the price being satisfactory.

On the Mont Saleve rack railway, in Savoy, which is worked by electricity generated by water power, electric heating has been introduced into the cars. The heating apparatus consists of two resistance boxes, 33 inches wide by 12 inches high and 7½ inches broad, each containing 42 coils of galvanized iron wire 1½ millimeters thick. These coils are 1 inch in diameter, and contain about 20 feet, or between 500 and 600 yards in each carriage. The current is taken directly from the rail conductor and passes through the coils, which are coupled in series. The quantity absorbed is 15 amperes, which at 500 volts represents about 10 horse power. The temperature of the wire is raised to the boiling point of water, and that of the carriage is easily maintained at 60 to 70° Fahrenheit even in the coldest weather. In spite of the large amount of power required, this system of heating is possible on account of the traffic being small in cold weather, only four carriages being usually required, so that 30 or 40 horse power can be spared from the driving current for conversion into heat. The cost of the apparatus is $11.62 per carriage.

## TRADE NEWS.

The Washington Electric company, Chicago, is still behind in its orders for annunciators, rheostats and stage dimmers. This speaks volumes for the popularity of these specialties.

Green's economizer for utilizing the waste heat from steam boilers is very handsomely illustrated and fully described in a pamphlet recently issued by the Fuel Economizer company of Matteawan, N. Y., and which will be sent upon application. These well-known economizers are said to be applied to 150,000 boilers. They can be attached to any type of boiler, and without stoppage of the works.

The Triumph Electric company of Cincinnati announces to its friends and patrons that it has opened a New York office at No. 203 Broadway, with J. A. Machado as manager. Mr. Machado is well known in electrical circles and any business intrusted to him will receive prompt and careful attention. It is believed that this move will bring the company into closer and more cordial relation with the eastern trade.

S. F. B. Morse & Co., 225 Dearborn street, Chicago, general western agents for Kerite, are out again with a highly delectablesouvenir in celebration of the New Year, which they are distributing among their friends. It is similar to the onepresented a year ago by their predecessors, Cushing & Morse, which attracted such universal attention on account of its novelty; but the little box containing two of the good things of life this time bears the legend, "Happy New Year and Kerite Wire—S. F. B. Morse & Company." The other "good thing," which it is said is synonymous with happiness during the coming year, is to be found in almost unlimited quantities at the well-stocked warerooms of the firm in wire, solid, stranded, plain or braided, or in cable, aerial, lead en-

cased, underground or armored submarine—labeled in all cases Kerite.

James W. Godfrey, one of the best known men in the electrical fraternity and for many years general manager of the New York Insulated Wire company, has associated himself with the India Rubber & Gutta-percha Insulating company of New York as manager of the sales department, and connected with him are Frank Harrington, formerly with the Western Electric company and later with the Tropical American Telephone company and the New York Insulated Wire company, and James B. Olsen, who was for some time Chicago representative of the New York Insulated Wire company. The combination is a strong one, the gentlemen composing it having a wide acquaintance in the trade and being thoroughly alive to the requirements of the business, and their energetic management should make Habirshaw wires and cables even better known and more largely used than they are to-day.

## BUSINESS.

The American Electrical Works of Providence, R. I., are sending out a New Years greeting in the shape of a very life-like portrait (in colors) of their favorite customer. It is a piece of rank favoritism, but one which has excited much curiosity in the trade.

The R. D. Nuttall company of Allegheny, Pa., has received information from one of its customers that a number of the Nuttall trolley wheels have run 22,000 miles and are still in first-class running order. This is said to be the best record that has ever been made by any trolley wheel in the market.

O. W. Russell, advertising manager of the Link Belt Machinery company, Chicago, is favoring the trade with a tasteful New Year's greeting in the shape of a quotation calendar. Mr. Russell never lets the grass grow under his feet, so to speak, and his original "ads" for the Link Belt company keep it constantly before the buying public.

The Electric Appliance company is offering something new in the line of an alternating current switchboard instrument made by the Whitney company. The instrument is of a special form, with a large scale particularly adapted for switchboard work. The frame and case are entirely of metal, and all connections are made at the back of the board. The instrument does not require recalibration and is not affected by external magnetism, and promises to be a winner.

C. E. Sargent of Chicago, long identified with engine interests and well known in the West, became the representative in Chicago of the Ball & Wood company on January 1st. Mr. Sargent's headquarters, for the present at least, will be in the Home Insurance building, and he will doubtless make for the Ball & Wood engine in the West the same reputation and popularity it enjoys in the East. Mr. Sargent will be glad to welcome his friends, old and new, in his new headquarters.

The Wallace Electric company, 307 Dearborn street, Chicago, has recently installed in its office two of the ornamental lamps manufactured by the Electric Construction & Supply company, which it represents in the western territory. The arc lamps are of the latest design, and their operation is noiseless. The design is very ornamental, and an opal globe of the latest pattern is included. The entire line of arc lamps manufactured by the Electric Construction & Supply company is of one general design, and the street railway lamp handled by this company has, after careful tests, proved that it will burn satisfactorily on a street railway circuit, where the fluctuations in voltage are great.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued December 25, 1894.*

531,310. Electric Cut-out. Harry Hansen, Everett, Mass. Application filed January 23, 1894.

An electric cut-out and box combined, consisting of a sunken box of insulating material having face plate and detachable cover, said box having longitudinal and lateral insulated ribs, and conductors connected by fuses to the line wires and lamp wires connected to said conductors by means of binder posts and fuses.

531,331. Trolley. Charles E. Powell, Philadelphia, Pa. Application filed October 31, 1894.

A trolley rod for use on overhead electric railway systems, having a bracket at its upper ends, in which is mounted a roller, the bracket being provided with a fender, consisting of two integrally formed outwardly projecting arms, one on each side of the roller, said arms having inclined upper faces, and pins projecting from their outer ends.

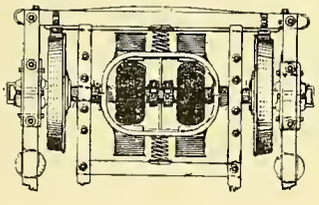
531,351. Flexible Gear for Electric Car Trucks. Ferdinand A. Wessel and Ernst Egger, New York, N. Y. Application filed September 22, 1893.

The invention provides in an electric car, the combination with the truck and car axles of a motor having a shaft, a pair of levers rotary around both the shaft and the axles, gear wheels upon each end of the shaft, a gear wheel upon one end of each axle, but upon opposite sides of the car, and intermediate gearing between the gear wheels on the shaft and axles, and said intermediate gearings supported on said levers and springs between said car and said levers.

531,354. Electric Conductor Support. Johan M. Andersen, Boston, Mass. Application filed July 9, 1894.

Consists in the combination with a support for electric conductors, comprising grooved end portions, and an intermediate portion weaker than the said end portions, of a bridge or anti-buckling device intermediate of the said end portions and reinforcing the weaker intermediate portion of the support.

531,365. Controlling Electro-magnetic Machines. William I. Donshea, New York, N. Y. Application filed January 29, 1894.



NO. 531,421.

This invention comprises the method of controlling electro-magnetic machines, which consists in exciting the field coil of such machine by connecting it to a source of current exterior to the machine itself when throwing the machine into use, and before closing the armature circuit and converting it into a self-exciting machine before or while throwing it out of use, whereby field discharge is accomplished gradually.

531,366. Means for Controlling Electric Locomotives. Ernst Egger and Ferdinand A. Wessel, New York, N. Y. Application filed May 17, 1893.

The object of the invention is the combination with a constant speed electric motor and with the wheels of an electric car of conical pulleys respectively therefor connected by a driving belt, a belt shifter for tightening and shifting the belt along the lengths of said pulleys, a circuit controller, and means for operating simultaneously the said belt shifter and the said circuit controller, said means consisting of a handle on the platform of the car, a shaft extending under the car having cranks, and geared to said handle, pivoted rods connecting said cranks to said belt shifter, and gearing connecting said shaft to said circuit controller, said circuit controller consisting of means for including more and more resistance in circuit with the field magnet of the motor when said handle is turned farther and farther in either direction, and for reversing the motor when said handle is turned in opposite directions, a brake magnet in circuit with said circuit controller and with the field magnet of said motor, and a loose pulley at the end of one of said conical pulleys.

531,383. Trolley. George A. Newhouse, New Albany, Ind. Application filed July 28, 1894.

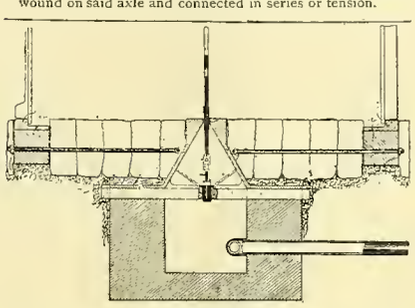
A trolley, comprising a pole, a fork, and connections between the fork and pole included within the limits thereof, and tending to maintain the fork and pole in their normal relations while permitting an oscillating movement of the fork.

531,406. Commutator. Henry L. Bridgman, Blue Island, Ill. Application filed July 3, 1894.

A commutator comprising the insulating frame, having the flanges affording pockets and an electro-deposited filling of metal in said pockets, affording the conducting portion of the commutator.

531,421. Electric Lighting System for Railway Cars. Morris Moskowitz, Newark, N. J. Application filed August 10, 1894.

The invention consists in a system for electrically lighting railway cars in combination with the car axle frame sections, and having bearing portions and bolts for securing said sections to the car wheel axle, field magnets on the outside of said frame sections, springs as-couneting said frame sections with the truck frame, and two or more armatures arranged and wound on said axle and connected in series or tension.



NO. 531,450.

531,422. Electric Arc Lamp. Edwin J. Murphy, New York, N. Y. Application filed February 16, 1894.

The invention comprises in an electric arc lamp, the combination with a vertically movable upper carbon carrying rod, and a shaft for moving said rod, of a brake wheel connected with said shaft, a brake strap applied to said wheel, two levers connected to opposite ends of the strap, and a magnet for operating one of said levers.

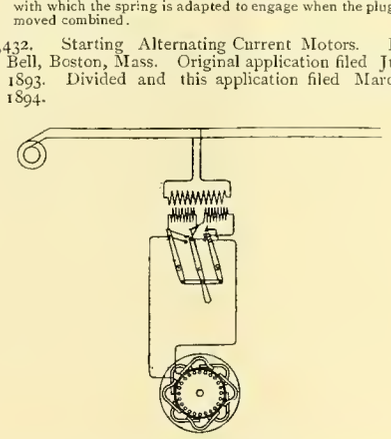
531,423. Insulator. Louis McCarthy, Boston, Mass. Application filed November 19, 1894.

An insulator comprising a case having holes or perforations therethrough, one or more connections within said case, insulating material adjacent said connection or connections and a mass of insulating composition applied exteriorly to the said case, interiorly thereof around the said connection or connections and extending through the said holes or perforations aforesaid.

531,424. Electric Plug Switch. Augustus H. Palmer, Utica, N. Y. Application filed October 17, 1894.

A plug switch or "jack" having the face plate or body with a plug opening, a spring having a shoulder closing the opening against the plug, and a projection through the face of the body by means of which the spring can be operated, and a conductor with which the spring is adapted to engage when the plug is removed combined.

531,432. Starting Alternating Current Motors. Louis Bell, Boston, Mass. Original application filed July 3, 1893. Divided and this application filed March 12, 1894.



NO. 531,432.

This invention comprises the method of operating an alternating current motor supplied from a transformer, having a divided secondary coil which consists in arranging the divided secondary coils in series to start the motor, and changing the relation to multiple when the motor attains speed.

531,437. Trolley-wire Bracket. Winfield S. Kline, Bolivar, and John B. Westhafer, New Philadelphia, O. Application filed October 17, 1894.

The device comprises an arm having adjustably attached thereto clips and a spring and hinged arm

531,441. Electric Railway. Charles H. Macloskie, Schenectady, and Henry M. Brinckerhoff, Matteawan, N. Y. Application filed May 17, 1894.

An electric railway combining with a main track a main conducting rail outside of the track, a branch track and a branch conductor outside of the branch track, the main and branch conductors being separated by a mechanical break, and a supplementary sectional conductor located near the switch on the side of the track opposite to that upon which the main conductor is located, the arrangement and location of the parts being such that a contact device makes contact with the conductors to preserve the continuity of the circuit.

531,445. Electrical Connection for Railway Rails. Arthur J. Moxham, Johnstown, Pa. Application filed June 2, 1894.

A cross electric connection for railway rails, said connections consisting of a metal bar having flexible portion or portions, and having integrally secured to its ends portions of metal adapted to be welded to the track rails.

531,450. Conduit Electric Railway. William H. Swift, Boston, Mass. Application filed April 27, 1894.

An underground electric railway comprising sub-masonry in closing a conduit, beams extending across said conduit and supported on the sub-masonry, and having bifurcated ends projecting beyond the same, castings forming the entrance slot for the trolley and supported on the sub-masonry and cross-beams, said castings being in sections fitted together end to end and having ears extending over the bifurcated ends of the beams and notched to their confronting edges, and bolts engaging said bifurcated beam ends and the casting ears.

531,486. Dredging Machine and Electrically Actuated Bucket Therefor. Colcord Upton, Salem, Mass. Application filed October 15, 1894.

A bucket having two movable jaws, a frame to which said jaws are connected, an electric motor mounted on said frame, and means actuated thereby to close said jaws.

531,499. Electric Locomotive for Elevated Railways. Fritz B. Behr, London, England. Application filed February 27, 1894.

NO. 531,614.

An electric locomotive for a single rail elevated railway, having a pair of bogies, each consisting of a bogie frame carrying a pair of vertical running wheels and a pair of horizontal guide wheels, and passenger compartments supported on said frame, each of said vertical wheels being mounted between a pair of electro-magnets and provided with coils, and a commutator on each of its faces to operate as an electric motor.

531,515. Hinge for Electric Apparatus. Arthur B. Davis, Elkridge, Md. Application filed May 12, 1894.

An electrical conductor combining the leaves of the hinge, a pintle of non oxidizable material connecting the two leaves of said hinge, and two circuit wires attached to the leaves and in electrical connection with said pintle.

531,556. Telephone Index. Charles A. Orth, Trenton, N. J. Application filed September 18, 1894.

In a telephone index leaves hinged and having vertical play upon their axis in combination with diagonal series of grooves adapted to lock said leaves by means of their own gravity.

531,575. Truck for Electric Cars. William Sutton, St. Louis, Mo. Application filed February 19, 1894.

A truck for electric cars, combining traction driving wheels, pony trailing wheels, dual supporting springs, spring housing caps, upholder pedestals having holder lugs, an intervening integral supporting frame having integral horizontal projecting flanges, and a car or carriage supported by said elements,

531,614. Electric Cable. Theodore Guilleaume, Cologne, Germany. Application filed April 26, 1892.

The invention consists of an electric cable having a strand or bundle consisting of one or more pairs of flat wires or ribbons, each insulated from the other or others, and each pair serving to convey flow and return currents in a closed circuit, the several wires or ribbons being laid flatwise against one another and the whole group being then twisted together.

531,617. Automatic Rheostat. Rodolphus W. Hollis, Atlanta, Ga. Application filed April 30, 1894.

A rheostat consisting of segments, a shaft mounted centrally thereof, a brush carried on said shaft, and adapted to traverse said segments, a ratchet wheel mounted on said shaft, a lever, a pawl thereon adapted to engage said ratchet wheel, an electro-magnet adapted to actuate said lever, and means for short-circuiting said magnet on the depression of the lever, consisting of a shunt circuit, including vertically movable separated terminals, and a pin carried on the lever adapted to engage said terminals on the depression of the lever.

# Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, JANUARY 12, 1895. No. 2.


## A Clever Illusion.

Few people realize the extent to which electricity is being employed in the arts nowadays. There was a time when the daily papers chronicled with startling headlines the appearance of every little electrical novelty or odd adaptation of the current as an aid in its application to secure light, heat or power. It is now left more largely to the technical paper to unearth curious things electrical. The adaptability of the electric light has made it "king" as compared with gas for theatrical work, and in this application of electricity, as well as in its use for advertising, lighting of store fronts, etc., many really remarkable effects are being brought out. The general public quickly appreciates the effect, the *modus operandi* being left for the enjoyment of the technical man. On this account the WESTERN ELECTRICIAN reader fond of the curious will be interested in the accompanying pictures and description of an advertising novelty doing daily service at the Chicago department store known as the Fair.

As the daily papers had it, electricity is being used at the Fair "for illusion purposes." How electricity plays its part, even after one has seen the illusion, it is safe to say, very few of the hundreds of spectators who have seen the exhibition would venture to explain. But for one versed in physics and with a knowledge of the nice gradations in lighting effects obtainable through the use of groups of ordinary incandescent lamps, with plain or colored globes, it may not, perhaps, be a very difficult matter to gain an inkling of the secret.

Fig. 1.

Fig. 2.

A CLEVER ILLUSION.

Fig. 3.

On the second floor of the Fair is a little theater built as an exhibition place for the illusion. Every ten minutes the crowd gathers before the little stage, a large music box is started, Illusionist A. B. Carrington commences his speech of explanation, the red curtain parts, is drawn aside, and the chief and only actress in the illusion of "Pharaoh's Daughter" stands revealed to public gaze.

What appears to be a white marble statue stands on the center of the stage, which is about five feet wide, the statue holding in its hands a basket containing the infant Moses. The statue proper, the infant and basket are all apparently of pure white marble, and the figure stands alone on the little stage against a background, of which the predominating color is green mixed with a little gray. Fig. 1 is a reproduction of a photograph of this marble statue.

Gradually and as if in obedience to the words of the illusionist a change appears to take place in the statue. Without a motion, and under the very eyes of the spectators, the cold white marble begins to change. The dead white begins to disappear, and flesh tints come to take its place, the marble hair begins to darken, the robe to tint, and in a word the thing of stone seems gradually to become imbued with life. Life blood appears to steal through the figure. With the gradually increasing life-like change come movements of chest, lips and eyes which at last, when their effect is combined with the now thoroughly natural colors of the face and dress—the latter a delicate green—serve to make the transformation complete.

A comparison of Figs. 1 and 3 will give a fair idea of the extent of the change that takes place, but to appreciate fully the very clever transformation one must witness it and for himself see little marble Moses in his cradle of stone change slowly into a basket of flowers. Fig. 2 shows the statue in a half-changed condition.

Without going into details as to the manner in which Mr. Carrington, the designer of this illusion, produces these clever effects, it may be said generally that such an illusion might be brought about by the use of a plate of clear glass placed in front of the stage and at an angle of 45 degrees to the plane of the stage, in such a position that a marble statue placed horizontally in a sort of pit or opening in front of the stage proper, and under the glass, would be reflected, and appear to the eye of the spectators to be standing on the stage. The stage floor being at about the level of the eye, the opening in front of the glass plate could only be observed by standing, say, on tip-toe. With sets of electric lights properly grouped and located, one set, say, on each side of the glass, with the incandescent lamps so placed that they illuminated the figures (a living woman on the stage behind the glass and a statue horizontally placed in the opening in front of the stage under the glass), without the source of light being seen, it would seem possible to so darken the stage proper that the living figure would disappear and the reflected image of the statue on the glass only be seen. Then, again, it would seem easy so to lower the lights in front and raise those behind, thus illuminating the stage proper and the living figure, so that the image would disappear.

Fig. 4 shows the automatic controller by which the lights are raised and lowered. The white cylinder carries the wire resistance. A motor pulls two contacts slowly along the cyclinder.

C. E. Doty and G. W. Stephenson of Chicago were the electrical contractors who worked out Mr. Carrington's ideas.

## Northwestern Electricial Association.

The third annual meeting of the Northwestern Electrical association will be held at the Hotel Pfister in Milwaukee on January 16th and 17th. This young organization has had a phenomenal growth since its inception, and is continually increasing in strength. At the meeting in St. Paul last year there were over 100 members present, and the promise is for a large gathering next week. An interesting and profitable programme has been prepared, and practical subjects will be discussed by thorough-going men. Space will be reserved for the display of electrical goods if application is made for the same in season.

## High Pressure Wires in Concord, N. H.

Wire Inspector C. F. West of Concord, N. H., recently reported to the city government that in his opinion the Concord Land & Water Power company, whose three-phase plant has been heretofore described in this journal, was transmitting current through the city at a voltage so high as to be dangerous to life and property. The matter was referred to A. E. Kennelly, Louis Bell and F. E. Cabot, as electrical experts, and these gentlemen made a valuable report which contains much of interest to the electrical fraternity at large and is here reproduced almost entire:

The system consists of six continuous-current series, arc lighting circuits, operated at present at pressures of from 2,000 to 3,750 volts, and of a combined incandescent lighting and power alternating three-phase circuit, operated at a pressure of approximately 2,200 volts between the primary wires. The alternating pressure is reduced in the buildings to 110 volts by transformers situated outside the buildings.

The following is a partial list of towns and cities, in the United States and abroad, where similar or greater alternating current pressures are employed. The first list of 47 cities includes those employing approximately 2,200 volts within city limits, and the second list of four cities includes those employing alternating current pressures from 4,000 to 10,000 volts within city limits.

The list of cities employing within city limits alternating pressures of 2,200 volts is as follows: American—Bangor, Me., Chicago, Ill., Green Bay, Wis., Livermore, Me., Toronto, Ont., Phœnix, Arizona, Ridgewood, N. J., Peterborough, N. H., White River Junction, Vt., Pocatello, Idaho, North Yakima, Wash., St. Paul, Minn., Tampa, Fla., Walla Walla, Wash., Seattle, Wash., Haverhill, Mass., Portland, Ore., Jackson, Mich., Ashland, N. C., Rockland, Me., Hooksett, N. H., Ithaca, N. Y., Wellesley, Mass., Winooski, Vt., Port Chester, N. Y., Easton, Pa., Riverpoint, R. I., Laredo, Tex., Topeka, Kas., Attleboro, Mass., Memphis, Tenn., Bellows Falls, Vt., Griffin, Ga., Menominee, Mich., Ludington, Mich., Antrim, N. H., Traverse City, Mich., Oregon City, Ore., Redlands, Cal., Taftville, Conn., Worcester, Mass. Foreign—Havre, France; Santos, Brazil; Odessa, Russia; Osaka, Japan; Bordeaux, France; Santo Rosalia, Mexico.

The list of cities employing within cities limits alternating current pressures higher than 2,500 volts: Hartford, Conn., 4,000 volts; Pomona, Cal., 10,000 volts; San Bernardino, Cal., 10,000 volts; Guadalajara, Mex., 5,000 volts.

The arc light circuits in the city of Concord, above referred to, are similar in regard to pressure to those which are universally employed throughout the country.

We therefore do not find that the pressures employed in the city limits of Concord are in excess of those used in general practice elsewhere.

In our opinion, such a system, installed, operated and maintained in accordance with the requirements of good practice, is not a menace to the lives and property of citizens.

We consider all pressures, whether continuous or alternating, in excess of 500 volts, as being capable of producing danger to person and property, unless properly installed, operated and maintained.

We do not consider that any dangers which might threaten persons or property from a pressure of 2,200 volts, such as exists in the city of Concord to-day, would be materially reduced by reducing pressure to 1,100 volts, for the reasons: First—That the customarily employed insulation

of wires carrying 1,100 volts will adequately protect wires carrying 2,200 volts pressure. Second—That under conditions of contact which imply danger to person, pressures of 1,100 volts alternating may be fatal. Third—That in cases which imply danger from fire, pressures of 1,100 volts alternating are capable of producing and maintaining at least equally dangerous conditions as pressures of 2,200 volts alternating.

We have investigated the injuries reported by your city inspector of wires, and such other cases of injury as have come to our notice in this city. We have only discovered two cases of injury to person, and in both cases to linemen employed in their regular duties, and who did not take proper precautions in executing the same. In one case the injury was trivial, and the man descended from the pole without assistance; in the second case the man was rendered unconscious for some minutes and received medical attendance. He received slight burns and was unable to resume his regular work for about six days.

We have investigated the damages to property which have come to our notice, and find that these occurred on two occasions, on the 24th of May and on the 2d of June last, respectively. These were both occasioned by accidental contacts existing between primary and secondary overhead wires. The accident of June 2d was precipitated by a lightning flash, and both occurred during wet weather. The danger was removed by removing the accidental contacts referred to. There is no reason to believe that if the pressure employed within the city limits had been 1,100 volts instead of 2,200, these accidents would not have occurred.

We have examined the line construction in the streets and around buildings of the city, and find it to be, at the present time, generally in accordance with good modern practice. We find, however, that the Concord Land & Water Power company is at present remiss in the following particulars:

First—That there are numerous joints, in both primary and secondary wires, on the poles which are not adequately protected.

Second—That the company has, in certain cases, permitted temporary construction to remain uncompleted for an undue length of time, and that such construction is at the present moment in an unsatisfactory condition.

Third—That in some instances the company has employed on its overhead arc circuits a few lengths of wire of which the insulated covering is useless from age.

Fourth—That some dead wires of the company yet remain on the poles in the streets.

Fifth—That in some cases the company does not appear to have followed the rules of the Board of Fire Underwriters of New Hampshire in entering buildings.

In order, therefore, to fully bring the plant up to the requirements of standard practice, we recommend the following:

First—The removal as soon as possible of all dead wires.

Second—The systematic taping of all joints in both primary and secondary wires.

Third—The removal of all danger of contact between wires and trees in the street.

Fourth—The soldering of all secondary joints.

Fifth—The proper insulation of all wires where entering buildings, in accordance with the fire underwriters' rules.

Sixth—All arc light wiring on which the insulation is defective from the effects of weather should be replaced by properly insulated wires, namely, wires of insulation equivalent to that employed on the alternating current circuit.

Seventh—That in these and all other respects the fire insurance rules be complied with.

We further recommend that the city instruct its inspector to report, at regular intervals, whether the wiring throughout the city conforms in all respects with the above mentioned fire insurance rules of the state of New Hampshire, and wherein such rules may not be complied with.

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At a recent meeting of the Allegheny Pa., city council Mayor Kennedy vetoed the award of the contract for electric light extension to the Westinghouse company of Pittsburg. The Western Electric company of Chicago bid several thousand dollars lower than the Westinghouse people, and Mayor Kennedy scored the councilmen for trying to take the contract from the lowest bidder. Both branches of the council sustained the veto and the contract was given to the Western Electric company.

## 1894 Electrically Considered.

From Charles G. Armstrong's review of the electrical progress of 1894, published in the *Chicago Record*, the following paragraphs are taken:

The alternating motor has made numerous advances during the last year, and it is apparent that we will soon have this very-much-desired motive factor in such a state of perfection that it can be used with the same confidence that we now place in the direct current motors. For various scientific reasons it is very much easier to generate, transmit or modify the alternating current than the direct current, and when the alternating current is perfected many now difficult engineering problems will be economically solved.

The telephone situation has changed greatly, as predicted a year ago. The two main Bell patents have expired and the Berliner patent has been decided by the United States Circuit Court null and void; further, the United States Supreme Court has under advisement an important case known as the Bate refrigerator patent, which is an insignificant matter in itself, but on that decision depends the life of several of the minor details of the telephone patents. The lower courts have uniformly decided this question in favor of the people, and no one who has studied the situation can believe for a moment that the Supreme Court will do anything but ratify the decision of the lower courts. This, together with the Berliner decision, will throw the battery transmitter open to the public, which will make the telephone practically public property. As to the other minor detail patents now owned by the Bell company, substitutions can be made. This does not mean that the citizens of Chicago will have reduced telephone rates. The telephone business is somewhat like advertising in a newspaper, the larger the circulation the more valuable your advertisement becomes to you. If it were possible for some outside company to use every patented device now in use by the Bell company, and if it were to establish in Chicago lower rates than the other companies, it would be very hard for them to get business, from the fact that the value of the telephone exchange is the greater number of people you can reach through your telephone, and it would take years for the new company to cover the field so that one exchange could be as useful as the other. The only avenue of relief to the people of Chicago is an ordinance through the city council, or better, a state law limiting the price for telephone service, which price should not exceed $80 a year, and could easily be $60, and yet leave a fair profit for the company. The magneto telephones, upon which patents have expired, can be purchased now at a very moderate price and are being used very extensively in place of speaking tubes connecting desks, offices and different parts of factories.

The storage battery question has been so complicated with the various patents and long-drawn-out, tedious litigations that people have approached the question with considerable hesitancy from the commercial standpoint, and the easy way with which the batteries destroy themselves and their great weight have been a drawback from a scientific standpoint, yet the storage battery has a very useful field and one that cannot be occupied by anything else. During the last year there has been a consolidation of nearly if not all of the storage battery patents in one trust company, and we believe this consolidation will be a good thing for the storage battery business, as it will at once clear up any and all uncertainties as to patents and perhaps the combined good qualities of the different batteries will be united, and the result will be that a much better battery will be placed on the market. This consolidation has only taken place within the last two months and yet a marked improvement has already appeared.

Through the united influence of the higher class of engineers and a better mode of applying insurance rules, the class of wiring done throughout the country is becoming better and better each year. During the present year a system of iron tube has been devised to cover and protect wires. Many manufacturers of electric wires are vying with each other to make, not a cheaper, but a better class of insulation, all of which tends to make electricity a safer and more desirable agent to introduce into our domestic economy.

Taken as a whole, the year of 1894 has been one of gradual improvement in electrical lines, resembling more a constant, healthy growth, rather than sudden advancement. Electricity has become an exact science like that of steam or hydraulic engineering, and the lines of improvement are not apt to be so marked as they have been in the past. Yet in the coming year we look forward with hope for the discovery of the means of producing electricity from coal without the intervention of the steam engine, thus doing away with expensive engines and dynamos, and the wasted economy of the engine and at once place electricity within the reach of all, and further we also hope that an incandescent lamp will be invented which will give more light for a given amount of current. Both of these are possible and probable; and there awaits for the fortunate individual who discovers them more treasures than Aladdin's wonderful lamp could produce, and homes will be benefited by reason of his discoveries, for the comforts enjoyed now by the few will be placed in the hands of the many, and electricity, that marvelous power toward which all eyes are turned, will be wider known and better appreciated.

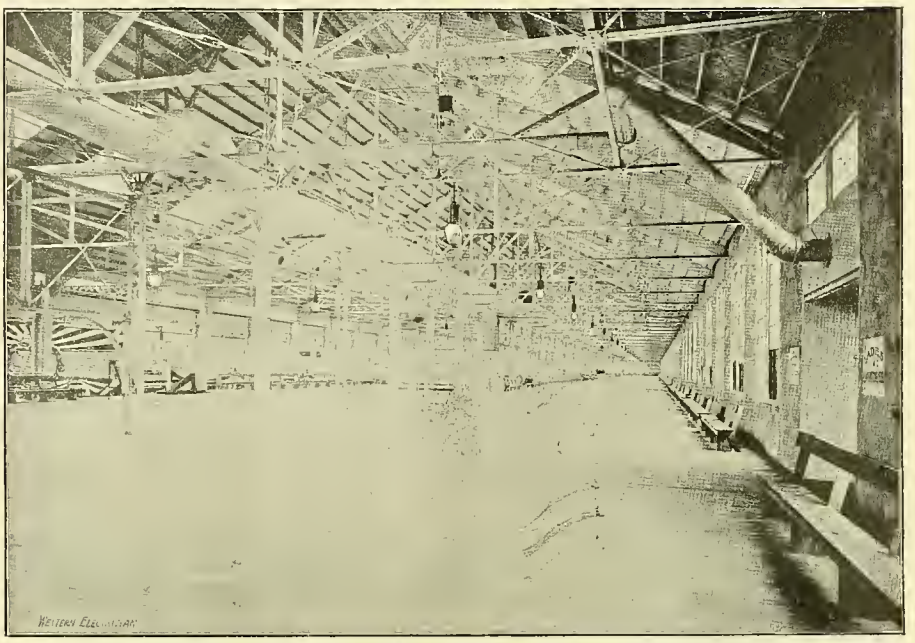

FIG. 2. NEW WESTINGHOUSE WORKS AT BRINTON, PA.

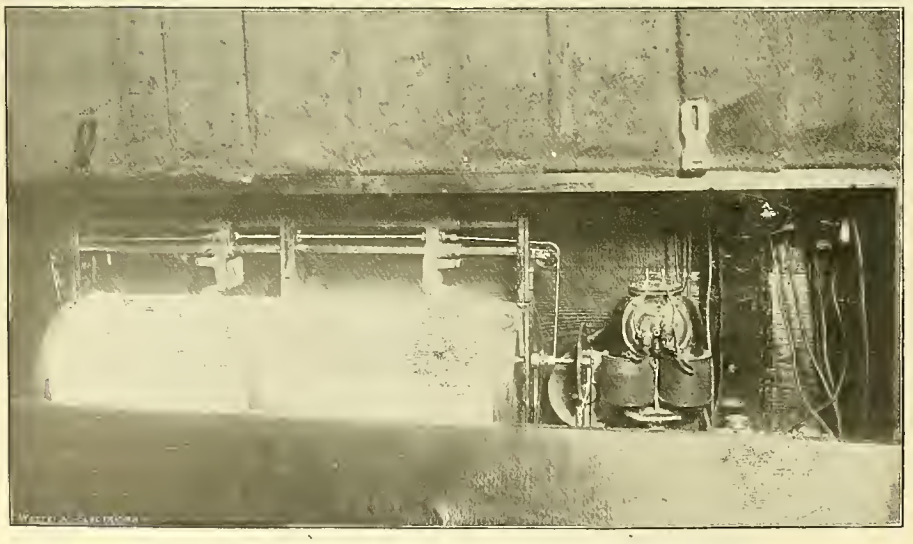

FIG. 4. A CLEVER ILLUSION.—LIGHT REGULATOR.

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## Lighting Company Embarks in the Telephone Business.

The second paragraph of the following press dispatch from Erie, Pa., is of particular interest in this era of telephone extension:

The introduction of a new electric lighting plant in Erie broke the monopoly on street lighting. The Erie County Edison Electric Light company has had the monopoly of the street lighting for years. Its contract last year was 30 cents per lamp per night. The new company, the Merchants and Manufacturers' Electric Lighting company, reduced the price to 22 cents per lamp for 2,000 candle power lights. The city lighting was divided between the two companies.

The decision against the validity of the Berliner patent on transmitters has caused the Merchants and Manufacturers' company to decide upon putting in a competing telephone service in Erie and vicinity.

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F. H. Jeannin of St. Louis will soon establish an electric light plant in Arcadia, Fla.

## City and South London Railway.

In a recent issue of a London engineering journal J. H. Greathead writes of the City and South London railway. In view of the tunnel projects for rapid transit in American cities the following extract from Mr. Greathead's paper will be of interest to electrical men:

The trains were originally intended to be drawn by endless wire ropes running up one tunnel and down the other from a central motive power station near the Elephant and Castle. There were to be two wire ropes: one starting from the engine house, proceeding to the city along the "up" and returning along the "down" line, the other making a similar circuit in the opposite direction to and from Stockwell. The rope was to travel in the first instance at the rate of ten miles an hour, giving an average speed of the trains of about nine miles per hour, including stoppages. The cable system would have possessed certain advantages over any system of traction by separate locomotives; the weight of train for a given number of passengers would be less, the trains would get into speed more quickly, and to attain a given average speed the maximum speed would consequently be lower; but the wear and tear and loss of power would be very considerable with a high cable speed. When, therefore, the rapid advances made in electric traction during the construction of the railroad made that system available, it was determined to adopt it for the working of the trains mainly on account of the higher speed which it rendered practicable.

There are gradients of 1 in 30 against the load, and, in one place, of 1 in 14 with the load, and curves in places as sharp as in 1½ chain radius. The line is consequently not an easy one for locomotive working. At the termini the lines converge into one tunnel, and the locomotive of every train has to be changed. This, on a short line involves a large proportion of shunting, which could be avoided, as it is on the Liverpool overhead railway, by the use of electric motors on the carriages themselves instead of on separate locomotives. There are also other advantages attached to motor carriages which have been recently fully discussed at the Institution of Civil Engineers in connection with the Liverpool overhead railway.

The generating station at Stockwell is equipped with four engines, each driving one generating dynamo. These engines are of the vertical compound open type, and were built by John Fowler & Co. of Leeds; they run at 100 revolutions per minute, are each capable of indicating 400 horse power, and drive the dynamos with link-leather belts. The engines are fed by eight boilers of the Lancashire type, set on Livet's principle, and arranged in two groups of four, with independent flues and chimneys.

There can be no question that rapid transit facilities in great cities in the immediate future will take the shape of railways in tunnels under streets, deep enough generally to avoid interference with other underground structures and worked by electricity.

## An Electrician in Every Village.

As an instance of the widespread interest in electrical machinery and of the manner in which ingenious mechanics in all parts of the country are studying electrical development and making the simpler forms of electrical apparatus, the following, from a paper published in Moline, Ill., is of interest:

W. C. Oswald, a blacksmith at the Wilson Buggy company, is going quite extensively into the construction of electrical machines. He has just finished a one horse power eight-light generator for the Lancashire-Marshall Organ company. A few weeks ago he finished a 10 horse power motor for the Elevator company, which now runs an elevator in Kansas City. He has just secured a contract at a small town near Princeton for a plant of 300 incandescent lights. It is a five-year contract. He is to own the plant and to receive so much from the town for furnishing the light. It will be put in this winter or early next spring.

The city of Tampa, Fla., is about to establish a municipal lighting plant.

## New Westinghouse Works at Brinton, Pa.

The new manufacturing establishment of the Westinghouse Electric & Manufacturing company at Brinton, Pa., is illustrated in the accompanying picture, Fig. 1. The buildings, which are now about completed, are located upon a block of land of 40 acres, having a frontage of 2,300 feet along the main line of the Pennsylvania railroad, at Brinton, Pa., 12 miles from Pittsburg, and it is proposed to concentrate here all the manufacturing of the company, which now employes 3,500 operatives. These new shops, as will be seen, are very extensive and will be unexcelled in completeness of detail. They have been laid out and constructed with reference to economy and convenience in the manufacturing of electrical apparatus, and they have been so designed as to admit of future extensions to accommodate the constant growth of the company's business. The railroad facilities to and on the grounds of the company are ample and convenient. Electric cranes traverse the buildings, and from building to building, and are capable of handling the largest machinery.

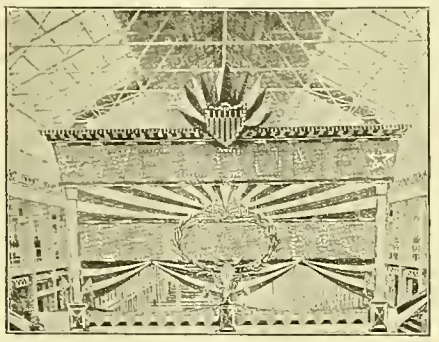

FIG. 3. NEW WESTINGHOUSE WORKS AT BRINTON, PA.

The five buildings now completed are the machine shop and the warehouse (the two large buildings side by side in the foreground of Fig. 1); the power house, lying beyond the warehouse; the sheet iron department, immediately beyond the two chimneys; and the blacksmith shop, which is at the side of the sheet iron department. The addition of the foundry, carpenter shop and one or two minor buildings will complete the plant as far as intended at present.

The dimensions of the buildings are as follows: Machine shop, 231 by 754 feet; warehouse, 76 by 754 feet; power bouse, 76 by 205 feet; sheet iron department, 76 by 258 feet; blacksmith shop, 83 by 243 feet. The area of the first floor of the machine shop is 4 acres, and of both floors 7 acres. The area of the floors of the five buildings is 10.8 acres. Other interesting figures are: Cubic yards of stone masonry, 16,037; number of brick, 4,638,000; feet of lumber (board measure), 6,000,000; weight of steel, pounds, 9,000,000.

It was in these buildings that the great reception to the Grand Army of the Republic was given on September 12th last. This reception was a very large and brilliant gathering, and it is stated that 6,500 guests were present. An idea of the great interior of the machine shop, arranged for the reception, can be gained from Fig. 2, while Fig. 3 shows a large and handsome lamp design.

The Westinghouse company has secured the contract for the electric lighting plant in the Agricultural and Mechanical College at Raleigh, N. C.

## Improvements in Storage Batteries.[1]

By Maurice Barnett.

The recent award by the Franklin Institute of Philadelphia to the inventor of the "chloride accumulator" is indicative of the great commercial importance attached to the use of secondary batteries for storage purposes. That the recipient of the medal is a Frenchman is not strange, considering that France is far ahead of the United States in its application of accumulators to the uses of central stations for electric lighting and traction work. In Paris alone 21 stations are supplied with these storage cells (containing 760 tons of plates) which run 120,000 lamps. Paris has three lines of cars run by chloride accumulators, while the same system is in use at Cannes, Boulogne, Sur Mer, Nantes, Clichy and other towns. Stimulated by the hope of reward from a new and increasing industry, French genius had been for a long time directed to this branch of electro-economics, with the result that a Frenchman's efforts produced the successful solution of electric storage. That is why the honor of the award of the Scott medal fell to foreign rather than to domestic genius.

Although electric companies in the United States have been backward in taking advantage of efficient secondary batteries as an adjunct of their generating systems, the recent placing by the Edison company of New York of a large order for accumulators of the French type is exceedingly suggestive, indicating a tendency to follow the example of foreign companies. The necessity for such accumulators in the central stations of electric lighting companies, for traction work and for large office buildings, is apparent after momentary consideration. In electric lighting stations it is found that during the winter months, for a few hours every night, the generating plant is loaded beyond its capacity, while during the summer months the load is carried easily. It is obvious that a simple generating plant must have a capacity equal to the maximum demand that may be made upon it. Furthermore, the day load at no time of the year is of sufficient importance to justify the expense of running. Inasmuch as day lighting is necessary, electric companies frequently run during that period at a loss to themselves. It is here that the storage battery proves of great commercial value; for with the help of a secondary battery a generating plant does not need to have a capacity sufficient to satisfy the maximum demand, as a much smaller generating plant worked up to its full capacity in connection with a set of accumulators can store up its surplus output and make a requisition upon it during the hours of the day when the load is in excess of the capacity of the dynamos. Such storage batteries can carry the day load and furnish light on Sundays without the necessity of operating a power plant at those times. Besides the economy in wages and fuel, there is a great opportunity to lower the cost of installing a power and generating plant, as a small generating plant with the aid of secondary batteries can do the work of a large and more costly installation of generators alone. With regard to the lighting of large office buildings, it has been the custom either to buy the light from electric lighting companies or to operate a dynamo plant and produce the light in the buildings themselves. Both of these practices involve a rather large tax upon the income of the owners of these office buildings, as in the first case, the lighting company's charges are frequently excessive, and in the second case day and night help must be maintained. It is the experience of companies using storage batteries that they can have light every hour of the day, Sundays included, and get along with the help of one engineer. Lastly, the advantages of accumulators to electric railway plants would be obvious if for no other purpose than in saving the engines and dynamos from the great fluctuations of load so noticeable in these plants. In such cases a storage battery soon pays for its installation. If such a system is placed at suitable points along a railway line considerable "feed wire" can be done away with, and a more even pressure of current maintained. These auxiliary plants act automatically, and require very little attention. Their value is most apparent when it is considered that a break in the supply circuits or a shutting down in the generators does not necessarily involve the stoppage of the cars. Installa-

1. From the *Engineering and Mining Journal*.

FIG. 1. NEW WESTIN HOUSE WORKS AT BRINTON, PA.

tions of these batteries can be made to carry the whole load late at night and early in the morning, when few cars are running, the income from operating which by generators would not defray expenses. As an instance in which the application of electric accumulators to traction purposes has been crowned with commercial success may be mentioned the two lines of cars running from Paris into the suburb of St. Denis, the combined length of which is 11 miles. The power plant consists of three 150 horse power boilers, three 150 horse power engines, and a number of dynamos of 250 volts and 300 amperes output each. Each of the cars of the company is furnished with 108 storage

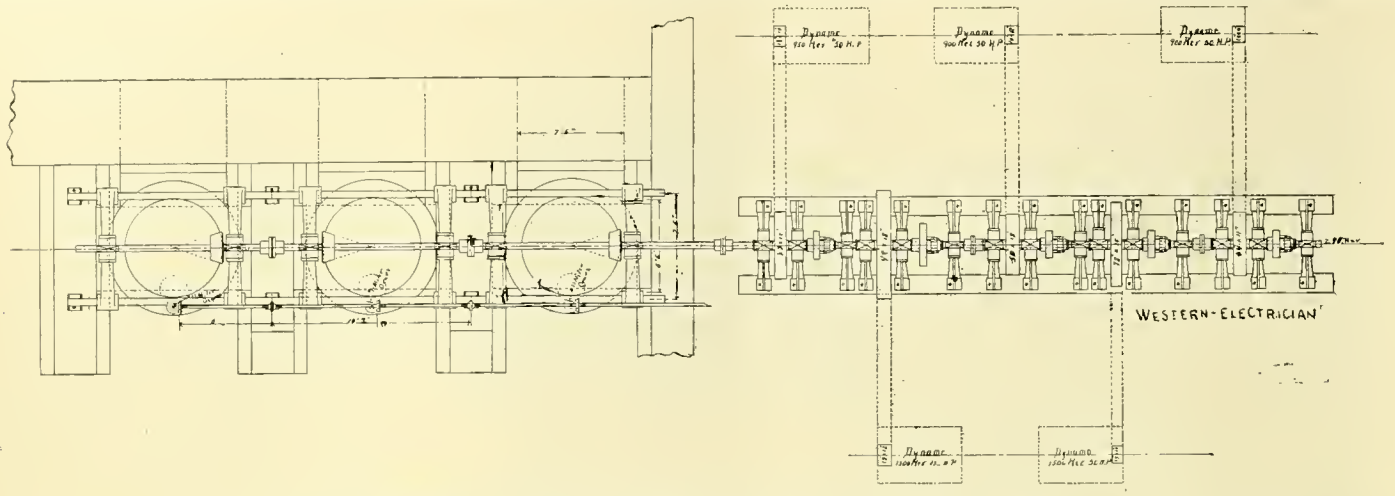


FIG. 1. TURBINE PLANT OF THE BUCHANAN POWER & ELECTRIC COMPANY.—PLAN VIEW.

cells designed especially for traction purposes, and of a capacity capable of running the car a distance of about 40 miles under the conditions of the severe gradients and curves along these lines. Considering that the gradients are frequently as high as 4 per cent., that the cars are intended to carry 50 persons, that the weight over all is 28,000 pounds, that 52 batteries of 5,616 cells and 61,776 plates perform an equivalent of 1,550 car-miles daily, and that up to May 1, 1894, one million car-miles had been run since accumulators supplied the motive power—the feasibility of using storage batteries for traction work is very apparent. The success attending the use of these batteries was so great that horse power was entirely superseded over a year ago, and a new line running from the Saint-Ouen Town Hall to Neuilly is now being supplied with the same type of accumulator.

Although theoretical and practical considerations affecting electric storage have long held out great promise to the inventor of an accumulator, efficient under all the conditions to which it might be exposed, it has only been within a very few years that such a storage cell has been perfected. The cause of this is to be found in the fact that inventors have been led astray for a number of years by erroneous methods; and in trying to make the "pasted" battery meet the demands of modern engineering, have failed most signally. Of late years there has been a tendency to revert to the Planté type of battery, which has been improved by French genius until, in the modernized form of this battery, founded on correct mechanical and scientific principles, we have an accumulator of a very high grade of excellence.

The qualities that a good storage battery must have are:

First—Non-liability to mechanical disintegration after continued use or during rapid charges or heavy discharges.

Second—A large active surface for small weight of elements.

Third—Good contact between the active surface and the inclosing frame.

Fourth—Low internal resistance.

The old method of producing lead storage batteries was to phase the lead plates slowly by electrolysis until they had the required spongy condition. The later way s to cast a frame of lead, ribbed normally in two directions with square depressions between the ribs, or to punch a lead plate full of holes and fill these with a pasty mixture of red oxide of lead in positive plates and litharge in negatives.

Accumulators made in this way can hardly be said to possess, in a high degree, any of the four qualifications just mentioned. It is almost invariably noticeable with such cells that when they have been in long use, or during heavy discharges, mechanical disintegration of the plate takes place—shown by small fragments of lead and lead oxide falling down between the elements, short-circuiting them, and in many cases causing serious damage by producing either buckling, sulphating or both. This disintegration is evidently due to the fact that the lead oxide pastes placed in these holes is a mechanical rather than a chemical compound, and that during the action of the cell the cohesion of the particles is ruptured by the change of volume attending chemical action. Furthermore, the process of cementing lead oxide paste into or against a lead frame in order to obtain the necessary active material will not produce the porosity and surface area which will give a maximum of capacity for a given weight and size of cell—a feature of great importance where storage cells are destined for traction purpose. Lastly, cells made in this way show a poor contact between the active substance and the lead frame. The result of this is increased internal resistance and heating, with consequent diminished output.

Some years ago John Scott of Edinburg, gave the city of Philadelphia a sum of money, the interest on which was to be used for the encouragement of "ingenious men and women who make useful inventions." The legacy provides for the distribution of a medal inscribed "To the most deserving," and a money premium. The Board of City Trusts of the city of Philadelphia delegated to the Franklin Institute the power to examine inventions and award the Scott medal and premium. The investigations are made by the Institute under the competent assistance of its "committee on science and the arts," and recommends for the award all meritorious inventions.

The committee that was appointed to investigate the merits of the "chloride electric storage battery," or "chloride accumulator," handed in its report recently, and recommended the award of the John Scott premium and medal to Clement Payen, the inventor. Incidentally, mention was given to Herbert Lloyd of Philadelphia, for important improvements made in the Payen cell. As this accumulator is considered by the ablest electrical engineers in the country to mark an era in the history of electric storage batteries, a description of its construction with some comments upon its efficiency will doubtless be of value to any one interested in electrical science.

The method of construction of these cells would seem to make possible of production a secondary battery that would possess the important qualifications, just mentioned, of non-liability to mechanical disintegration after continued use or during heavy discharges, a large active surface for small weight of elements, a good contact between the active material and the inclosing frames, combined with low internal resistance. The active material is obtained, not as in the old way, by cementing lead oxide paste into a frame, but in a manner purely chemical. A mixture of the chlorides of lead and zinc, in certain proportions, is fused, and the product cast into pastilles in suitable molds. When thus cast, the mixed chlorides are of a whitish color, vitreous character and very brittle. The pastilles to be used for negative plates are about ¾ inch in cross-section and 5 16 inch thick, and are cast in groups of four, which are united by filaments from 3-32 to ⅛ inch thick. The "positives" are cast separate—each one having a beveled V-shaped periphery. These pastilles are then placed in a suitable mold, and molten antimonial lead cast around them under high pressure. This feature of casting under pressure is one of the improvements due to Herbert Lloyd, and has been patented by him. The connecting sheets of the negative groups, the V-shaped bevel of the positives and the casting under pressure combine to make the fixation of the active matter exceedingly good. The frames alternating with zinc plates in metallic contact are then immersed in a bath of dilute zinc chloride. This arrangement acts like a primary battery that has been "dead short-circuited," with the result that the chemical changes which take place effect the removal of the zinc chloride. There is then left the dense frame of antimonial lead containing now pastilles of spongy lead, which are then "formed" in the usual manner.

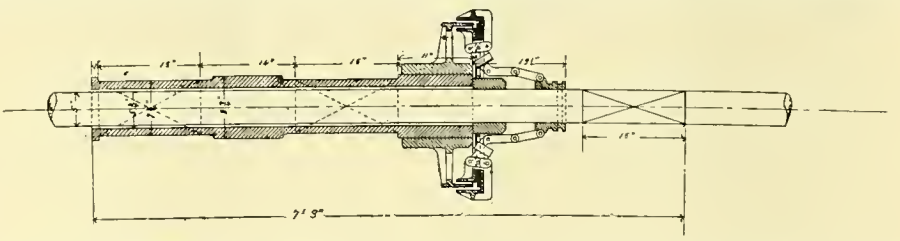

FIG. 3. TURBINE PLANT OF THE BUCHANAN POWER & ELECTRIC COMPANY.—DETAIL OF QUILL.

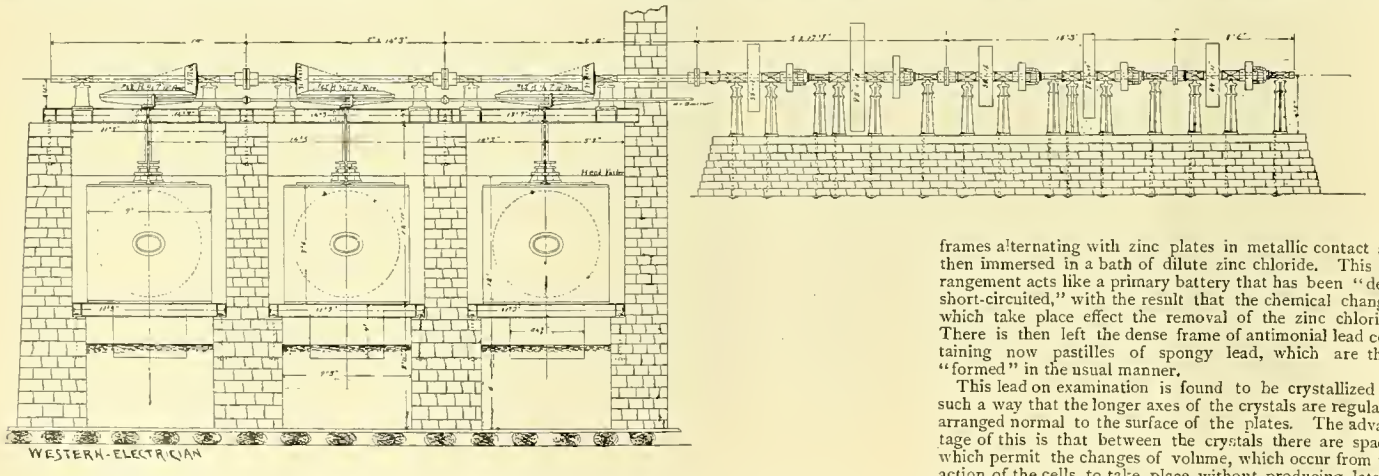


FIG. 2. TURBINE PLANT OF THE BUCHANAN POWER & ELECTRIC COMPANY.—SIDE VIEW.

This lead on examination is found to be crystallized in such a way that the longer axes of the crystals are regularly arranged normal to the surface of the plates. The advantage of this is that between the crystals there are spaces which permit the changes of volume, which occur from the action of the cells, to take place without producing lateral stresses upon the crystals or in any way causing their disintegration. Owing to this circumstance heavy discharges can take place without mechanical violence to the structure. Furthermore, the cohesion of the pastilles of this spongy lead, and consequently of the peroxide of the "formed plates," is very great; for it is well known that "in a crystalline form the molecules of matter are arranged in a different order from what they are in any mechanical mixture. In the mechanical mixture the aggregation of the atoms is strictly fortuitous; that is to say, it is a mere question of chance how they are arranged, and they have no cohesion among themselves beyond that which is given to them by the cementing mixture which holds them together. In the crystalline form, however, all this is changed; the molecules of the body are arranged in perfect symmetrical order, and they are held together by molecular affinities which regulate the order of their distribution and secure

the coherence of the mass." In other words the particles of this spongy lead and peroxide are bound together far more strongly than it is possible in "forming" plates by the old method of mechanical mixtures. Beyond this it is obvious that the peculiar structure of this spongy lead admits of a maximum active surface of uniform consistency through the entire plate—save where the antimonial lead frame intervenes. And as the capacity of a cell of given size and weight depends upon the amount of chemically active material, the cell under discussion will require less floor space than other accumulators.

Although the construction just described seems thoroughly effective in preventing the tendency to disintegration, it has nevertheless been considered expedient, as a precautionary method solely, to introduce between the plates a thin sheet of woven asbestos cloth so that any small particles which might be detached could not short-circuit the cell. It is found that this asbestos increases the resistance of the cell to a very small extent—which is compensated for, however, by the fact that the contact in this accumulator is exceptionally good owing to the shape of the chloride pastilles, and to the fact that they were cast in the frame under pressure. The internal resistance is no greater than in other lead cells, being about .002 ohm.

If the data were available, it would be exceedingly interesting to compare the relative capacities of the "chloride accumulator" with other storage cells manufactured in this country. Unfortunately, makers of strictly American types of secondary batteries have not published information regarding the capacity and efficiency of their cells. The only information at hand is a table of comparative capacities per pound of positive and negative plates, compiled by Hardman Arthur Earle, and covering only the French, German and English types. A glance at this table shows the status of the art in Europe and the position held by the chloride accumulator. The Crompton-Howell is the English type and the Tudor the German type of storage cell.

| | Type of accumulator. | Rate of discharge—Small | Normal. | Strong. | Max. |
|---|---|---|---|---|---|
| Capacity in ampere-hours. | Chloride (Payen cell) | 8.1 | 6.7 | 5.3 | 4. |
| | Crompton-Howell | .. | 2.5 | 2.34 | 1.17 |
| | Tudor | 2.2 | 1.9 | 1.7 | 1.48 |

In conclusion it may be said that this battery is destined to play an important part in the economy of light and power installations. It is manufactured abroad by the Société Anonyme pour le Travail Electrique des Métaux of Paris, France, a company controlled by the Rothschilds, and by the Chloride Electrical Storage Syndicate, Limited, of Manchester, England, of which Dr. Edward Hopkinson is managing director. In this country the Electric Storage Battery company of Philadelphia has undertaken its manufacture under the management of Herbert Lloyd, whose name was mentioned in connection with having taken out patents in the United States for improvements in the manufacture of the Payen cell and its adaptation to traction purposes.

## Turbine Plant of the Buchanan Power & Electric Company.

In the WESTERN ELECTRICIAN of November 3, 1894, there was presented a description of the water power lighting and power plant at Buchanan, Mich. The article referred more particularly to the electrical portion of the installation, and is now supplemented by a number of important details relating to the water power plant proper.

Buchanan is situated on the Big St. Joseph river, about eighty miles east of Chicago, on the line of the Michigan Central railroad. Two years ago a company was incorporated under the laws of the state of Michigan, under the name of the Buchanan Power & Electric company. The officers are: President, Peter English; vice-president, J. G. Holmes; secretary and treasurer, Frank English. This company acquired the water rights and necessary land to build a dam across the St. Joseph river, which will furnish the company with about 3,000 minimum horse power at low water. During the summer months the average flow is 12 inches over a stone dam 400 feet in length.

The dam was finished and the plant put in operation during the month of November, '93. The equipment consists of three 48-inch "Special New American" turbine water wheels, which operate under a head of 12 feet and develop 434 effective horse power. As will be seen from the accompanying drawings, Figs. 1, 2 and 3, comprising a plan and side view and detail of the water power machinery, these wheels run vertically and are geared to one line shaft, so arranged that any wheel can be thrown out of gear and the line run with one or more wheels as may be required. Fig. 4 shows the large bevel gear connection between turbines and line shaft, and Fig. 5 gives a clear idea of the line shaft, which extends into the dynamo room and is permanently secured to a brick foundation supported by iron stands and arranged to drive five dynamos.

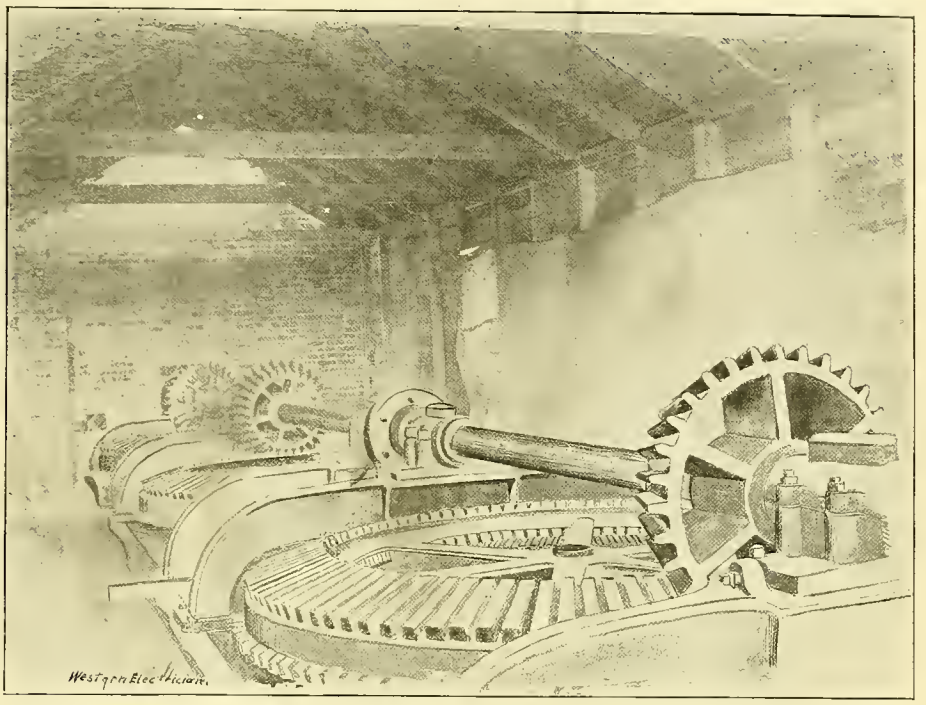


FIG. 4. TURBINE PLANT OF THE BUCHANAN POWER & ELECTRIC COMPANY.—GEARING BETWEEN TURBINES AND LINE SHAFT.

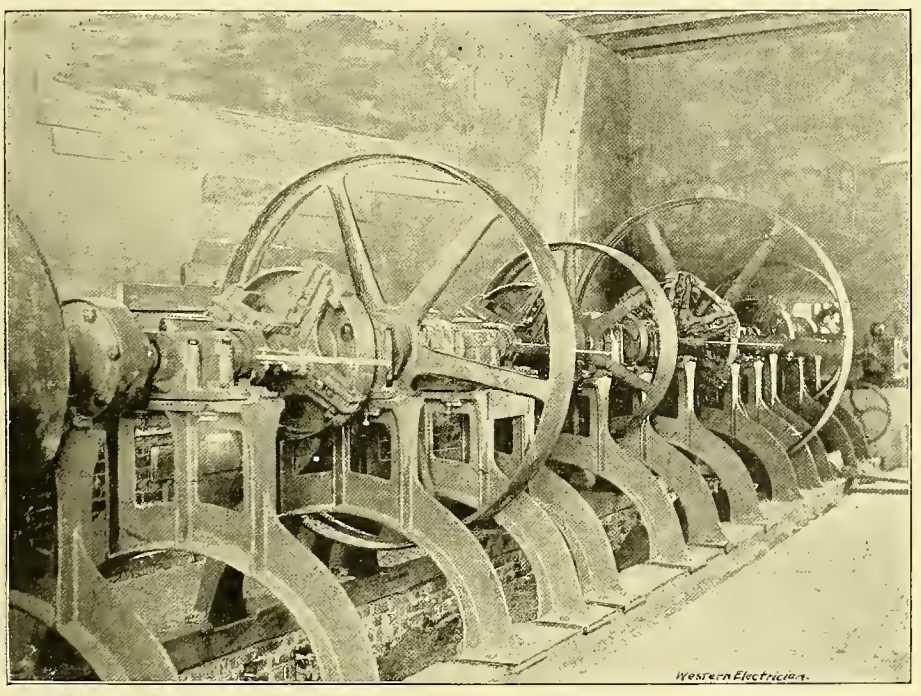


FIG. 5. TURBINE PLANT OF THE BUCHANAN POWER & ELECTRIC COMPANY.—LINE SHAFT.

The pulleys which drive the dynamos are on separate quills or hollow shafts, Fig. 3, the line shaft passing through the quills, with a bearing on the line near the end of each. The quills are provided with a journal at each end and are supported by stands independent of the main driving shaft, so that when not in operation the quills remain at rest on their respective hearings. Each quill is provided with a friction cut-off coupling, one-half of each coupling being keyed on the line shaft, and the other half on the quill. By engaging or disengaging the couplings either dynamo can be put in operation or stopped at pleasure while the turbines are in motion. The gate shafts of the turbines are all geared to one Fruen governor, which regulates the speed when a change is made in the load.

It is stated that late tests of these wheels at the Holyoke testing flume, Holyoke, Mass., show a remarkably high efficiency from whole to half water, and that the wheels are especially adapted to drive electrical machinery, as the gates which admit the water to the wheels are very easily and quickly operated by a governor.

The present electrical equipment of the plant consists of one 60 light Standard arc dynamo operating at 900 revolutions a minute, which furnishes current for the street lamps and commercial arc lights; a 45 kilowatt, 550 volt compound wound multipolar power generator running at 675 revolutions a minute, which furnishes current for the power circuit, to which is attached motors for driving the pumps in the city water works, as well as various smaller motors scattered about the town; also a Standard 1,250 light alternator, with a self-contained exciter furnishing 1,100 volts on the primary circuit, with a full equipment of arc lamps, converters, etc.

The plans for the water power outfit, with the system of driving with quills, were designed and the plant furnished by the Dayton Globe Iron Works company of Dayton, O. Those who are in a position to know state that the plant has been giving excellent satisfaction and presents a fine example of an electric plant operated by water power.

## Electric Railway in the Yosemite Valley.

A company composed largely of Chicago capitalists is about to commence the construction of an electric railway from Merced, Cal., a point on the Southern Pacific 152 miles south of San Francisco, to run westward over the old stage route via Mariposa to the Yosemite, and as the right of way has been obtained and the natural difficulties are for most of the distance small, it probably will not be many months before tourists can ride comfortably in a few hours from San Francisco into the heart of perhaps the most majestic scenery on the continent. Power is to be obtained from the Merced river at three points, thus converting the forces of nature into the means of transportation, and surmounting one of the most serious difficulties of railway operation in California, the high cost of fuel. A large revenue is also assured from the electric power in rentals for mining and manufacturing purposes, and the enterprise will thus aid in the industrial development of the country. The road, which will be of standard gauge, is expected to do a freight as well as passenger business, though its chief object, of course, will be to replace the tedious and expensive stages that now carry some 7,000 tourists into Yosemite valley yearly, and to increase the travel many fold.

A committee consisting of A. D. Hurt, John W. Muncaster and A. J. Miller is investigating the best system and cost of an electric light plant for the city of Henderson, Ky.

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## HIGH WATER MARK

CIRCULATION, 16,630.

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IT is painful to observe that it is an electrical journal—an English publication, to be sure, but still one that mildly devotes itself to electrical matters—that speaks of "an effluvia." This "effluvia" is a long way off, and the subject is not, perhaps, of the very first importance, but one is still tempted to inquire, What's the matter with effluvium?

WHEN one stops to think of the feat of actually transmitting by electrical aid a man's handwriting three hundred miles, over land and under sea, as was done in the telautographic test between Paris and London last month, the achievement is seen to be really remarkable. Dr. Gray's telautograph, the only great electrical novelty at the World's Fair, has added another trophy to the triumphs of human inventive genius.

A COMMITTEE of capable electrical engineers has decided that the citizens of Concord, N. H., need apprehend no danger from alternating current of 2,200 volts potential in the streets of that city, provided the circuits are properly installed, maintained and operated. The engineers point out some defects in line construction that should be remedied, but do not find that the pressure is in excess of that used in general practice elsewhere. Their report, which is given on on another page, will be endorsed by all members of the electrical fraternity, who will wonder why the high voltage should in itself have excited the fears of the city wire inspector. With proper insulation, pressures much higher than 2,200 volts can be carried in city streets with perfect safety, as every electrician knows. Perhaps it was the strange terror that is excited in many minds by the words "alternating current" that actuated the city fathers.

THE *Daily Evening Post* of Pekin, Ill., voices a complaint that seems to point to an instance where storage batteries could be used to advantage in central station work. "When the light is turned on the service is very good," it says, "but the objectionable feature is that the lights are turned off just when they are most needed. Very often every establishment requires more or less light throughout the day, but between 7:30 and 8 o'clock each morning the lights are turned off and remain so until about 4 o'clock in the afternoon. If this could be overcome electric lighting in Pekin would be pronounced a decided success and the patronage increased. As it now is incandescent lights are a great annoyance, for instead of deriving a benefit from them during a gloomy day a merchant is required to use gas or bring out the old oil lamp. We hope the company will see its way clear whereby this objectionable feature can be overcome and light furnished whenever necessity demands."

Would it not be good policy, in a case of this kind, to supplement the station dynamos by sufficient storage battery capacity to carry the light day load? This is a point to which the managers of lighting plants should give careful attention.

THERE is one very noticeable trait of Frank W. Hawley, the man who is devoting himself to the project of operating the boats on the Erie canal by electrically transmitted power from Niagara Falls; he believes in the use of electricity, and he doesn't care who knows it. He believes further in publicly expressing his views and in clothing his ideas in a mellifluous rhetoric that shall charm the ear of the populace. For instance, in closing a recent address on "Electricity Down to Date," he prophesied of future electrical development in the following glowing terms:

Submarine vessels will be built and voyages made equaling that of Verne's Nautilus. The sandy floors and azure gulfs of the sea will be explored and mapped. Ocean will display to the scientist its hidden wonders and beauties. Our mints will reclaim the golden wedges of foundered galleys and the plate and jewels of long-lost argosies. Lord of the earth and sea, it will then but remain for man to assert his supremacy over the air. It is possible that a future inventor may successfully adapt electricity to some form of aerial navigation. Perhaps some Morse of coming time may establish electric communication with the planets by means of colossal signals read with telescopic aid. The scientists of following centuries may devise means for so using electric currents as to conduct away from unhealthy localities the pestilential miasm which generates disease, and meteorological conditions may be mastered so as to enable the Weather Bureau electrically to preserve or alter the equilibrium between the soil and the atmosphere, thus directing the fall of rain. Such achievements seem incredible to us, but we must remember that the dreams of one age are often the facts of the next. Thanks to the advent of this mystic power, the lives of our descendants promise to be most rosy and luxurious ones, their principal toil being occasionally to push a button and permit that universal and unwearied servitor—electricity—to do the rest.

"Rosy and luxurious" indeed! If but a tithe of the wonderful things he describes come to pass, Mr. Hawley will have earned the position of seer and prophet of the "electric era," on the threshold of which, he says, "the world now stands trembling and expectant."

We have indicated but a few of the electrical marvels of the future which are promised by Mr. Hawley. Indeed, it is difficult to choose. We are told that bicycles and tricycles operated by storage batteries will come into general use, and bring in their train a splendid system of public roads. We shall yet be able to hold communication with a person in any part of the globe, and not only hear his voice, but see his image. Telegrams can now be received on board moving trains; it is but a step further to hold communication with ships far out at sea. Electrical stoves, shaped in ornamental panels or forms of art, will adorn and heat our dwellings. Coal will no longer be required, and with it will depart the annoyances of dust, smoke and soot. Historic spots can be accurately reproduced and the classic gems of dramatic art be exhibited in a setting such as they deserve. Electric displays and transparencies will be an important feature of the political parades of the future, and by such means our descendants can commemorate Independence Day with a pomp and grandeur far surpassing our finest pyrotechnic exhibitions. Scenic effects will be heightened by colored and variously shaded lights, bathing in prismatic glories lawns and walks and statues, lighting gardens and terraces and gleaming from mimic lakes. Broad bands of color can be cast on the curtains of the night and be harmoniously changed and blended at will. From grotto and arbor will breathe delicious music, like strains from fairyland, and every statue be vocal, like ancient Memnon's.

We can thus see that the blissful period foretold in Holy Writ as the Millennium is none other than what is now known to be the resplendent "electric era."

THE two avenues of extension that are now most promising in the development of electric traction are the electrical equipment of elevated railroads in large cities and the building of trolley lines connecting villages and smaller, cities to give a service corresponding to that now furnished, in many instances, by steam railroads. The movement in the former direction has been heretofore considered in this journal, but the tendency to build rural electric railways is scarcely less important and must not be overlooked.

Naturally it is in the more thickly settled eastern states that projects of this character have thus far been carried into execution or are under way—particularly in Massachusetts, Connecticut, New York, New Jersey and Pennsylvania—but extensive networks are planned in Ohio and Indiana, and to a lesser extent in Michigan, Illinois and Wisconsin. In Minnesota there is the interurban line connecting St. Paul and Minneapolis, which is not precisely of the type of rural railways now under consideration but which has conclusively demonstrated the greater popularity of electric over steam passenger service between adjacent cities. The projected Baltimore-Washington electric line is another road of this character on a more extensive scale, while several other ambitious projects, such as the Philadelphia-New York and Chicago-Milwaukee schemes are in various stages of talk.

Among other connecting lines in Massachusetts may be mentioned the one in successful operation between Fall River and New Bedford, a distance of fourteen or fifteen miles, and a line is now projected and will at once be built between Fall River and Taunton, about the same distance. In Pennsylvania several trolley lines have been constructed and are now being operated over country roads. The farmers, who were at first opposed to them, are now the strongest advocates. The *Elmira*, N. Y., *Gazette* says that Waverly, Sayre and Athens are connected by a trolley line; that Corning and Painted Post will be connected this year by a line for which the franchise has just been granted; that a movement is on foot to connect Havana and Watkins, and another scheme proposes to unite Waverly, Chemung, Wellsburg and Elmira; that a franchise has been granted to build a line between Binghamton and Union; and that progress is being made with a scheme to connect Williamsport, Pa., and Binghamton. Many similar extensions might be cited if it were desirable to swell the list.

These country electric roads are already cutting into the local business of the steam railroad companies and will do so, of course, in far greater degree in the future, unless the present outlook is totally misleading. This fact has caused the steam railroad men to raise the cry that the competition of the electric railway companies is unfair because the latter, to a large extent, use the highways under franchise from county and state authorities, whereas they have been compelled, usually, to purchase land for their tracks. The steam railroad companies contend that such use of the highways is improper, and it is believed that they are endeavoring to secure legislation in several states to prevent it.

The question thus raised is an important one, and is bound to excite much discussion. After considering the subject carefully, sensible men can hardly fail to agree, however, that the interests of the inhabitants of the tributary territory can best be served by allowing the use of the highways, under proper restrictions, for the electric cars. It is entirely a question of local interest—a neighborhood service. Will not the easily accessible trolley lines in the main roads of the district afford the farmers and the residents of near-by towns a more ready and economical means of transportation for themselves and their products than any other system? The answer will almost always be in the affirmative. The people will allow the highways to be used for this purpose because it advances their own prosperity and convenience.

But the privilege of running trolley cars along country roads at comparatively high speeds will be granted, of course, with reasonable conditions. The question will arise, What are proper and reasonable restrictions? The state road commissioner of New Jersey, Edward Burroughs, has laid down certain rules which he regards as vital to protect the public interest. His main point is that the grants of right of way should require the track to conform to the width of vehicles generally in use on the highways; that the rails shall have at least four inches flange, and that wherever the tracks are laid upon public roads the space between the rails and for at least 15 inches outside of them shall be either paved or macadamized so as to secure a good roadbed. These requirements are not unreasonable, in view of the value of the franchise granted, unless exception is made in the matter of paving; but of course local conditions will largely govern in each case. Electric railway companies, like all other corporations, should respect the rights of the people in seeking franchises, and should live up to the requirements imposed after the latter have once been accepted.

## Paris-London Telautographic Test.

From private advices received in Chicago it is learned that the long-expected test of Gray's telautograph over the long-distance telephone line between Paris and London came off on the night of December 15th and resulted in a great success. The line is under the control of the French and English governments, and as no newspaper men were present no publicity has heretofore been given to this interesting and important event, the WESTERN ELECTRICIAN having the good fortune to make the first announcement.

Some delay at the outset was caused by a broken wire at the Paris end, but after this was remedied the telautograph representatives wrote back and forth for an hour and a half without any trouble. The French goveroment was represented by three engineers, who were delighted with the result. The distance over which the writing was electrically reproduced was 312½ miles, and all agreed that it was a wonderful spectacle to watch in Paris the instantaneous reproduction of the movements of a pen in the hands of a mao writing in London.

Of the 312½ miles of line 23 miles is submarine cable and 5½ miles consists of buried conductors at Paris. All of the English land line is overhead. Current was supplied, at the London end, by a battery of bichromate cells, two rows in parallel, the voltage being 57, while at Paris there were storage batteries and Callaud cells, the latter being arranged four rows in parallel, the potential being 63 volts. The resistance

To Prof Gray

This writing is done at Paris and received in London

Yours very truly
T. W. Cushing

Paris Dec 15. 1894

How is it

PARIS-LONDON TELAUTOGRAPHIC TEST.

of the circuit was 706 ohms and the capacity was 11 microfarads. The platen resistance at each end was 550 ohms. The difference in voltage at the ends of the line was merely an incident due to convenient arrangement of the batteries. No change from ordinary conditions was made in the machines or adjustments, except in the Morse relays.

The actual counted speed of transmission was 18 words in 36 seconds at one time and 22 words in 40 seconds at another, the average number of letters in each word being five. The writing was perfectly legible but somewhat ragged at very high speed. An interesting reproduction of an actual message written in Paris and received in London during the test is herewith given, somewhat reduced in size. Mr. Cushing, who wrote it, is the foreign representative of the Gray European Telautograph company and is a well-known Chcago electrical man.

The French minister of posts and telegraphs, with the officers of his staff, visited the laboratory at Paris and inspected the machines, appearing to be much interested. One of the department engineers will make an official report of the test to the government of France.

The telautograph was exhibited and explained at a special meeting of the Société Internationale des Electriciens in Paris on December 18th. M. J. Voisenat, a telegraph engineer, delivered the lecture, which was illustrated by elaborate diagrams and by the actual operation of a set of the machines. About 300 persons were present and all were greatly interested and eager to obtain samples of the electrically transmitted writing. At the conclusion of the lecture A. Postel-Vinay, the president of the society, spoke in terms of warm praise of Dr. Elisha Gray and his wonderful invention.

Mr. Cushing, in a recent letter, makes amusing allusion to the difficulties experienced by the Frenchmen in pronouncing American names. Dr. Gray is known as Eleezi-g-r-r-r-ay and Mr. Cushing has become Monsieur Coosteen. Mr. Cushing hopes to be able to sail from Genoa for home this month.

## National Electric Light Association.

A partial list of the papers to be read at the Cleveland meeting of the National Electric Light association on February 19th, 20th and 21st is as follows: "Some Economies in Electric Light and Power Stations," by Edward Weston; "Arc Carbons and the National Electric Light Association Standard of Light," by L. B. Marks; "The Monocyclic System," by Dr. Louis Bell; "The Correct Method of Protecting Electric Circuits," by W. E. Harrington; "The Evolution of Arc Lighting Machines," by C. N. Black. E. A. Leslie's paper, read at the Buffalo meeting, and entitled "The Operation of High Tension Currents Underground from a Physical and Financial Standpoint," will be taken up and discussed.

The Central Traffic Association has granted the application for excursion rates to the Cleveland meeting, and it is announced that the rate from all points in its territory to Cleveland will be a fare and one-third for the round trip on the certificate plan. The other associations will undoubtedly concede the same rate.

The revised rules of the National Electric Light association for electrical construction and operation have been neatly issued in pamphlet form, and may be had of the secretary, Geo. F. Porter, 136 Liberty street, New York.

## Modern Theories as to Electricity.[1]

BY HENRY A. ROWLAND.

It is not uncommon for electricians to be asked whether modern science has yet determined the nature of electricity, and we often find difficulty in answering the question. When the latter comes from a person of small knowledge which we know to be of a vague and general nature, we naturally answer it in an equally vague and general manner; but when it comes from a studeot of science anxious and able to bear the truth, we can now answer with certainty that electricity no longer exists. Electrical phenomena, electrostatic actions, electromagnetic actions, electrical waves—these still exist and require explanation; but electricity, which, according to the old theory, is a viscous fluid throwing out little amoeba-like arms that stick to neighboring light substances and, contracting, draw them to the electrified body, electricity as a self repellant fluid or as two kinds of fluid, positive and negative, attracting each other and repelling themselves—this electricity no longer exists. For the name electricity, as used up to the present time, signifies at once that a substance is meant, and there is nothing more certain today than that electricity is not a fluid.

This makes the task of one who attempts to explain modern electrical theory a very difficult one, for the idea of electricity as a fluid pervades the whole language of electrical science, and even the definitions of electrical units as adopted by all scientists suggest a fluid theory. No wonder, then, that some practical men have given up in despair and finally concluded that the easiest way to understand a telegraph line is to consider that the earth is a vast reservoir of electrical fluid, which is pumped up to the line wire by the battery and finally descends to its proper level at the distant end. Is not this the proper conclusion to draw from that unfortunate term "electric current"? Remembering this fact—that we cannot yet free ourselves from these old theories, and exactly suit our words to our meaning—we shall now try to understand the modern progress in electrical theory.

This whole progress is based upon something in the human mind which warns us against the possibility of attraction at a distance through vacant space. Newton felt this impossibility in the case of gravitation, but it is to Faraday that we must look principally for the idea that electrical and magnetic actions must be carried on by means of a medium filling all space and usually called the ether. The development of this idea leads to the modern theory of electrical phenomena.

Take an ordinary steel magnet and, like Faraday, cover it with a sheet of paper, and upon this sprinkle iron filings. Mapped before us we see Faraday's lines of magnetic force extending from pole to pole. We can calculate the form of these lines on the supposition that a magnetic fluid is either distributed over the poles of the magnet or on its molecules, assuming that attraction takes place through space without an intervening medium. But at this idea the mind of Faraday revolted, and he conceived that these lines, drawn for us by the iron filings, actually exist in the ether surrounding the magnet; he even conceived of them as having a tension along their length and a repulsion for one another perpendicular to their length.

Two magnets, then, near each other, become connected by these lines, which, like little elastic bands always pulling along their length, strive to bring the magnets together. These so-called lines of force (now called tubes of force) were, by his theory, conducted better by iron and worse by bismuth than by the ether of space, and so gave the explanation of magnetic attraction and diamagnetic repulsion.

The same theory of lines of force was also applied by Faraday to electrified bodies, and thus all electrostatic attractions were explained. By this idea of lines of force it will be seen that Faraday did away with all action at a distance and with all magnetic and electrical fluids, and substituted, instead, a system in which the ether surrounding the magnet or the electrified body became the all-important factor and the magnet or electrified body became simply the place where the lines of force ended; where a line of magnetic force ended, there was a portion of imaginary magnetic fluid; where a line of electric force ended, there was a portion of imaginary electric fluid. As the quantities of so-called plus and minus electricity in any system are equal, we can thus imagine every charged electrical system to be composed of a group of tubes of electrical force (more strictly electric induction) which unite the plus and minus electrified bodies, each unit tube having one unit of plus electricity on one end and one unit of minus electricity on the other. The tension along the tube explains the reason why such an arrangement acts as if there were real plus and minus electrical fluids on the ends of the tube, attracting one another at a distance. Consider a plus electrified sphere far away from other bodies. The lines of force radiate from it in all directions, and, being symmetrical around the sphere, they pull it equally in all directions. Now bring near it a minus electrified body, and the lines of force turn toward it and become concentrated on the side of the sphere toward such a body. Hence the lines pull more strongly in the direction of the negative body, and the sphere tends to approach it.

In the case of a conducting body the lines of force always pass outward perpendicularly to the surface, and hence, if we know the distribution of the lines over the surface, or the so-called surface density of the electricity, we can always tell in which direction the body tends to move. It is not necessary to know whether there are any attracting bodies near the conductor, but only the distribution of the lines. These lines then do away with all necessity for considering action at a distance, for we only have to imagine a kind of ether in which lines of force, with given properties, can exist, and we have the explanation of electric attraction.

But the question now arises as to how the lines of electric force can be produced in the ether, or, in other words, how bodies can be charged.

In the first place we know that equal quantities of plus and minus electricity are always produced. As an illustration, suppose it is required to charge two balls with electricity. Pass a conducting wire between them with a galvanic battery in its circuit. The galvanic battery generates the lines of force; these crowd together around it and push each other sideways until their ends are pushed down the wire and many of them are pushed out upon the balls.

When the tension backward along the lines of force just balances the forward push of the electromotive force of the battery, equilibrium is established. If the wire is a good conductor, there may be electrical oscillations before the lines come to rest in a given position, and this I shall consider below.

The motion of the ends of the lines of force over and in the wire constitutes what is called an electric current in the wire, which is accompanied by magnetic action around it, and also by waves of electromagnetic disturbance which pass outward into space.

If, after equilibrium is established, we remove the wire, we have simply two charged spheres connected by lines of electrostatic force and thereby attracted to each other. If we replace the battery by a dynamo or by an electric machine the effect is the same.

But there is another way by which bodies are often charged, and that is by friction. In this case we can suppose the glass to take hold of one end of the lines of force and the rubber the other end, and it is then only necessary to pull the bodies asunder to fill the space with lines. The friction is merely needed to bring the two bodies into intimate contact and remove them gently from each other.

The following considerations may guide us in understanding the details of the process. It is well known from Faraday's researches that a given quantity of electricity has a fixed relation to the chemical equivalents of substances. Thus it requires 10,000 absolute electromagnetic units of electricity to deposit 114 grammes of silver, 68 grammes of copper, 34 grammes of zinc, etc.

Hence we can consider, for instance, in chloride of silver that the atoms of silver are joined to the atoms of chlorine by lines of electrostatic force which hold them to each other. If, by rubbing the chloride of silver we could remove the chlorine on the rubber while leaving the silver, we could stretch them asunder and so fill space with the lines of electrostatic force. According to this theory, then, each atom has a number of lines of force attached to it, and it is only by stretching the atoms apart that we can fill an appreciable space with them and so cause electrostatic action at a distance.

We come to the conclusion, then, that all electrification is originally produced by separating the atoms of bodies from one another, which can be done by breaking contact, by friction, or by direct chemical action of one substance on another, or in some other manner not so common. The lines of electrostatic force in a case of electricity at rest must always begin and end on matter, and they can never have their ends in space free from matter. The ends can be carried along with the matter, constituting electric convection, or they can slide through a metallic conductor or an electrolyte or rarefied gas, making what we call an electric current, but as they cannot end in a vacuum they cannot pass through it. Thus we conclude that a vacuum is a perfect non-conductor of electricity.

The exact process by which the ends of the lines of force pass through and along a conductor can at present be only dimly imagined, and no existing theory can be considered as entirely satisfactory. In the case of an electrolyte, however, we can form a fairly perfect picture of what takes place as the decomposition goes on. Thus, in the case of zinc and copper in hydrochloric acid, we can imagine the zinc plate attracting the chlorine of the acid, thus stretching out the natural line of electric force connecting the chlorine atom and the first hydrogen atom; we can imagine the atoms of chlorine and hydrogen in the body of the liquid recombining with each other, and their lines of force uniting until they form a complete line long enough to stretch from the zinc to the copper plate; and all without once making a line of force without its end upon matter. We can further imagine the ends of this line sliding along the copper and zinc plates to the conducting wires and down their length, thus making an electric current and carrying the energy of chemical action to a great distance.

If the ends of the lines should slide along the wire without any resistance, the wire would be a perfect conductor, but all substances present some resistance, and in this case heat is generated. This we always find where an electric

1. From the *Engineering Magazine*.

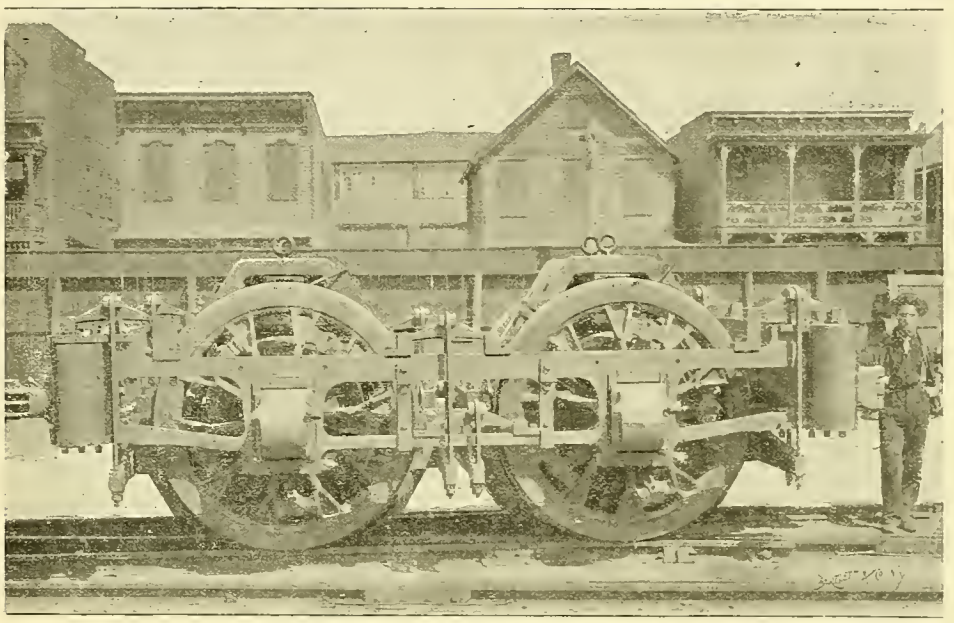
current passes along a wire. As to the exact nature of this resistance or the nature of metallic conduction in general we know little, but I believe we are approaching the time when we can at least imagine what happens in this most interesting case.

Besides the heating due to the electric current, steadily flowing, we must now account for the magnetic lines of force surrounding the current and the magnetic induction of one current on the other.

If the current is produced by the ends of the tubes of electrostatic force moving along the wire, then we may imagine that the movement of the lines of electrostatic force in space produces the lines of magnetic force in a direction at right angles to the motion and to the direction of the lines of electrostatic force. At the same time we must be careful not to assume too readily that one is the cause and the other the effect; for we well know that a moving line of magnetic force (more properly induction) produces, as Faraday and Maxwell have shown, an electric force perpendicular to the magnetic line and to the direction of motion. Neither line can move without being accompanied by the other, and we can, for the moment, imagine either one as the cause of the other. However, for steady currents, it is simpler to take the moving lines of electrostatic force as the cause and the magnetic lines as the effect.

We have now to consider what happens when we have to deal with variable currents rather than steady ones.

In this case we know from the calculations of the great Maxwell and the demonstrations of Hertz that waves of electromagnetic disturbance are given out. To produce these waves, however, very violent disturbances are necessary. A fan waved gently in the air scarcely produces the mildest sort of waves, while a bee, with comparatively small wings moved quickly and vigorously, emits a loud sound.



BALTIMORE & OHIO ELECTRIC LOCOMOTIVE TRUCK.

So, with electricity, we must have a very violent electrical vibration before waves carrying much energy are given out.

Such a vibration we find when a spark passes from one conductor to another. The electrical system may be small in size, but the immensely rapid vibrations of millions of times per second, like the quick vibration of a bee's wing, sends out a volume of waves that a slowly moving current is not capable of producing. The velocity of these waves is now known to be very nearly 300,000 kilometers per second. This is exactly the velocity of waves of light, or other radiation in general, and there is no doubt at present in the minds of physicists that these waves of radiation are electromagnetic waves.

By this great discovery, which almost equals in importance that of gravitation, Maxwell has connected the theories of electricity and of light, and no theory of one can be complete without the other. Indeed they must both rest upon the properties of the same medium which fills all space—the ether.

Not only must this ether account for all ordinary electrical and magnetic actions, and for light and other radiation, but it must also account for the earth's magnetism and for gravitation.

To account for the earth's magnetism, we must suppose the ether to have such properties that the rotation of ordinary matter in it produces magnetism. To account for gravitation it must have such properties that two masses of matter in it tend to move toward each other with the known law of force, and without any loss of time in the action of the force. We know that moving electrical or magnetic bodies require a time represented by the velocity of light before they can attract each other in the line joining them. But, for gravitation, no time is allowable for the propagation of the attraction.

But the problem is not so hopeless as it at first appears. Have we not in two hundred and fifty years ascended from the idea of a viscous fluid surrounding the electrified body and protruding arms outward to draw in the light surrounding bodies to the grand idea of a universal medium which shall account for electricity, magnetism, light and gravitation?

The theory of electricity and magnetism reduces itself, then, to the theory of the ether and its connection with ordinary matter, which we imagine to be always immersed in it. The ether is the medium by which alone one portion of matter can act upon another portion at a distance through apparently vacant space.

Let us then attempt to see in greater detail what the ether must explain in order that we may, if possible, imagine its nature.

First—It must be able to explain electrostatic attraction. These electrostatic forces are mostly rather feeble as we ordinarily see them. Air breaks down and a spark passes when the tension on the ether amounts to about $\frac{1}{100}$ pound to the square inch. It is the air, however, that causes the break-down. Take the air entirely away, and we then know no limit to this force. In a suitable liquid it may amount to 500 times that in air or 5 pounds to 1 square inch, and become a very strong force indeed. In a perfect vacuum the limit is unknown, but it cannot be less than in a liquid, and may thus possibly amount to hundreds, if not thousands, of pounds to the square inch.

Second—It must explain magnetic action. These actions are apparently stronger than electrostatic actions, but in reality they are not necessarily so. A tension on the ether of only a few hundred pounds on the square inch will account for all magnetic attraction that we know of, although we are able to fix no limit to the force the ether will sustain. No signs have ever been discovered of the ether breaking down.

Again, we must be able to account for the magnetic rotation of polarized light as it passes through the magnetic field; and it can only be accounted for by assuming a rotation around the lines of magnetic force. This action, however, takes place only while the lines of magnetic force pass through matter, and it has never been observed in the ether itself. The velocity of rotation, however, is immense, the plane of polarization rotating in some cases 300,000,000 times per second.

The ether must also account for the earth's magnetism. If we assume that magnetic lines of force are simply vortex filaments in the ether, we have only to suppose that the ether is carried around by the rotation of the earth, and we have the explanation needed. The magnetism of the earth would then be simply a whirlpool in the ether.

Third—The ether must be able to transmit to a distance an immense amount of energy either by means of electromagnetic waves as in light or by the similar action which takes place in the ether surrounding a wire carrying an electric current.

The amount of energy which can be transmitted by the ether in this manner is enormous, far exceeding that which can be carried by anything composed of ordinary matter. Thus take the case of sunlight: On the earth's surface illuminated by strong sunlight a horse power of energy falls on every seven square feet. At the surface of the sun the etherial waves carry energy outward at the rate of nearly 8,000 horse power per square foot!

Again, an electric wire as large as a knitting needle, surrounded with a tube half an inch in diameter in which a perfect vacum has been made to prevent the escape of electricity, may convey to a distance a thousand horse power, indeed even ten thousand or more horse power, there being apparently no limit to the amount the ether can carry.

Compare this with the steam engine, where only a few hundred horse power require an enormous and clumsy steam pipe. Or, again, the amount carried by a steel shaft, which, at ordinary rate of speed, would require to be about a foot in diameter to transmit 10,000 horse power.

When we compare the energy transmitted through a square foot of ether in waves, as in the case of the sun, with the amount that can be conveyed by means of sound waves in air or even sound waves steel, the comparisn becomes simply ridiculous, the ether being so immensely superior. As quick as light, the ether sends its wave energy to the distance of a million miles while the sluggard air carries it one. Thus, with equal strain on each, the ether carries away a million times the energy that the air could do.

Fourth—The ether must account for gravitation. For this purpose we are allowed no time what ever to transmit the attraction. As soon as the position of two bodies is altered, just so soon must the line of action from one to the other be in the straight line between them.

If this were not so, the motion of the planets around the sun would be greatly altered. Toward the invention of such an ether, capable of carrying on all these actions at once, the minds of many scientific men are bent. Now and then we are able to give the ether such properties as to explain one or two of the phenomena, but we always come into conflict with other phenomena that equally demand explanation.

There is one trouble about the ether which is rather difficult to explain, and that is the fact that it does not seem to concentrate itself about the heavenly bodies. As far as we are able to test the point, light passes in a straight line through space even when near one of the larger planets, unless the latter possesses an atmosphere. This could hardly happen unless the ether was entirely incompressible or else posessed no weight.

If the ether is the cause of gravitation, however, it is placed outside the category of ordinary matter, and it may thus have no weight although still having inertia—a thing impossible for ordinary matter where the weight is always exactly proportional to inertia.

Ether, then, is not matter, but something on which many of the properties of matter depend.

It is curious to note that Newton conceived of a theory of gravitation based on the ether, which be supposed to be more rare around ordinary matter than in free space. But the above considerations would cause the rejection of such a theory. We have absolutely no adequate theory of gravitation as produced by the ether.

To explain magnetism, physicists usually look to some rotation in the ether. The magnetic rotation of the plane of polarization of light, together with the fact of the mere rotation of ordinary matter, as exemplified by the earth's magnetism, both point to rotation in the ether as the cause of magnetism. A smoke ring gives, to some extent, the modern idea of a magnetic line of force. It is a vortex filament in the ether.

Electrostatic action is more difficult to explain, and we have hardly got further than the vague idea that it is due to some sort of elastic yielding in the ether.

Light and radiation in general are explained when we understand clearly magnetic and electrostatic actions, as the two are linked together with certainty by Maxwell's theory.

Where is the genius who will give us an ether that will reconcile all these phenomena with one another and show that they all come from the properties of one simple fluid filling all space, the life-blood of the universe—the ether?

## Baltimore & Ohio Electric Locomotive Truck.

The accompanying illustration gives a side view of one of the heavy-duty locomotive trucks electrically equipped for the Belt Line tunnel of the Baltimore & Ohio Railroad company by the General Electric company. These trucks are of forged iron, each resting upon four driving wheels of cast steel, sixty-two inches in diameter. Flexibly supported upon each of these trucks are two six-pole gearless motors, one for each axle, transmitting their motion from the armatures to the wheels by means of an especially designed flexible coupling. The method of spring suspension has been carefully modified to allow of the immediate adjustment of the wheels to the irregularities of the tracks and thus effect a diminution in the wear both to the motors and the track. The massive armatures are of the iron-clad type. A hollow shaft serves to support the armature, and through this passes the wheel axle, to which it is connected by the universal coupling already mentioned, which allows of freedom of movement in any direction.

The complete motors are the largest railway motors in the world, and while ponderous in appearance are by no means so bulky as might be expected from the heavy duty they will be called upon to perform. They are so set on the truck that they will be easy of access under all circumstances, whether the locomotive is at a standstill or in motion.

The cab, which will be spring-supported on the truck frame, will be of sheet iron and wood and will have windows on all sides in order that the occupants may have an unobstructed view in all directions. Within the cab will be set up the series parallel controller, by means of which the movements of the locomotive will be at the command of the driver, and the air pump, operated by a small electric motor, which will supply the air for the compressed air brakes and the whistle. The locomotive will be also equipped with bells, safety devices, etc., and will have a Janney automatic coupler at each end.

From the illustration of one truck it will be seen that the finished locomotive will be an imposing piece of electrical machinery. It will weigh in its completed state ninety-five tons, will be 14 feet 3 inches long, 9 feet 6¾ inches high and will be of standard guage. The maximum speed will be 50 miles an hour. This will be reduced to 30 miles an hour when half the drawbar pull is exerted and to 15 miles an hour with full drawbar pull. The average speed of the loaded train will be about 30 miles an hour. It can of course be run either forward or backward.

This locomotive is designed for heavy work and will be called upon to handle trains as heavy as those now hauled by the heaviest steam locomotives. A test of one of the trucks completed, as shown in the illustration, was recently made upon the tracks at the Schenectady works of the construction company. In order to obtain the necessary load a New York Central heavy six-wheel engine was made use of, and the electric locomotive truck coupled to it. The

machines were then sent in opposite directions and tugged at the connecting coupling as in a tug of war. The electric locomotive had a slight advantage over the steam engine in weight on the driving wheels, and pulled it up and down the track with apparent ease. For the same weight upon the drivers it was shown that the electric locomotive will start a greater load than the steam locomotive, the pull being constant throughout the entire revolution of the wheel, the difficulty of variation of pull with the angle crank as in the steam locomotive being eliminated. The test also proved that not only were the motors sufficiently powerful, but that the driving mechanism and armature couplings are amply strong to transmit the torque of the armature to the axle.

The power house at Baltimore is rapidly nearing completion and the generating machinery is almost ready for installation. The overhead apparatus, which has been especially designed to meet the extraordinary requirements, will shortly be in position, and before many months have passed the steam locomotive will have become a neutral object in the operation of trains in the Belt Line tunnel, which, freed of smoke and soot, will be brilliantly lighted by incandescent lamps. A great step will then have been made toward universal electrical locomotion on steam roads.

## Callender Telephone Exchange System.

Romaine Callender has spent several years in perfecting the details of an automatic telephone exchange system, by which subscribers make their own connections, dispensing entirely with operators and the elaborate and expensive switchboards now in use in telephone exchanges. This system, which is of great interest, bearing evidence of the thought and ingenuity expended upon it, is now about to be made public, and an exhibition of it will be given in Mr. Callender's laboratory in the Decker building, Union Square, New York, on or about January 16th. Space will permit only a brief outline description.

The system is based upon the fact, shown by statistics of exchanges, that an average of not over 20 per cent. of the total number of telephones is in use at one time. A percentage exchange system, as invented by Mr. Callender, is one which provides mechanism enough to do the estimated maximum business at any busy portion of the day. Instead of an individual mechanism for each and every subscriber, a percentage only of mechanisms is provided. A telephone subscriber, on turning in a call to the exchange, individualizes for his own use one of the common mechanisms not in use at the time his call arrives. A division of the apparatus into signal receiving mechanisms, signaling mechanisms, connecting mechanisms and mechanisms through which conversation may be obtained, allows of the full benefit of percentage use, as these mechanisms may exist in exact proportion to their use. Provision is made by which the receiving mechanism stores up the incoming call long enough to allow some portion of the system to fall into disuse, thus enabling the stored call to become effective.

At the subscriber's station is a telephone, Fig. 1, with a signaling transmitter of special form. It consists of an insulated rotatable cylinder carrying ten contact strips of varying length. Held against the cylinder are ten contact brushes. One of these is adapted to make electrical connection successively with each one of the contact strips on the cylinder, when the cylinder is rotated. Another of the contact brushes connects with only nine of the contact strips, while the next brush connects with only eight strips, and so on to the tenth brush, which makes electrical connection with only one of the contact strips. This circuit making and breaking cylinder has electrical connection with a series of hand-operated indicator switches, located on the front of the signaling transmitter case. Each of these switches is adapted for indicating any one of a series of numerals, 0 to 9 inclusive. The number of the switches is equal to the number of numeral places in the value of the highest numbered line in the system—that is to say, in a system of not more than two numeral places, up to 99, two switches, as in Fig. 1, are necessary. In a system of three numeral places, up to 999, three switches are required, and so on. The impulse transmitting cylinder revolves as many times as there are indicator switches on the outside of the case. In a system of not more than 99 telephones the cylinder is caused to revolve two complete revolutions, together with an extra preliminary revolution for transmitting a preliminary impulse to the exchange station for the purpose of seizing some unused portion of the percentage apparatus; the succeeding revolutions being for transmitting the signaling impulses representing the thousand, hundreds, tens and units in the number of the telephone with which connection is desired. The mechanism of the signaling transmitter includes a controlling commutator for changing the circuit through the several indicator switches in succession. To illustrate its working suppose that a call is just being turned in for connection with some other telephone, say number 684. Three of the signaling transmitter indicator switches would be set in numeral order, from left to right, so that the left-hand switch would indicate 6, the middle switch 8, and the right-hand switch 4. The controlling commutator, by changing the circuit through the indicator switches from left to right successively for each rotation, causes impulses the equivalent of 684 to be transmitted to the exchange station. Should it be desired to signal for connection with telephone number 6, only one of the indicator switches is required to be set. It does not matter which one of the switches is set, the result will be six impulses transmitted. The impulses as they arrive at the exchange are automatically classified into hundreds, tens, etc. The signaling transmitter is set in operation by a lever which projects from the side of the transmitter case. The lever when drawn down stores up energy in a coil spring. The spring operates a wheel train and fan, with which are connected the circuit-making and breaking cylinder and its controlling commutator. This controlling commutator revolves only once at each operation, but the circuit-making and breaking cylinder revolves as many times as there are numerals places in the value of the highest numbered line in the system, as has already been explained.

Whenever a signal is transmitted to the central station, a preliminary impulse precedes it and causes the seizure and isolation of one of a number of connecting strips controlling access to mechanisms for registering the number of the telephone with which connection is desired. The signaling impulses, as they arrive at the exchange, are registered on one or more instruments designated "numerical receivers." Each series of impulses, corresponding to hundreds, tens, etc., is registered on a separate receiver. In series with each group of numerical receivers is an instrument designated the "numerical separator." The office of the separator is to distribute the different sets of impulses to their respective receivers, so that if a call is turned in, for say number 36, the separator divides the first set of impulses from the second, and causes them to be registered on two different receivers—the tens on one and the units on the other. An instrument known as the "numeralizer" now comes into play and totalizes the indications of hundreds, tens, etc., and then selects the circuit of equivalent numerical value. The signaling telephone is then connected to the telephone signaled for, and at the same time a copper ball, which has been released over a signaling track, runs along it by gravity and causes the call-bells of both subscribers to be operated, notifying them of their interconnection. Each of the foregoing division reverts to common use as soon as it has done its share in the making up of the complete connection; the connector only remaining in use during the time that conversation is being held over the connected lines.

It will be impossible to go into detailed description of the central station apparatus in this place. Fig. 2 shows the circuit selector, which is used for receiving incoming calls, for seizing any of the unused portions of the apparatus, and for individualizing to the calling subscriber, for the time being, that portion of the apparatus seized. The functions of the other devices may be summarized as follows: Figs. 3 and 4, progressive switch, a mechanism common to all of the subscribers, which when brought under the control of a signaling subscriber, is held by him free from interruption until the several steps making up the connection have been effected; Fig. 5, numerical receiver, for registering the number of the telephone with which connection is desired; Fig. 6, numerical separator, for separating the sets of impulses constituting the call, so that they are automatically classified into thousands, hundreds, tens, and units, as they arrive at the exchange station; Fig. 7, numeralizer, for totalizing the thousands, hundreds, tens, and units registered by the numerical receivers, for selecting the telephone with which connection is desired, and acting also as an auxiliary for bringing said telephone into connection with the line of the signaling subscriber; Fig. 8, signaling track, for signaling the subscribers when connection is established or, where a telephone called is in use, for signaling that fact to the call-

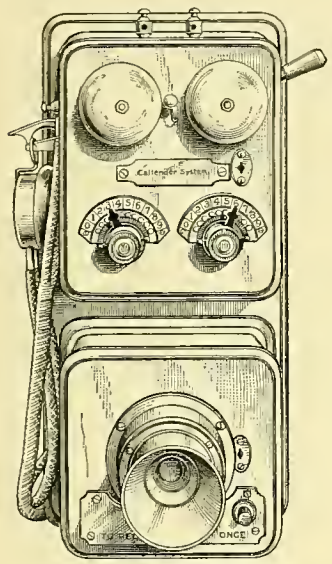


Fig. 1. Signaling Transmitter.

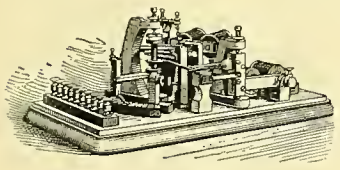


Fig. 5. Numerical Receiver.

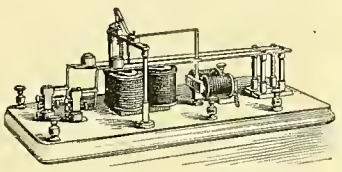


Fig. 6. Numerical Separator.

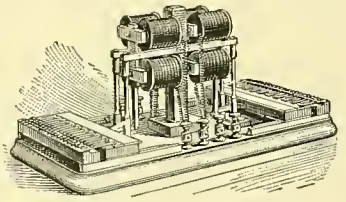


Fig. 7. Numeralizer.

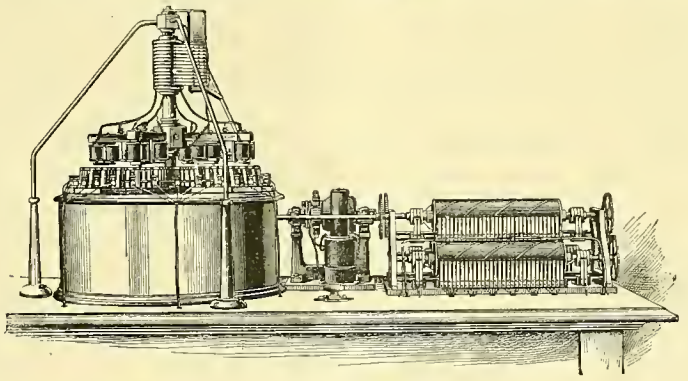


Fig. 2. Circuit Selector.

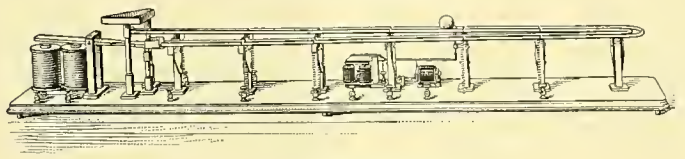


Fig 8. Signaling Track.

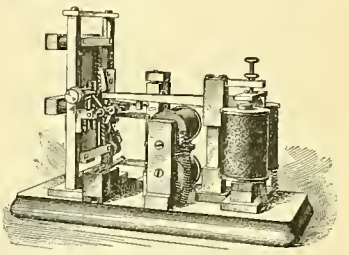


Fig. 3. Progressive Switch.—First View.

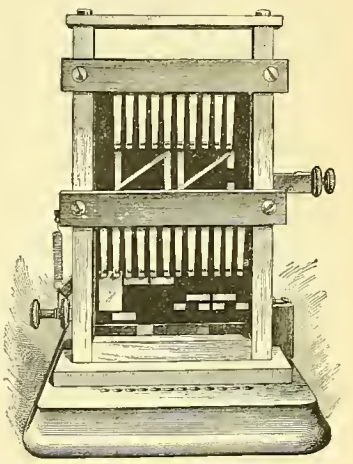


Fig. 4. Progressive Switch.—Second View.

CALLENDER TELEPHONE EXCHANGE SYSTEM.

ing subscriber. The connector is an apparatus having a plurality of conductors, through which the calling and the called subscribers are interconnected.

It is claimed that these improvements will make the construction and maintenance of an exchange so much less expensive than existing systems that telephones can be supplied to subscribers at from 30 to 60 per cent. less than present rates, the exact saving depending upon local conditions.

### A Great Supply House.

With business men the new year season is one alike of realization and anticipation. During the last two years, notwithstanding the general depression in trade, there are some merchants and firms, particularly in the West and in the electrical business, that can look back upon a growth that must to them be a matter of much satisfaction. While the year 1894 has not fulfilled the expectations of all electrical concerns, it is a pleasure to chronicle the fact that there are quite a number of enterprises in the West that nobly pushed ahead, some progressing not only in a manner indicative of sound financial policy and good business methods, but making what should rightly be termed remarkable records, and especially so when viewed in the light of comparatively small beginnings. A notable example is to be found in the growth and present prosperity of one of Chicago's great supply houses. There are few men in the West who cannot remember the conservative start made in 1891 by Willard W. Low and Thomas I. Stacey, now respectively president and secretary and treasurer of the Electric Appliance company of Chicago. Travel where you may throughout the United States to-day, it would be hard to find an electrical buyer who has not heard of the Appliance company. In the early days, with Mr. Stacey at the helm in the office and Mr. Low managing the commercial policy of the firm on the road, these two young men made their start. To-day the business is such as to confine both closely to their offices and necessitate the employment of a large number of skilled traveling men and many clerks to take care of the great volume of trade which their effective promotion and management has brought to them.

In a recent issue of the WESTERN ELECTRICIAN the story of the progress of the undertaking of these two enterprising young men was told at length. Unnecessary although it is to enumerate the details of their energetic careers, no better compliment could be paid them than to call to mind the comparatively modest start made four years ago and to point to the now prosperous and rapidly growing business at their extentsive headquarters, 242 Madison street, Chicago.

### Phonograph versus Graphophone.

A decision was rendered in the Supreme Court of the District of Columbia on December 24th, in the suit which had been pending for nearly two years, brought by the American Graphophone company, nominally against the Columbia Phonograph company, but the real parties defendant being Thomas A. Edison and the Edison Phonograph Works. It was alleged by the American Graphophone company that the original Edison tin foil phonograph was a failure, as the sound records it made were not accurate, permanent, nor capable of being reproduced as often as desired, could not be detached from the machine, handled and transported, and that the art as now known was created by the inventions of Alexander Graham Bell, Chichester A. Bell and Charles Sumner Tainter, who began their work under the auspices of the Volta Laboratory association and whose patents were afterward acquired by the American Graphophone company, and that every phonograph, every phonograph cylinder and every phonograph record became practical and valuable only so far as it relied upon the principle of engraving the record as distinguished from the abandoned method of indenting, used in Edison's original tin foil phonograph. No testimony was taken for the Columbia Phonograph company in the case, and when the time limit fixed by the court had almost expired the defendant withdrew counsel and allowed a decree by default. The court finds for the American Graphophone company on every point, issues a decree of injunction against the defendants, and orders an accounting by the auditor of the court. Other suits are pending in New Jersey, New York, Ohio, Massachusetts, Illinois and Kansas.

## COMMUNICATION.

### Ottawa Winter Carnival.

*To the Editor of the* WESTERN ELECTRICIAN:

I will esteem it a favor if you will kindly notice in your valued paper the fact that a grand winter carnival will be held in this city commencing January 21st and continuing until the 26th. Our winter weather is practically the same as Montreal, where, as you are probably aware, very successful winter carnivals have been held. Ottawa is the political capital of Canada and is but three and one-half hours from Montreal. It is beautifully situated and has a population of 50,000, all progressive people. The city should be especially attractive to my electrical confreres, as Ottawa is generally recognized as electrical headquarters, and, in proportion to population, it has, I may venture to say, on a larger scale than any other city in America, adopted electricity in its various domestic applications. The operation of our electric railway in the midst of a Canadian winter should be in itself interesting. Our street railway system, with its water-power power house, has always been a subject of much favorable comment from our American cousins.

Will the WESTERN ELECTRICIAN kindly extend in behalf of our carnival management a hearty invitation to any and all of your readers and their friends to visit Ottawa during carnival week? T. AHEARN.

Ottawa, December 22, 1894.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, January 5.—The affairs of the trolley railway companies continue to attract a large share of public attention. In Brooklyn the prospect of a strike now appears to be remote. Representatives of the companies and of the men have had several conferences, and it appears likely that a compromise will be reached, although the agreement has not been signed. Some of the motormen declare that in the event of a strike the railroad officials would not dare, in the face of the present public indignation against the alleged reckless operation of the trolley cars, to run their cars with inexperienced men. This feeling is caused by the increased number of trolley car accidents of late. Mayor Schieren has appointed an advisory commission to take into consideration the whole matter of the speed of trolley cars and the responsibility of the manner of running the cars, which has caused so many accidents. The subject has been discussed by the mayor and the heads of departments since he vetoed the resolution of the Board of Aldermen providing for a commission to pass upon the relative merits of safety fenders and providing a penalty if they were not used by the street cars companies. The commission consists of John Gibb, merchant; W. H. Nichols, broker; Prof. Austen of the Polytechnic Institute; John H. Schumann, manufacturer, and R. S. Walker, merchant. The state railroad commissioners are also coming to Brooklyn next week to take up the trolley question.

On Monday the Brooklyn City company will begin to carry mails on one of its lines. The matter has been under consideration for some time, and it was left for the company to decide which one of its many lines should be first used in an experimental way. The decision was in favor of the Flatbush lines, by which mails will be carried after January 7th between the general postoffice in Brooklyn and the postoffices in Flatbush and Flatlands. This new arrangement will undoubtedly open the way for the carriage of mails on an extensive scale by the Brooklyn City company, whose lines penetrate to almost every part of the city. The new service at first will consist simply of the transportation of mailbags in both directions on the trolley cars, under the custody of the motorman and conductor. The mails will be placed on the front platforms of certain cars at Fulton and Johnson streets, the nearest point of connection between the railroad tracks and the postoffice, and will be deposited at the two offices already mentioned, from which in turn the mails will be returned and received by the general postoffice again at Johnson street. At present no postal cars will be supplied by the City company, though it is probable that in the future, when the system of mail transportation is further extended, regular mail cars will be run, similar to those used on the Atlantic Avenue company's road.

The employes of the Consolidated Traction company, which operates electric railway lines in Jersey City, Newark and the Oranges, have asked for increased wages and other privileges. This company has also been required by the Board of Street and Water Commissioners of Jersey City to provide better transfer facilities. Three damage suits against it, which were on the Circuit Court calendar in Jersey City, have been compromised, and the company is out $15,000. The plaintiffs were Bernard Battles, Richard Grace and James Bailey, former employes of the company. These three men were linemen employed in putting up wires and repairing them. About a year ago they were standing on the platform of a tower wagon at York and Washington streets, Jersey City, when a trolley car dashed into the wagon and threw them to the pavement. The men were two months in the hospital. The $15,000 will be divided between them.

The newly incorporated Trenton, N. J., Traction company, which for several months has been negotiating for the lease of the Trenton electric railway, has acquired control of the system by purchasing the ten-thousand-share interest of Col. Lewis Perrine, paying, it is said, $500,000 for the block. The company has elected Thomas C. Barr of Newark president and John L. Kuser of Trenton as secretary and treasurer. Henry Moore of Philadelphia is to be manager of the road.

In announcing the transformation of the banking firm of Drexel, Morgan & Co. into J. P. Morgan & Co., the *Sun* notes that Drexel, Morgan & Co. were active in the development of electric lighting from the time of Edison's inventions in 1878–79, being interested in the Edison company, which in 1892 was consolidated with the Thomson-Houston company under the name of the General Electric company. "Owing to developments, for which they were in no way responsible," adds the *Sun*, "and as the result of a policy which they opposed, the General Electric company became encumbered with a large floating debt, and in the panic of 1893 it was saved from bankruptcy only by the skillful financiering of Drexel, Morgan & Co., who joined in its rescue and have since been active in bringing about a radical change in the methods of the company."

Justice Cullen of Brooklyn has rendered judgment in favor of J. Philip Rinn, a Boston architect, in his suit to foreclose a mechanic's lien on the property of the Electric Power company of Staten Island. The plaintiff alleged that he prepared the plans and supervised the construction of the engine house, and that he had received $3,427, but that there was still due him $10,288.35. Justice Cullen awarded him $6,006.22 as the sum for which a lien should be given, with a personal judgment for the remainder of the claim.

During the year 1894 the total speculation in General Electric stock on the New York stock exchange amounted to 1,230,923 shares.

Chief Engineer Parsons of the Rapid Transit Commission, after consulting with A. Fteley and Theodore Cooper, has reported that it will cost $66,000,000 to build an underground road on the general plans proposed. As the limit of expense laid down by the law is $50,000,000, there is much consternation. The commission has appointed ex-Mayor A. S. Hewitt, T. C. Clarke, Charles S. Smith, W. H. Burr and Octave Chanute as a committee of experts to pass upon the report. W. F. O.

### Northwestern Notations.

MINNEAPOLIS, January 4.—Yankton, S. D., will soon have a $15,000 electric lighting plant.

The application of the United Electric corporation for a telephone franchise in St. Paul was referred to the committee on streets.

The company operating the White Bear and St. Paul electric line, running from St. Paul to White Bear Lake, has been ordered to run cars every thirty minutes. The company has been in a hard way financially for some time and told the council that it was losing money, the receipts being only $19 per day. The superintendent is running one of the cars. The company is arranging to close up its affairs and go out of business, but there is a proposal to reorganize the line and extend it to Stillwater, Minn.

Seymour, Barlow & Co., Tacoma, Wash., bankers, with C. Hurley, an eastern gas man, have purchased a controlling interest in the electric light plant of the Commercial Electric & Power company from the Tacoma Light & Water company. Some claim that this sale was hurried through because the city has sued the old water company for damages for an alleged swindle in selling the water plant to the city at a large price.

It is probable that the Breckinridge, Minn., village authorities will establish an electric plant in connection with the water works, as business men generally favor the move.

C. P. Wainman, general superintendent of the Northwestern Telephone Exchange, said in Fargo recently that the company would build a line from Grand Forks, N. D., to Fargo, in the spring and might extend the Fargo and Casselton line on through Wheatland and Buffalo to Tower City and probably connect with Mayville, via Hillsboro, with Fargo. The long-distance line from Minneapolis to St. Cloud, Minn., will be extended to Little Falls and in time to Fargo, thus giving long-distance communication with Chicago via Minneapolis and St. Paul.

The Postal Telegraph-cable company has bought the line of the Chicago, Milwaukee & Lake Superior Telegraph company, running from Chicago to Marquette. Additional wires will be strung, the line rebuilt and extended to all the important points in Northern Michigan and Wisconsin. The transfer took place January 1st.

C. J. Nickells of Wahpeton, N. D., has been granted an electric light franchise by the Fergus Falls, Minn., council, for 20 years. He is now seeking power and says if he has to operate with steam he cannot accept the franchise. He has ten days in which to accept.

Rushford, Minn., people think of running a telephone line to Pilot Mound and Arendahl and if the venture proves a success extending it to Bratsberg, Choice and Highland.

M.

## PERSONAL.

J. Grant High, president of J. Grant High & Co., manufacturers of switchboards, Philadelphia, was in Chicago last week.

Among the new lecturers for the current year at the Massachusetts Institute of Technology is Professor Elihu Thomson, who will deliver a course upon "Recent Developments in Applied Electricity."

James F. Kelly, for many years connected with the Edison General Electric company, has connected himself with the sales department of the New York Insulated Wire com-

pany. Howard C. Whitney, formerly with the Crocker & Wheeler company of New York has also taken a position in the same department of the New York Insulated.

W. W. Smith, secretary of the Missouri & Kansas Telephone company, died at his home in Kansas City on December 29th of valvular disease of the heart. Mr. Smith was born in Charleston, Ind., fifty-seven years ago. He was at one time vice-president of the Illinois Central and Louisville railroad with headquarters at Cincinnati. He became interested in electricity and took charge of the entire telegraph department of the Big Four road. Afterward he became interested in telephony and was the first general manager of the telephone exchange at Indianapolis. He was the inventor of many improvements in telephone exchange work.

## NEW INCORPORATIONS.

Rushville Electric Light company, Rushville, Ill.; capital stock, $12,500; C. W. Wainman, Rushville, Ill.

Florissant Avenue Electric Railway company, St. Louis, Mo.; capital stock, $2,000; T. P. Bell, St. Louis, Mo.

Potts Machinery Supply company, Columbus, O., capital stock, $10,000; to manufacture and deal in electrical and other specialties; Walter B. Page, Columbus, O.

## TRADE NEWS.

Chas. D. Shain of 136 Liberty street, New York, remembered all his friends by a New Years greeting for 1895.

Kohler Bros. of Chicago. for several years the efficient western agents of the Eddy Electric Manufacturing company, have resigned that position. They are still looking after the interests of the Walker Manufacturing company.

The Charles F. Burns company of Rochester, N. Y., has been incorporated. Its purpose is to manufacture and sell supplies for electric railways. The capital stock is $5,000, divided into 250 shares of $20 each. The company is to run fifty years and the directors for the first year are Charles F. Burns, Alfred Green and Ezra M. Higgins. The shareholders are Charles F. Burns, Ezra M. Higgins, Alfred Green, William J. Moran and Robert Bannard.

The stockholders of the Electric Selector & Signal company, New York, have by unanimous vote authorized the issue of $40,000 of 5 per cent. five-year gold bonds to be used for the extension of that company's manufacturing facilities. The entire issue was immediately subscribed for by the directors and principal stockholders of the company at par. The company reports a steadily increasing demand for its electric light appliances, block signals and railroad telegraph instruments.

The popular demand for Okonite wires and cables continues unabated, and the company reports that 1894 closed its largest year's business since this famous insulation was first presented to the electrical public. Under the efficient management of Captain Willard Candee and H. Durant Cheever, managers, and George T. Manson, general superintendent, this happy state of affairs has been brought about. The gentlemen named have never for one moment allowed the name of Okonite to be forgotton among the trade north, south, east and west, and thus Okonite ranks as one of best advertised among electrical wares, its many sterling qualities also having made it a pronounced success and permanently in demand in electrical installations. During the last year the Okonite company's large factory has been taxed to its full capacity, the greater portion of the time running night and day to fill orders, and Captain Candee looks enthusiastically forward to even more business, larger orders and increased prosperity all around for his company during 1895.

## BUSINESS.

Pepper & Register, engineers and general contractors, have removed from the Provident building to 1414 South Penn square, Philadelphia.

The Washington Electric company, 207 South Canal street, Chicago, is prepared to do special electrical work of all kinds and is equipped to give quick and efficient service.

Cameron & Gillett, electrical engineers and contractors, Detroit, have removed to 212 Griswold street, where, with increased facilities, they are prepared to receive orders for construction work, which they will hereafter be able to turn out better than ever before.

Lee & Collins report that their trade for December was 50 per cent. better than that for any other month during the year of 1894. This firm has displayed great energy in its business, and the fact that the December trade was so good leads them to expect great things of the new year.

The Western Electric company, Chicago, is now carrying a full supply of Pass & Seymour's porcelain specialties, the firm named having made an arrangement with the Western Electric company which enables that company to supply its own trade from a large and well assorted stock carried in Chicago.

The Electric Applicance company has just closed a very successful year's business and is starting out with renewed energy for the campaign of 1895. It has very largely increased its stock during the past year and has added several very desirable new specialties, among which may be mentioned the line of Lynn electric railway material, which is meeting with a large sale.

Porcelain is one of the most peculiar of the manufactured products, and can vary from the most porous and brittle to a most impervious and tenacious material. R. Thomas & Sons company, the largest porcelain manufacturer in the world, is so baking and preparing the porcelain which it places upon the market for electrical purposes as to make it absolutely moisture proof.

The annual ordinary general meeting of the Okonite company was held at the New York office of the company, 13 Park Row, December 27th, Edward Lyman Short presiding. A large percentage of the stock was represented. Reports from the heads of the several departments showed a good business transacted by the company during 1894 and substantial indications that the business of the new year just entered upon will be still better. The meeting adjourned after re-electing the auditors.

The Bryant Electric company of Bridgeport and Chicago has placed upon the market during the year 1894 a dozen or more valuable articles for street railway and electric light purposes. It promises a few more in the near future, and, judging from the past, it is safe to predict that whatever this company may offer will find a place for use, and be good in idea, material and construction.

General Manager C. F. Shaw of the Law Telephone company of New York reports that during December the largest orders ever received by the company were booked for shipment, and that the orders received thus far in January point to a very large increase in the business over the corresponding month of last year. The company has a number of new electrical features which will be soon presented to the trade.

J. W. Godfrey, general sales agent of the India Rubber & Gutta Percha Wire company of New York, extended an invitation to the electrical fraternity to inspect the new offices on December 31st. Mr. Godfrey was assisted by F. W. Harrington and J. B. Olsen, who extended a warm welcome to all. The guests were invited to partake of an elaborate lunch, over which many were the good wishes for the success of these gentlemen in their new business connection.

S. Morgan Smith, York, Pa., is now building for the Minneapolis General Electric company, Minneapolis, Minn., two horizontal McCormick turbines, each to develop 1,000 horse power. They are for the new plant being put in by that company and will be a very important installation. The water wheels are of immense proportions, each wheel with its pipe, etc., weighing about 50,000 pounds. Mr. Smith also has some other important wheel contracts for other plants, and his shops are very busy on work of this class.

The Watertown, N. Y., Steam Engine company reports recent sales to the following named: Standard Ladder company, Glenville, O.; Rowell & Chase Machinery company, Kansas City, Mo; Lord & Burnham company, Irvington, N. Y.; E. P. Hampson & Co., New York; S. L. Holt & Co., Everett, Mass.; Lehigh Valley Railroad company; Home Insurance company, Minneapolis, Minn.; Williams & Werner, Rochester, N. Y.; Hendrie & Bolthoff, Denver, Col.; Keystone Lime & Sand company, Tyrone, Pa.; Stevens & Thompson, N. Hoosick, N. Y.; Chadwick Leather company, Chadwicks, N. Y.; Piercefield P. & M. company, Piercefield, N. Y.; Missouri Medical College, St. Louis, Mo.; Vienna Electric Light company, Vienna, Ill.; New York Air Brake company, Watertown, N. Y.; Manuel Escovar, Mexico; Nelson Hotel company, St. Louis, Mo.; Merle & Heaney, Chicago, Ill.; Seville Apartment House, New York; B. Goldsmith, Milwaukee, Wis.; Grand Haven Electric company, Grand Haven, Mich.; Cortland & Homer Traction company; city of Winston, Winston, N. C.; Southwark Manufacturing company; Geiger, Fisk & Co., Louisville, Ky.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued January 1, 1895.*

531,623. Armature for Dynamo-electric Machines or Motors. Ward Decker, Owego, N. Y. Application filed November 17, 1892.

The invention consists in an armature, the combination with a core, of two series of coils, each having a rectangular form, but having sides of different lengths, the shorter of said series of coils being arranged upon the core, with their longer sides adjacent to one another at distances less than the width of any side of any coil, and the longer of said series of coils being arranged with their longer sides also adjacent to one another at distances less than the width of any side of any coil and between the said longer sides of the short coils.

531,635. Electric Wire Holder or Insulator. Albert Iske, Lancaster, Pa. Application filed May 29, 1894.

The device comprises in an electric wire supporter or carrier an insulator comprising two portions, the one having a central socket and the other having a central plug fitted into said socket, the oppositely disposed retaining lugs projected from the adjacent faces of said portions, and the wire passage openings between the adjacent pairs of said lugs, with means provided, such as a screw passed through the axial bore of the portions, to bind the parts together and to secure the insulator in place.

531,650. Telephone Indicating Apparatus. John I. Sabin and William Hampton, San Francisco, Cal. Application filed July 25, 1894.

A telephone system, combining a self-restoring visual indicator, a non-restoring indicator, and means for actuating the non-restoring indicator when the self-restoring indicator is actuated.

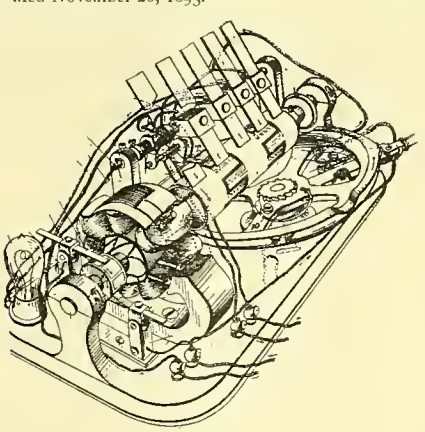
531,651. Electric Block Signal. Charles H. Sallada, Pittsburg, Pa. Application filed April 9, 1894.

A railway cab signaling system, comprising a series of insulated track rail sections contacts along the line of way connected to one line of rail of each section, a track instrument for each track section, comprising an electro-magnet, a circuit therefor, including the rails of an adjoining track section, movable contacts operated by said magnet, contact strips adapted to be engaged by the movable contacts, one of said strips having a ground connection through a local battery and a connection through its movable contact with a distant station, and also with a local contact along the line of way, the second contact strip being connected with a distant station in the other direction of travel, and through its movable contact to a second local contact along the line of way, in combination with a movable object provided with contact brushes, and a signal device on said movable object connected with said brushes.

531,657. Transmuter for Electrical Currents. William J. Still, Toronto, Ont. Application filed April 5, 1893.

The object of the invention is the combination with a motor adapted to be run by an alternating current, of a transmuting cylinder formed of three rings insulated from each other, and from the central spindle on which is located the motor and cylinder, and having rectangular, tooth-shaped lateral projections alternately arranged and designed to fit into the spaces between the lateral projections of the adjacent ring, and means whereby the alternating current is conveyed to the rings and transmuted to a constant current to be conveyed away from the rings

531,663. Base for Incandescent Electric Lamps. George C. Thomas, South Framingham, Mass. Application filed November 28, 1893.



NO. 531,657.

The invention consists in a base for an incandescent lamp, the combination of a shell having an inwardly extended cam-shaped head, and a disk of insulating material having its edge surface conformed substantially to said head.

531,664. Closed Conduit for Electric Railways. Robert J. Turnbull, St. Paul, Minn. Application filed January 19, 1894.

A conduit formed in two parts adapted to be united longitudinally, a conductor rail formed in sections and held between the parts of said conduit and projecting downward into the interior thereof and extending above its upper surface, and moisture-proof insulator strips interposed between said conductor rail sections and conduit, and overlapping the upper portion of said conduit, whereby means are provided for conducting moisture away from said conductor rail sections and insulating the conductor rail sections from the conduit.

531,669. Indicator for Electric Currents. Edward Weston, Newark, N. J. Application filed February 21, 1894.

An indicating or signaling device composed of two bodies movable with reference to one another, one of said bodies having an opening and the other, of less area, being disposed before said opening (whereby the relative movement of said bodies is shown by the change in outline of the space included between the outer periphery of said body of less area and the inner periphery of said opening), and a scale of translucent material in rear of said bodies, and a source of illumination in rear of said scale.

531,677. Printing Telegraph. Samuel V. Essick, Yonkers, N. Y. Application filed April 20, 1892.

In a printing telegraph receiver or analogous printing instrument, a type wheel carried rotatively by a shaft, controlling mechanism for determining its forward rotation, a carriage connected to the type wheel and movable to feed the latter across the face of a stationary sheet of paper, a mechanical motor constituting a power-impelled feeding device exerting a constant stress tending to propel the carriage forward to advance the type wheel, and an escapement for controlling said feeding device, and thereby determining the feeding movements of the type wheel.

531,690. Phonograph. Stewart D. McKelvey, Canton, O. Application filed March 31, 1892.

The invention comprises in a phonograph, the combination with a diaphragm, of a style and amplificatory mechanism intermediate the diaphragm and style.

531,698. Electric Arc Lamp. Charles A. Pfluger, Chicago, Ill. Application filed April 5, 1894.

An arc lamp, combining a main circuit magnet or solenoid, a shunt magnet or solenoid, a lever for the latter, a system of levers associated with the main circuit magnet, a spring connecting such last system with the shunt magnet lever, so that the latter is lifted and elastically suspended by the action of the main circuit magnet, a clutch for the carbon rod and a connection therefrom to the shunt magnet lever.

531,702. Cleat for Electric Wiring. Joseph H. Swift and William F. Maintien, Plainville, Mass. Application filed March 17, 1894.

An improved two-part wiring cleat having the working face of one member longitudinally grooved or recessed, and having the contiguous face of the other member the counterpart of said recessed face, the end portions of said cleat being provided with transversely arranged curved notches to receive the wires, and having vertical holes extending through the cleat to receive combined clamping and holding screws, said holes being located at points between the end notches and at substantially right angles therewith.

531,707. Brush for Dynamo-electric Machines. John B. Wallace, Ansonia, Conn. Application filed April 30, 1894.

A brush for dynamo-electric machines, consisting of a body of gauze or cloth, composed of a good conducting material,

with an inclosing or surrounding wrapper of gauze or cloth of a high resistance substance or material.

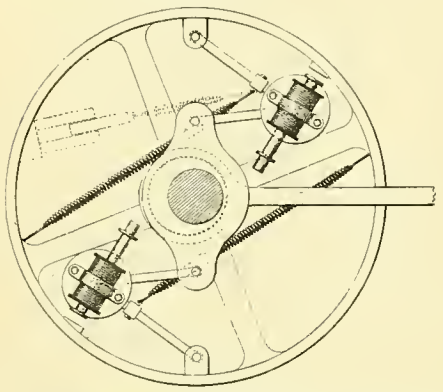
531,708. Electric Signal. William J. Wessenberg and Horatio F. Wilbur, Meriden, Conn. Application filed August 12, 1893.

A signal having two stationary lenses mounted on a suitable support, in combinat on with a swinging diaphragm, having a smaller opening and elongated opening, and mechanism for operating said diaphragm.

531,709. Electro-magnet. William J. Wessenberg and Horatio F. Wilbur, Meriden, Conn. Application filed September 27, 1894.

The invention comprises the combination of a magnet having the ends of its cores beveled off on straight lines in opposing bevels, and a segmental armatu e concentrically mounted with reference to said beveled ends, and having two compound faces, the forward part of each face being concentric and the rear part tangential thereto, said compound faces being a distance apart about equal to the distance from center to center of said cores.

531,729. Adjustable Hanger for Incandescent Lamps, Gas Fixtures, etc. Harry W. Lawrence, Denver, Colo. Application filed December 1, 1893.



NO. 531,849.

An adjustable hanger for incandescent electric lamps, combining with the lamp and suspension conductors, a spherical weight provided with an opening from top to bottom, a two-part casing inclosing said weight and having coinciding apertures, and an insulating tube passing through the apertures in the weight and casing.

531,761. Cut-out Box. George H. Alton, Lynn, Mass. Application filed February 7, 1890.

The object of this invention is in a cut-out box, the combination with the base, of a fuse carrying lid removably hinged to the base by a hinge forming a metallic extension of the fuse carrying and line blocks, said hinge being constructed to allow the cap to swing in a plane perpendicular to the plane of the base.

531,763. Temperature or Pressure Indicator. James Bartlett, Toledo, O. Application filed July 30, 1894.

In combination with a measuring instrument provided with contacts, and with a movable member adapted to make electrical connection with said contacts, a resistance connected at different points with the contacts, a galvanometer, a battery or source of ele tric supply and conductors connecting the battery and the galvanometer in circuit with the measuring instrument and the resistance.

531,764. Electric Car Lighting Apparatus. William Biddle, Brooklyn, N. Y. Application filed May 8, 1894.

The invention consists in the combination with a dynamo adapted to be run at varying speeds, and having reverse wound field helices and a se:ondary battery and working circuit, of circuit connections and a polarized compound switch having contacts in a circuit through one of the field helices of the dynamo to break such circuit when the electromotive force of the armature falls to that of the secondary battery.

531,765. Circuit Regulating Device in Electric Car Lighting Apparatus. William Biddle, Brooklyn, N. Y. Application filed May 28, 1894.

The invention consists in the combination with a secondary battery and a dynamo, having its field energizing helix in a shunt to the secondary battery, of a neutralizing helix in a shunt to the armature brushes, a three-point switch and main circuit connections to the armature brushes and the secondary battery respect vely, helices for actuating the three-point switch, such helices being double wound with one helix in the main circuit to the secondary battery, and the other helix in a shunt between the armature brushes.

531,790. Method of Operating or Controlling Electric Motors or Dynamos. Rudolf Eickemeyer, Yonkers, N. Y. Application filed November 2, 1891.

The object of the invention is to provide a method of operating reversible electric motors, which consists, first, in constantly supplying an armature circuit, and a field magnet circuit of constant magnetic resistance, with electric currents unvaried as to direction, and adapted to drive a motor in one direction; and, secondly, mechanically switching the magnetic current, and thereby reversing the direction of its flow with relation to an armature without changing its strength, and causing the rotation of the armature to be reversed without changing the direction of the electric current, either in the armature or in the field coils.

531,821. Constant Current Dynamo. James J. Wood, Fort Wayne, Ind. Application filed July 3, 1894.

The combination in a dynamo having movable commutator brushes, of a current regulator consisting of a clutch driven shaft, a brush shifting mechanism connecting said shaft to the brushes to move the latter, the driven members of two clutches fixed on said shaft, driving clutch wheels, a continuously revolving shaft, having a pinion driving the clutch wheel, a secondary shaft having a pinion driven from the shaft and a pinion driving the other clutch wheel, said pinions being relatively proportioned to drive one clutch wheel more rapidly than the other.

531,837. Trolley. Theodore Cooper, Providence, R. I. Application filed September 17, 1894.

A trolley, combining with circular side plates an annular contact removably secured between the side plates, and means adapted to interlock with portions of the contact to prevent the independent rotation thereof.

531,840. Adjusting Mechanism for Arc Light Carbons. Elie F. G. H. Faure, Schenectady, N. Y. Application filed August 22, 1894.

The invention consists in a carbon-adjusting mechanism for arc lamps, two carbon-supporting clamps arranged at right angles in different planes, each adapted to swing about a central point, whereby the carbons may move in planes at right angles to each other, and the point of intersection of the planes may be varied.

531,849. Electric Steam Engine Governor. Chester B. Melott, Rondout, N. Y. Application filed July 21, 1894.

The combination with the fly wheel of a steam engine and its valve regulating weights, of electro-magnets attached to said weights and adapted, by magnetic attraction, to assist the movement of the weights toward and away from the center of the wheel.

531,854. Telegraphic Transmitter. John J. O'Neill, New York, N. Y. Application filed February 28, 1894.

In a telegraphic transmitter, two conducting devices in connection respectively with the circuit terminals, one of said devices being a sliding carriage having a contact point, and the other of said devices being a key having a plurality of contact po nts, said key movable toward said carriage, and when moved bringing its contact points into the path of the contact points of said carriage, and said carriage movable relatively to said key, and when moved making successive electrical connection between its contact point and those of said key.

531,866. Method of and Means for Measuring Energy of Alternating Electric Currents. Oliver B. Shallenberger, Rochester, Pa. Application filed September 19, 1894.

The invention provides a methed of measuring the energy of multiphase alternating currents, which consists in the creation of two magnetic fields, one of which is proportional to and in phase with the current in one of the circuits, and the other proportional to and in phase with an electromotive force in quadrature with that of the said circuit, establishing thereby a resultant inductive influence, and producing thereby mechanical effects of definite va ue.

531,867. Method of and Means for Measuring Alternating Electric Currents. Oliver B. Shallenberger, Rochester, Pa. Application filed September 19, 1894.

The invention provides a method of measuring the energy transmitted by single phase alternating electric currents, which consists in establishing two alternating magnetic fields, one proportioned to and in phase with the current transmitted to the work circuit, the other derived from and proportional to the impres-ed electromotive force of the work circuit, and lagging approximately 90 degrees behind that electromotive force, producing by such two magnetic fields a resultant shifting magnetic field, producing by such resultant field mechanical motion against a force which is proportional to the speed, and registering such motion.

531,868. Indicating Watt Meter for Alternating Electric Currents. Oliver B. Shallenberger, Rochester, Pa. Application filed September 19, 1894.

The combination of a disk of conducting material, a shaft carrying the same, a spring opposing the rotation of the disk, means for producing two magnetic fields differing in phase, the axes of which fields traverse said disk at points so located that the two fields combine to form a resulting shifting field for rotating said disk, an index for noting the degree of rotation produced, and a damping device applied to said disk.

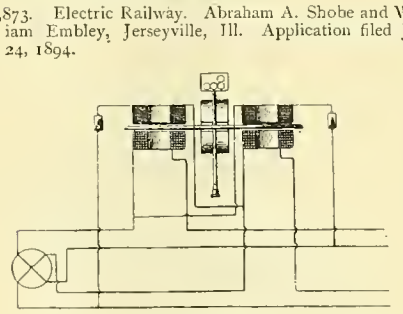
531,869. Watt Meter for Multiphase Alternating Electric Currents. Oliver B. Shallenberger, Rochester, Pa. Original application filed September 19, 1894. Divided and this application filed November 24, 1894.

The device consists in an electric meter, an actuating device responding to the currents transmitted over two or more circuits, consisting of an armature and two independently operating sets of actuating coils, each set comprising a series coil connected in one circuit and a shunt coil connected across another circuit.

531,870. Alternating Current Measuring Instrument. Oliver B. Shallenberger, Rochester, Pa. Application filed November 24, 1894.

In an electric meter, the combination of an armature, comprising a closed conducting circuit, an actuating coil in inductive relation thereto, an inductance coil connected in series with said actuating coil, a second actuating coil, a non-inductive resistance in series therewith, and means for determining the mechanical effect produced by the passage of alternating currents through said actuating coils.

531,873. Electric Railway. Abraham A. Shobe and William Embley, Jerseyville, Ill. Application filed July 24, 1894.



NO. 531,869.

An electric railway, combining with junction boxes, each of which comprises a lever fulcrumed in the sides of an inclosing chamber, said lever having jointed to one end thereof a vertical arm, and to the opposite end a vertically sliding block of insulating material, having in the face thereof bars adapted, when the said sliding block is actuated, to alternately close and open the electric circuit, of a jointed bar supported upon the upper ends of the arms, and located in a slot by the side of the rail, said jointed bar adapted to be depressed by a flange provided for that purpose on one of the car wheels, as the latter passes over it, so as to actuate the mechanism in the junction boxes.

531,890. Coin Controlled Electrical Musical Instrument. Philip Wuest, Jr., Philadelphia, Pa. Application filed September 12, 1893.

The device comprises the combination in an automatic electrically operated piano or organ, a motor, a sheet through which the hammers or reeds are operated, a plate on said sheet, a circuit breaker actuated by said plate, coin mechanism through which the motor driving circuit passes when the coin is in position, said circuit breaker releasing the coin and breaking the motor circuit when actuated by the plate.

531,913. Telephone Switch. Augustus G. Davis, Baltimore, Md. Application filed November 23, 1893.

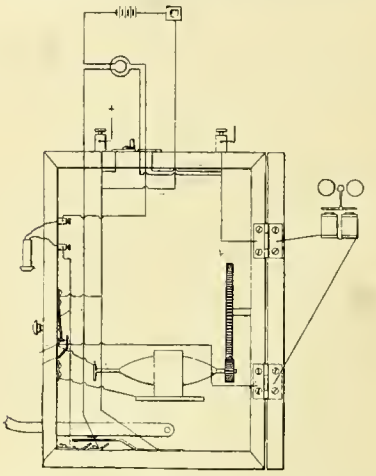
The combination with the main line circuit and the local circuit, including respectively the receiving and transmitting instruments, a switch lever having an insulated block, a single contact spring against which the said block bears, the said spring having electrical connection with the main circuit, two contact springs with which the first mentioned spring may be brought to bear by pressure upon the lever, the conductors which terminate at such contacts and connect respectively with the main and the local circuits, and means which normally hold the said lever in pos tion to break the engagement of the said contact springs.

531,919. Electric Railway Signal. Jake Frank, New York, N. Y. Application filed November 27, 1893.

In an electric railway signal, signal operating magnets, each connected on one side to a common rail, and on the other side in divided circuit to rail sect ons in front and rear of the magnets, and a vehicle carrying a signal controlling armature, and in turn adapted to close the circuit of the magnets.

531,929. Safety Device for Electric Circuits. Thomas Harden, London, Eng. Application filed April 27, 1894.

In a grounding or safety device for electrical circuits, the combination of sparking points, a fusible wire, a catch mechanically held by said wire, a contact arm held by said catch, and contacts adapted to complete the circuit from a low tension system to earth.



NO. 531,913.

531,961. Circuit Controller. Thomas Parker, John H. Woodward and Edmund S. G. Rees, Wolverhampton, Eng. Application filed February 24, 1892.

The device consists in an apparatus for completing or breaking an electric circuit, the combination of a circuit independent of the circuit to be completed or broken, an electro-magnet in the independent circuit and an armature therefor, with devices operated by the said armature to either make or break the main circuit by first magnetizing and then demagnetizing the said electro-magnet, and an electro-magnet in the main circuit, having an armature adapted to act upon the said device to break the main circuit upon a predetermined increase of the current in the said main circuit.

531,962. Distribution of Electricity. Thomas Parker, John H. Woodward and Edmund S. G. Rees, Wolverhampton, Eng. Application filed February 24, 1892.

An electrical distribution system, comprising means for supplying either high or low tension currents, with a sub-station or sub-stat ons having transformers, distributing mains and two sets of conductors to the transformers, circuits and switches controlled from the switch station, substantially as described, whereby either low tension currents can be supplied direct to the distributing mains, or the transformers may be thrown into circuit to convert the high tension current from the supply into low tension for the distributing mains.

531,970. Electrostatic Voltmeter. Henry A. Rowland, Baltimore, Md. Application filed February 24, 1894.

An electrostatic voltmeter, having its attracting and attracted parts immersed in a non-conducting liquid.

531,978. Electric Arc Lamp. Charles E. Scribner, Chicago, Ill. Application filed May 7, 1891. Renewed May 9, 1893.

The combination of guide rods, links connecting the two rods and maintaining them in parallelism, a cross head provided with a clamp for securing to it one carbon of the lamp and adapted to be clamped between the guide rods when the links do not extend at substantially right angles to the rods, and a stop adapted to cause the release of the cross head.

531,980. Electric Rail Bond. George E. Somers, Bridgeport, Conn. Application filed May 7, 1894.

A rail bond consisting of a series of strands of wire laid together and retained in place by ferrules, through which the ends of the strands are passed, the upper ends of the ferrules being pressed into the strands so as to lock the ferrules thereto and secure the strands together, and also to provide tapers at the lower ends, which are adapted to en,age the rails in setting the bond up to place.

531,996. Electric Converter. Robert H. Hassler, Pittsburg, Pa. Application filed April 30, 1894.

A magnetic core and coils surrounding the same, said coils having projecting portions arranged in a radiating position for the provision of increased air space.

532,003. Electric Signaling Apparatus. George E. Miller, Saugus, Mass. Application filed January 24, 1894.

In an electric railway signaling apparatus an electric current generator and steam motor connected thereto, and an insulated duplex alternately broken conductor combined with an alarm or signal in the circuit, a sweeper electrically connected to the conductors, electrical connections between the track rails and generator, and a steam va ve for the motor, having a lever arranged in the circuit when the valve is open, and means for cutting out the alarm or signal from the circuit when said valve lever is closed.

532,009. Electric Semaphore Setting Device. Homer A. Parrish, Jackson, Mich. Application filed February 10, 1894.

In an electric signal, the combination with the head, of electro-magnets, an armature, a pendulous lever carrying said armature and provided with an adjustable extension, a rock shaft, a curved arm on the rock shaft, arms carried by said rock shaft, and a banner and counter-weight carried by said arms.

# Western Electrician.

EVERY SATURDAY.

Vol XVI. CHICAGO, JANUARY 19, 1895. No. 3.


## Chicago General Railway Company's Plant.

At the annual meeting of the stockholders of the Chicago General Railway company, which was held in the office at the new power plant on Monday, the gentlemen interested and a number of invited guests were given an opportunity to inspect the new branches of the road, which have been constructed since the last meeting. The party was taken over the entire route in a new train of cars composed of one motor car and three forty-foot trailers, which the officers of the company have styled "the finest electric train on earth."

The twenty cars which were recently built by the Pullman company are the handsomest that have ever been turned out of the street car shops of that company. They are finished in oak and upholstered with cane. The windows are of French plate beveled glass. The cars are all vestibuled so as to afford the motorman and conductor protection during the winter months. The electrical equipment on each car consists of a fifty horse power Sperry flexibly connected motor and a Sperry electric brake. Views of this train are shown in Figs. 1 and 2.

The power plant, Figs. 1 and 3, is located in a spacious building especially planned for the addition of other machines. At present it consists of one 300 kilowatt General Electric generator and a 450 horse power tandem cross-connected Corliss engine of the Bates Machine company's make. Two Root boilers of 600 horse power capacity furnish the steam. The arrangement of the boiler room is such that coal can be unloaded directly from the cars to the furnaces, and as the plant is located directly on a railroad running to the coal fields of Illinois and Indiana the cost of fuel is reduced to a minimum. A plan of the whole plant is given in Fig. 4.

The buildings, which are centrally located with respect to the territory through which the company's lines run, are all of brick construction, and cover the greater portion of the block at Thirty-first street and Kedzie avenue. The plant is surrounded by a brick wall ten feet high for the protection of the company's property in case of strikes or in the event of fire on the surroundings prairies. Two entrances only have been left in the wall, one for the steam railroad and the other for the company's tracks.

At present the company owns and operates ten miles of track of the standard gauge with 80 pound girder rails. A number of new lines have been projected, including a downtown terminal and a branch line to Lincoln Park, running through a district west of the Chicago river.

## Rival Receivers for the Great Western Company.

H. B. Moore, the receiver for the Great Western Manufacturing company appointed by the District Court in Duluth, Minn., has applied for an order compelling John Kennedy, who represents the receiver appointed by the United States Court in Chicago, to show cause why he should not surrender the plant to Moore. The court has taken the matter under advisement. E. H. Fowle, the United States Court receiver at Chicago, in an affidavit says he holds the property by authority of the United States Court, and it there is any question as to the rights of parties it should be determined by proper proceedings brought for that purpose. It is thought the decision of this case will determine who is entitled to the property, and that the creditors will then endeavor to effect a reorganization of the company. Mr. Moore's attorney made a trip to Chicago to arrange with the First National Bank of this city to run the works and hold the proceeds subject to the outcome of the litigation between the receivers. The bank was unwilling to take the responsibility and the matter falls upon the Duluth receiver. As the Great Western company manufactured electrical machinery under a license from Foree Bain, the owner of the patents, there is a question as to the right of anyone else to use them. Mr. Bain claims that no one but the company has the right and has notified the receiver and creditors to that effect. If arrangements can be made with him to release his claim for royalty and to superintend the completion of the machinery whose construction has already been begun, Receiver Moore will complete it. Otherwise it will be sold as material for what it will bring.

On December 22d, the day of opening the new electric road in Middletown, Conn., the cars were run free.

## Strike on the Electric Roads in Brooklyn.

At five o'clock on the morning of January 14th all the trolley lines in Brooklyn were tied up, the employes refusing to take out the cars. Over five thousand men quit work. This included motormen, conductors, electricians, switchmen and others employed at the various power houses. All but one of the surface roads, and that a comparatively minor one, are affected. It is claimed that the strike will extend to the lines of the Brooklyn Elevated Railway company. The contract between the Kings County Elevated Railway company and its employes is such that it is believed there can be no strike on that line.

The companies expected that the men would go out and determined to anticipate them. They asked the electricians, about 1,000 in number, if they would take out the cars. Every one of them refused, and they were then told there was no work for them. One foreman was asked if he was willing to take out a car. He refused, and was the only foreman to go out. The people had to use the elevated roads. The trains were made up with extra cars to accommodate the rush. The public was greatly inconvenienced.

The demands of the men are stated by the New York correspondent of the WESTERN ELECTRICIAN. The employers' side is stated as follows: "The company cannot afford to increase its expenses one dollar. Immense sums of money have been borrowed to equip the roads with the electrical systems and this money has got to be paid sooner or later. The employes in the power houses are organized as Knights of Labor, the same as the motormen and conductors, and when the signal is given to stop work they will fall into line and not a car can be moved."

The tie-up is materially affecting the United States mail service. None of the trolley lines delivered the mail on the forenoon of the 14th. Postmaster Sullivan said he would have to go back to the old system of collecting the mail by aid of wagons. He had called upon every substitute and "lay-off" connected with the office to do duty. At eleven o'clock United States mailcar No. 102 of the Flatbush avenue line, with four blue flags, came down Fulton street. A letter-carrier was in front and the passengers were inside. It contained the Flatbush mail.

FIG. 1. CHICAGO GENERAL RAILWAY COMPANY'S PLANT.—POWER HOUSE AND CAR SHEDS, WITH FOUR-CAR ELECTRIC TRAIN.

## Thomson-Houston Regulator Patent Declared Void.

On Monday, January 14th, Judge Grosscup handed down his decision in the case of the Thomson-Houston Electric company against the Western Electric company. This litigation grew out of an alleged infringement by the defendant of the regulator patent granted March 1, 1881, to Elihu Thomson and Edwin J. Houston and transferred by them to the complainant. Judge Grosscup disapproves the opinion of Judge Colt of Boston and declares the patent of the complainant company void. The complainant was represented by R. S. Taylor, F. P. Fish, George R. Blodgett and Offield, Towle & Linthicum, while Barton & Brown appeared for the defendant. Following is a certified copy of the opinion, which was handed down in the United States Circuit Court, Northern District of Illinois.

FIG. 2. CHICAGO GENERAL RAILWAY COMPANY'S PLANT.—VESTIBULED ELECTRIC TRAIN.

This is a suit for infringement of patent No. 238,315, granted to Elihu Thomson and Edwin J. Houston, March 1, 1881, for "current-regulator for dynamo-electric machines."

The object of the invention is to control the operation of a dynamo-electric machine in such manner that the constant and unvarying strength of current shall be maintained in its circuit, notwithstanding changes of load occurring from variations in the number of lamps, or other devices actuated by it.

A dynamo machine is a device for converting mechanical energy into electricity. It has a revolving part called the armature, usually driven from a steam engine; at one end of the armature there is a projecting part called the commutator, standing out something like the hub of a wagon wheel. Upon two opposite sides of this commutator are placed two copper strips, bars, or bundles of thin copper leaves called commutator brushes, which press upon the surface of the commutator during its revolution. A wire joined to one of these brushes leads away from the machine through the lamps or motors in which the current is used, and back to and through the other brush; thus the electric current which is generated in the armature by its revolutions passes out through one brush and back through the other.

Prior to the time of taking out of complainant's patent the development of electrical lighting made it desirable to so construct a device that one, two or more lamps might be dropped out or added to the circuit, at will. In the operation of a dynamo it is necessary that the volume of current generated should be closely adapted to the work done. The problem was to change the output of the machine to meet the change of conditions presented by variations in the number of lamps burning. This could be done either by varying the speed of the machine, or interposing for each lamp extinguished a resistance which would consume the same amount of energy, or by any device that, notwithstanding the variations of load, would keep the volume of the current sustained. The device described in the patent accomplishes this by means of the mechanical elements described therein. It was known by the patentees that, by shifting the position of the brushes on the commutator, the volume of the current would be increased or diminished, and that this law of electrical mechanism was constant. For instance, if, after shifting the brushes to the position of least spark for eight lamps, a lamp should be cut out, the moving of the brushes forward a certain distance would so change the output of the machine that it would be adapted to the running of seven lamps; and a still farther movement forward would adapt it to six, five, and so on; and that by a like shifting of the brushes backward, a new load could be imposed without changing the apparent energy or varying the speed of the machine.

The object of the complainant's patent was to obtain the advantage of this effect in electrical mechanism through some device that would move the brushes automatically and upon the impulse of the condition that made the movement necessary. This was accomplished by means of a yoke on which the brushes were rocked backward and forward, and which obtained its motion through the interposition in the main circuit of an electro-magnet, consisting of a core of soft iron wound with insulated wire, which, becoming magnetic, more or less, according to the strength of the current, attracted an armature, supported upon a lever, at the other end of which was a spring antagonizing the attraction of the magnet. Thus the increase or diminution of the current decided whether the attraction of the electro-magnet, or the resistance of the spring was the stronger force, and in accordance therewith rocked the movable armature upward and downward; and by means of connecting devices likewise rocked the yoke, to which the brushes were attached, backward and forward. The intermediate motor device is not a part of the invention claimed and therefore may be dropped from view.

The claims of the patentees are for a combination and are expressed in the following terms:

"1. In a current-regulator for a dynamo-electric machine, the combination of a device responding to changes in the main or generated current, a shifting commutator for said machine, and mechanism controlled by said responsive device to shift the commutator to those positions where the current taken up by said commutator shall be constant.

"2. In a current-regulator for a dynamo-electric machine, an electro-magnetic device acted upon by variations in the main or generated current, an adjustable or shifting commutator for the machine, and mechanism controlled by said electro-magnetic device to adjust the commutator to those positions where the main or generated current taken up by said commutator shall be constant."

Through an inadvertence of the drawings, at variance in that respect with the written description in the patent, the complainant's device, as drawn, is inoperative. But this corrected, and the device in some other respects slightly modified, the so-called invention is both practical and highly valuable.

The principal defense is that, in view of the prior state of the art, and especially of the invention patented by Thomson and Houston, January 20, 1880, No. 223,659, this so-called invention has been anticipated, and the patent, therefore, is invalid. Much learning on this question by counsel for both sides, and by the experts called, has been put at the disposal of the court, and many questions relating to the laws of electricity, which are in their very nature, in the present state of the art, insolvable by one not an expert, are raised. I have availed myself as closely as I could of the excursions of counsel into these abstruse fields, but have come back from them, I confess, more bewildered than enlightened. So far as I have been able to ascertain all knowledge of electricity is, so far, purely empirical; and mere speculations, therefore, however acute and plausible, as to the ways and methods of this force, are likely to be erroneous, and therefore valueless. In the view of the case to which my judgment has come, it is unnecessary to enter these regions of speculation, or attempt to decide between the respective contentions so earnestly put forth and learnedly maintained.

Patent 223,659 discloses a device almost identical with that of the patent in dispute. As stated already, the commutator is made up of a number of subdivisions called segments, which are electrically insulated from each other. In the revolutions of the commutator each of these segments comes into contact, first, with one brush, then with the other, and as the contact is broken by the passing of the segment away from the brush, there is a tendency to form a spark between the tip of the brush and the edge of the leaving segment. When such sparking is violent or repeated, it eats away the metal surfaces between which it occurs, and is, in every respect, disadvantageous. Whatever may be the cause of the sparking, it was then discovered or known by the patentees that a proper shifting of the brushes upon the commutator would bring about a condition of minimum sparking. But the position of the brushes upon the commutator to prevent sparking was not necessarily uniform. It depended upon the speed of the revolutions, which, in turn, was dependent upon the uniformity of power, not so easily obtainable then as now. It depended also upon the accidental or proposed introduction or withdrawal of resistance from the circuit. It is apparent that a shifting by hand to meet these varying conditions would be both cumbersome and unsatisfactory, and the invention subsequently patented as 223,659 was to meet these electrical difficulties.

The object here, as in the subsequent patent of Thomson and Houston, was to obtain a device that would move the brushes backward and forward responsively to the electrical

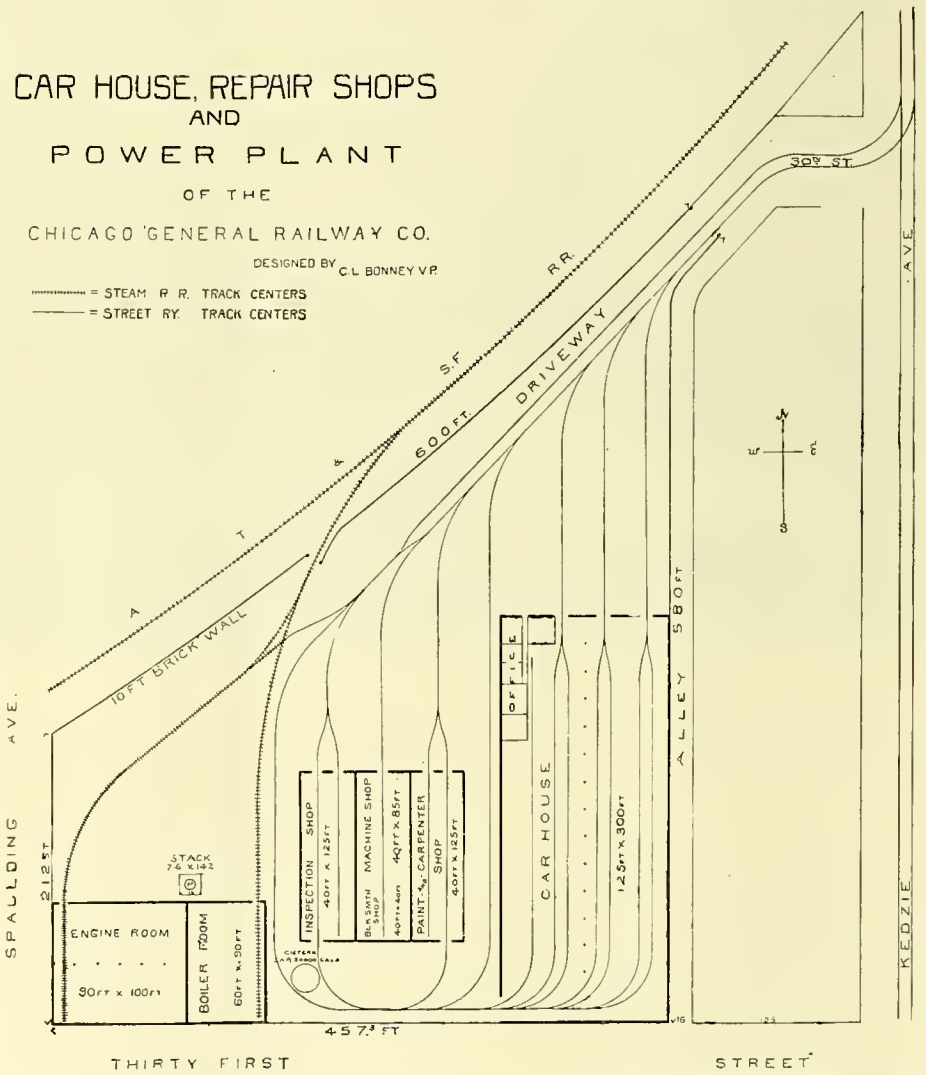



FIG. 4. CHICAGO GENERAL RAILWAY COMPANY'S PLANT.—GENERAL PLAN.

condition that such movements were intended to meet. For this purpose, the patentees employed a mechanical device in every substantial respect like that described in the patent in suit, except that the electro-magnet was put in the short-circuit beginning with the forward member of one of the brushes and ending in the main circuit at the rear of the other member of the brush, instead of having been put in the main circuit, as in the patent in suit.

It may be admitted that the anti-sparking device is, in some respects, different from the one in suit. The question is, whether the difference is one of principle and conception or only such difference in use as leaves the uses, nevertheless, analogous.

The complainant's anti-sparking patent revealed to the public a device by which the brush on the commutator could be automatically changed forward and backward responsively to a change in the current of electricity. The device, it may be admitted, was only used to prevent sparking, and was only acted upon by a small portion of the current, but it disclosed clearly and for all purposes a mechanism that would rock the brushes responsively to changes in the current, irrespective of whether such currents were the main, or only accessory ones. The problem sought to be solved by the patent in suit was a somewhat different one in its ultimate ends, but the object of both patents was reached by the application of any principle, and the use of any device, that would automatically maintain constancy of current, notwithstanding changes of motive power or of resistance. The fact that one may be intended to prevent destructive effects upon the machine itself, and the other to adapt the machine to the circumstances of changing resistance, will not make both devices patentable, if they employ substantially the same principles and the same mechanism. It seems clear to me that the real immediate use intended by both of these patents was to automatically equalize the volume of the current; the one, in the less, and the other, it is true, in a much greater degree. The immediate objects in view were thus analogous, and the ultimate uses into which they diverged, do not make them less so.

Now, if the uses were analogous, and the principles and devices employed were somewhat different, the sole question remains, whether an electrical mechanic having the knowledge of the art that the public possessed when the so-called invention in suit was conceived could, without invention, have adapted the anti-sparking mechanism to the analogous uses of the patent in suit?

It must be remembered that it was then well known to electricians that the shifting of the brushes forward and backward upon the commutator increased and diminished the volume of the current, and thus equalized it against the tendencies of a changed resistance. This is what the anti-sparking invention accomplished automatically within narrow limits. It is what the so-called invention in suit accomplished automatically through a wider scope. To an electrical mechanic bent upon devising a remedy for the inconstancy of the current caused by the putting in and taking out of the lamps, and possessed of the knowledge that a shifting of the brushes on the commutator would accomplish this, and that such shifting, within very narrow limits at least, could be accomplished automatically by the anti-sparking invention, the sole problem was presented whether, by a like device, an automatic shifting of the brushes through a wider scope, and adapted to the whole current, could be effectuated. The mechanical idea and conception, and the principle on which it was based, were all before him. There was required simply experimentation to determine its adaptability to the new purpose. Doubtless, such experimentation was difficult and delicate, and called into exercise a multitude of different adjustments of the brushes. But, it was all done in the light and along the lines of the earlier device and of electrical principles well known to the public. It was in my mind adjustment purely, and not a new conception of either a principle of electricity, or a mechanism to carry it out. If there is any mistake in this judgment it is, I think, in putting a higher estimate upon mechanical skill in electrical fields than is applied to other fields, but I do not see how this can or ought to be avoided. It necessarily requires high skill to be an electrical mechanic at all. Adjustments and adaptations are there every day made use of. To give to each of these the dignity and consequence of inventions would tie up permanently this whole useful field to monoply. No new distinct conception or discovery ought practically to go unrewarded. But, it certainly would, if its re-adaptations by experiment or adjustment, to the thousand uses the field of electricity discloses, were to be regarded as patentable improvements. I differ from Judge Colt in this case with reluctance, for I defer to his superior experience and wisdom in the patent field, but I cannot follow him in this case without violating my own sense of judicial responsibility.

The bill will be dismissed.

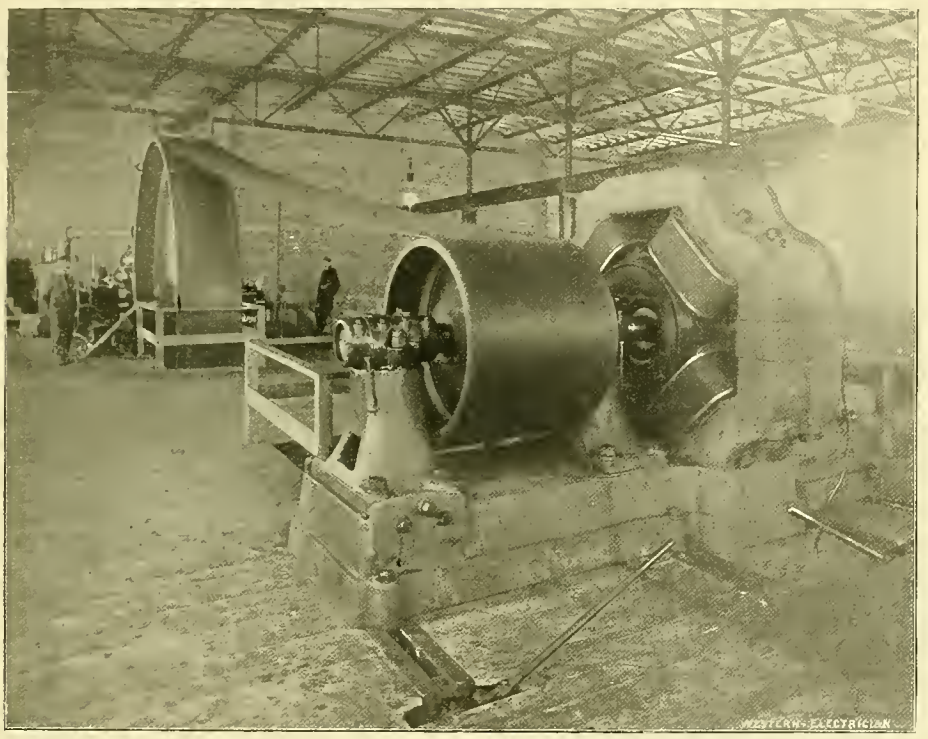


FIG. 3. CHICAGO GENERAL RAILWAY COMPANY'S PLANT.—INTERIOR OF POWER PLANT.

## Farmers Approve of Rural Electric Railways.

Apropos of the editorial in last week's issue of the WESTERN ELECTRICIAN on the subject of trolley-car lines on country roads, it is interesting to note that the Farmers' Alliance of Pennsylvania has taken formal action approving this use of the highways. The *Observer* of Washington, Pa., says:

It has been generally expected that the next Legislature would be flooded with protests from the people, and especially from farmers, against the use of the public highways for trolley lines, but the farmers have seen the trolley; they have counted its advantages, and, instead of rising up in arms against it, the Farmers' Alliance of Pennsylvania, through its state council recently held at Harrisburg, unanimously resolved that the Legislature should deny the right of eminent domain to trolley lines and compel them to "construct their tracks in the center of the public road." They also demanded that they "be required to use girder or step rail laid at the standard gauge of wagons so that vehicles may be driven on the rail, and that they be required to maintain the roadbed between the rails and 18 inches on the outside at their own expense."

The farmers have a practical eye to business. They see that the trolley is the railway of the people, furnishing the cheapest transportation in the world, and they aid cheap transportation by giving it the right to the public roads, while they look well to their own advantage by requiring that the rail should be so laid that in muddy weather they will have a solid highway on which to drive their teams. In addition to this they propose to utilize the trolleys as far as possible in helping to maintain the highways.

## American Institute of Electrical Engineers.

At the New York and Chicago meetings of the Institute on the 16th instant the announced papers were: "On the Units of Light and Radiation," by Prof. Alex. Macfarlane of Ithaca, N. Y., and "The Best Metal for Field Magnet Frames," by Alton D. Adams of Boston. Prof. Stine of the Armour Institute prepared, also, an illustrated historical sketch of the first three-wire Edison plant at Sunbury, Pa., for the Chicago meeting.

## Statistics of Electrical Fires.

William H. Merrill, Jr., the expert of the Underwriters' Electrical Bureau of Chicago, has prepared a statement showing the number of fires supposed to be due to electrical apparatus during the year ended October 1, 1894. Mr. Merrill says that the total number of electrical fires for the year, of which he has knowledge, is 475, with a total loss of $1,415,610.25—of course only a small proportion of the total fire loss of the United States. Reports in 319 cases showed little or no loss. Mr. Merrill believes that "the data secured, while incomplete, are very instructive, and will serve to practically demonstrate the necessity of rigid enforcement of many clauses of the rules, and will bring about a unanimity of opinion among inspectors regarding the problems presented by electricity considered as a fire hazard."

Following is Mr. Merrill's summary of the causes of electrical fires, the number attributed to each being given:

- *Arc Lamp*..
  - Grounds on—1.
  - Hanger boards—(See wood base devices) 3.
  - Hot carbons—2.
  - Spark arrester—1.
  - Resistance controller—3.
  - Sparks from—18.
  - Short-circuit—1.
- *Arc cut-out switch*—(See switches.)
- *Bond for rails*—(See Street Ry. current.)
- *Causes other than electrical in generating stations, or evidence not conclusive*— 10.
- *Conductors*..
  - Crosses on trolley—18.
  - Crosses on electric light wires—37.
  - Crosses on 500 volt power circuit—3.
  - Crosses, electric light on trolley—2.
  - Crosses, flexible cord
    - Ordinary—3.
    - Show window—5.
  - Grounds
    - Awnings—16.
    - Combination fixtures with no insulating joints. 8
    - On transformers—(See converters.)
    - Moisture—22.
    - On nails—4.
    - On pipes—12.
    - Roofs, cornices, metal fronts, etc. 28
    - Underground service—11.
    - Unmentioned—4.
    - Vaults, metal pans, cables, etc—4.
  - Open Circuit—3.
  - Overloaded wires—7.
  - Short Circuits.
    - Fixtures—1 (See also grounds on combination fixtures.)
    - Miscellaneous—12.
    - Moisture—4 (See also switches.)
    - Nails—1 (See also grounds.)
    - Sockets—(See incandescent lamps.)
    - Switches—(See switches.)
    - Trolley circuits—(See St. Ry. currents.)
    - Underground service—13.
    - Unfilled moulding—7.
    - Unprotected wires through floors, etc.—41.
- *Contacts, poor.*
  - Joints—4.
  - Sockets—2.
  - Switches—1.
- *Converters* ....27.
- *Crosses*.....(See conductors.)
- *Cut-outs*....
  - Grounded—6.
  - Fuses, improper—5.
  - Terminals, too near—1.
  - Uncovered—8.
- *Extension Plugs*—1.
- *Flat Irons, etc.*—4.
- *Flexible Cord*—(See conductors.)
- *Fuses*.....(See cut-outs.)
- *Generators*..
  - Armatures—2.
  - Resistance boxes—2.
- *Grounds*..... (See conductors, converters, cut-outs.)
- *Hanger Boards*—(See arc lamps and wood base devices.)
- *Incandescent Lamp*....
  - Bursting of—6.
  - In show window, inflammable material—7.
  - In show window, short-circuit in socket—2.
  - In series—2.
- *Interior Conduit*—(Not standard) 1.
- *Joints*.....(See contact.)
- *Lamps*.....
  - (See arc lamps.)
  - (See contacts, sockets.)
  - (See incandescent lamps.)
- *Lightning discharges on wires*—15.
- *Lightning Arresters, defective*—3.
- *Motors*.....
  - Arcing at commutator—1.
  - Armature, short-circuited—6.
  - Direct evidence lacking—5.
  - Resistance box—7.
  - Rheostat—(See resistance box.)
  - Switch, not in sight of motor—2.
- *Mouldings, not filled*—(See conductors.)
- *Multiple Lights*—(See St. Ry. currents.)
- *Resistance Boxes*.....
  - (See arc lamps.)
  - (See generators.)
  - (See motors.)
- *Series Multiple System*—5.
- *Short-circuit*—(See conductors, sockets and switches.)
- *Sockets, defective*—2 (See contacts.)
- *Static*.....2.

| | | |
|---|---|---|
| *Street Ry. Currents..* | Bonds—1. | |
| | Crosses (See conductors.) | |
| | Defective ground return—1. | |
| | Lights and power from—9. | |
| | Sparks—3. | |
| *Switches....* | Installation wrong | Arc—3. |
| | | Inc.—1. |
| | Short-circuit by moisture—4. | |
| | Short-circuit, no cause given—4. | |
| | (See contacts.) | |
| *Wood Base Devices...* | Cut-outs—5. | |
| | Hanger boards—13. | |
| | Switches—12. | |

## Central Station at Nancy, France.

The central station at the railway terminus at Nancy, France, installed by Fabius Henrion, is operated on an economical system which it is interesting to study in detail.

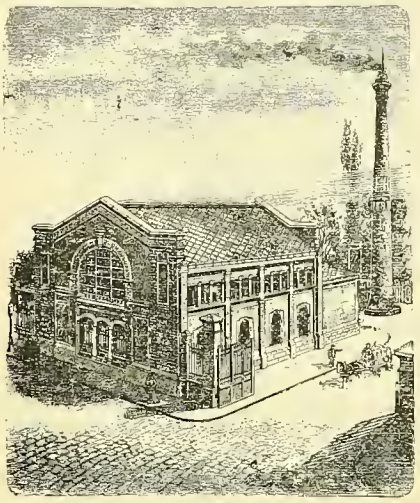


FIG. 2. CENTRAL STATION AT NANCY, FRANCE.

In Fig. 1 is shown the interior of the engine and dynamo room; Fig. 2 is an exterior view, and Fig. 3 is a ground plan of the station.

The boiler room, located at *A*, Fig. 3, has two semi-tubular boilers with a grate area of 60 meters capable of producing 750 kilogrammes of steam per hour. Feed water taken from the Moselle by means of an injector, and in case of stoppage of the injector by feed pumps. An automatic damper diminishes the draught when the fireman opens the door to fire. The stack is 50 meters high and is situated in a court at a distance of 40 meters from the power house. The purified water from the condensed steam of the engines is taken back to the boilers.

The engine room *B* has two Corliss condensing engines installed at present. The remaining space is reserved for the installation of other machines. The engines are of 50 horse power rated capacity, operated at 75 revolutions per minute at full load. By varying the cut-off the capacity can be raised to 90 horse power under good mechanical conditions, with consumption of steam at higher pressure. The two engines are located at *C* and *D*, with the two fly-wheels in juxtaposition. The shafts are prolonged one toward the other, and a special clutch coupling permits the running of the two machines coupled together. Under these conditions if an accident should happen to one engine or to a dynamo the idle engine can be used to run one of the dynamos or two at a time.

Each engine drives an F. Henrion overcompounded dynamo, giving 400 amperes at 110 volts, or 350 amperes at 115 volts, which is 40 kilowatts, at a speed of 500 revolutions per minute. The two dynamos are shown at *F* and *G* in Fig. 3. These overcompounded dynamos have the advantage of maintaining a constant difference of potential in spite of variations of load.

The current from the dynamos is carried to a special distribution board *H* mounted on marble. The connections are clearly shown in Fig. 1 to the left. The switchboard is provided with two voltmeters, two ammeters and a megohmeter to measure directly the insulation resistance of the system at a glance. As a continuation of this board is a second at *I*, on which are connected the different lighting circuits.

One hundred Pilsen arc lamps of four, eight and twelve amperes are used to light the railway station. There are also about 300 incandescent lamps for lighting the offices. The insulated cables are carried on porcelain insulators. Each circuit of two arc lamps is brought back to the station upon the board *I*, and is provided with cut-outs, a quick breaking switch and an ammeter showing at all times the running and regulation of the lamps.

The first cost of this installation was necessarily high, but the method employed ensures absolute certainly of operation and good running in an extensive and important terminus. It may be added that the lines, of which the length is 1,100 meters, serve as resistance and replace in part the ordinary rheostats, at least for those lines of which the resistance is sufficient.

The second board *J* is designed for operating the two batteries of accumulators, of a capacity of 300 ampere hours. These serve in case of emergency and to carry on the service during the day before the starting of the plant, and during the night after the shutting down of the plant. The accumulators built by Fabius Henrion are made of plates with fine grooves separated by grooved supports and tubes of glass. Special precautions have been taken in the installation of these batteries to secure good insulation from the earth. All contacts and connections are made with soldered joints. An automatic switch closes the circuit for charging and discharging; it connects the batteries to the general distributing circuits if the difference of potential drops below a certain value.

A third switchboard at *K* is for machine regulation. It carries a large voltmeter 50 centimeters in diameter, with wide divisions, and two automatic rheostats connected in the shunt circuits of the dynamos. A registering voltmeter records the continuous running of the station.

At a distance of 4.8 kilometers from the Nancy terminus is the terminus of Jarville, to which this plant also furnishes light. To operate the lamps at this distance a continuous current transformer is employed. At *L*, Fig. 3, is an electric motor of 88 amperes and 110 volts running at a constant speed; it is coupled directly to a series dynamo *M* giving 8 amperes at 800 volts. This dynamo feeds 16 arc lamps of 1,000 candle power each. The current is maintained constant by adjusting the brushes.

Taken as a whole the Nancy central station is principally notable for its economical operation. In the evening the plant is run by one man and during the day a man takes care of the arc lamps and replaces the carbons. The superintendent lives at the plant. Every day the curves of the registering voltmeter, of the registering boiler pressure gauge, the consumption of carbons, oil, water, etc., are carefully taken and preserved. During the month of April, 1893, the total electrical energy utilized was 11,666 kilowatt hours, the consumption of fuel being 22,030 kilogrammes. The average fuel consumption was 1,970 kilogrammes per kilowatt hour; this is practicallyc onstant for every day. The consumption of cylinder oil per kilowatt hour is more variable; it averages 5 grammes. The consumption of machinery oil is not very regular. The average consumption for the month is 1.96 grammes per kilowatt hour; during several days from the 15th to the 25th of April there was also consumed about 4 grammes of filtered oil per kilowatt hour. The coal used is worth 22 francs per ton delivered; the cylinder oil is of a fine grade and costs 110 francs per 100 kilogrammes; the machine oil costs 40 francs per 100 kilogrammes.

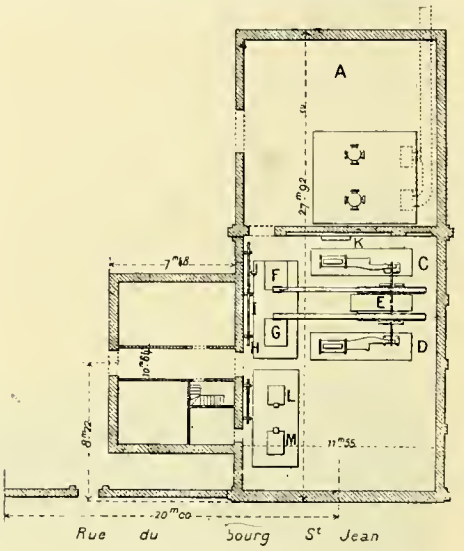



FIG. 3. CENTRAL STATION AT NANCY, FRANCE.

The expenditure for primary material, therefore, is as follows:

| | In centimes per kilowatt hour. |
|---|---|
| Coal | 4.30 |
| Cylinder oil | 0.55 |
| Machinery oil | 0.08 |
| | 4.93 |

To get at the exact cost it is necessary to add the expenditures for salaries, wages, renewals, repairs, etc. It may be noted that the expense for fuel of the Birmingham Electric Supply company in England was 9.24 centimes per kilowatt hour—over twice as high. It is right to add that the Nancy station has a more definite and regular load than an ordinary central station.

All these particulars show that the Nancy plant has been built under carefully considered conditions. The figures which have been cited, although incomplete, show that the operation is most economical.

The facts in the foregoing description and the illustrations are from *L'Industrie Electrique.*

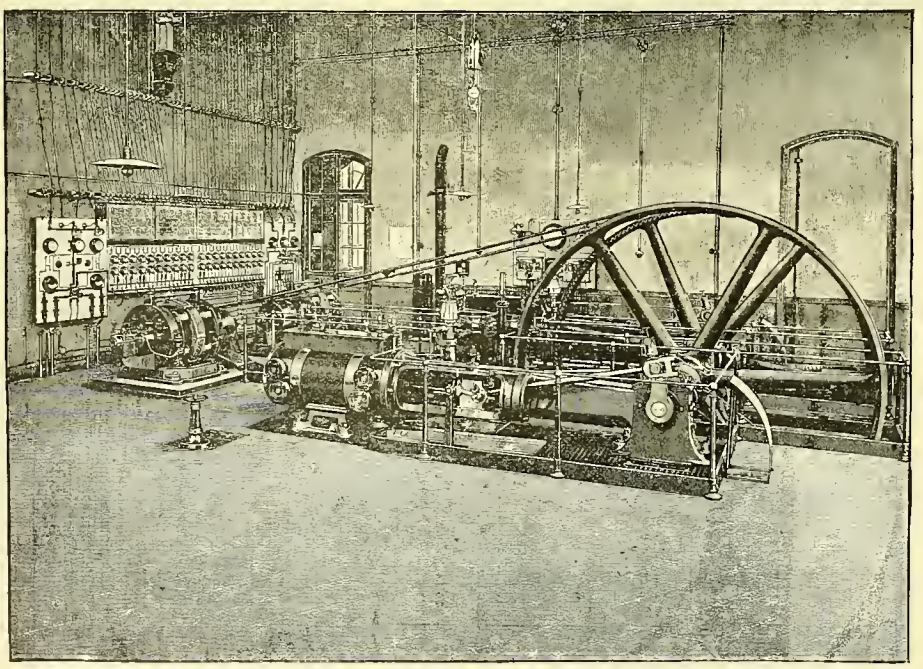


FIG. 1. CENTRAL STATION AT NANCY, FRANCE.

## Electricians Must Be Licensed in La Grange.

The Board of Trustees of the village of La Grange, Ill., near Chicago, has passed an ordinance to the effect that "Any person desiring to exercise or carry on within the corporate limits of the village of La Grange the business or trade of electrician or electrical worker, meaning thereby the business of wiring buildings for the use of electricity, or of erecting, setting or connecting electrical fixtures therein for like use, must first obtain a license therefor from the president and Board of Trustees of said village, and shall pay a fee of $25 per annum therefor." Licenses are granted for one year, and the licensee must give bond to insure the competent performance of his duties. For violation of this ordinance, which is now in force, a fine of not less than $25 nor more than $100 shall be imposed.

The Broadway and Kentucky street railway lines in San Francisco are now electrically operated.

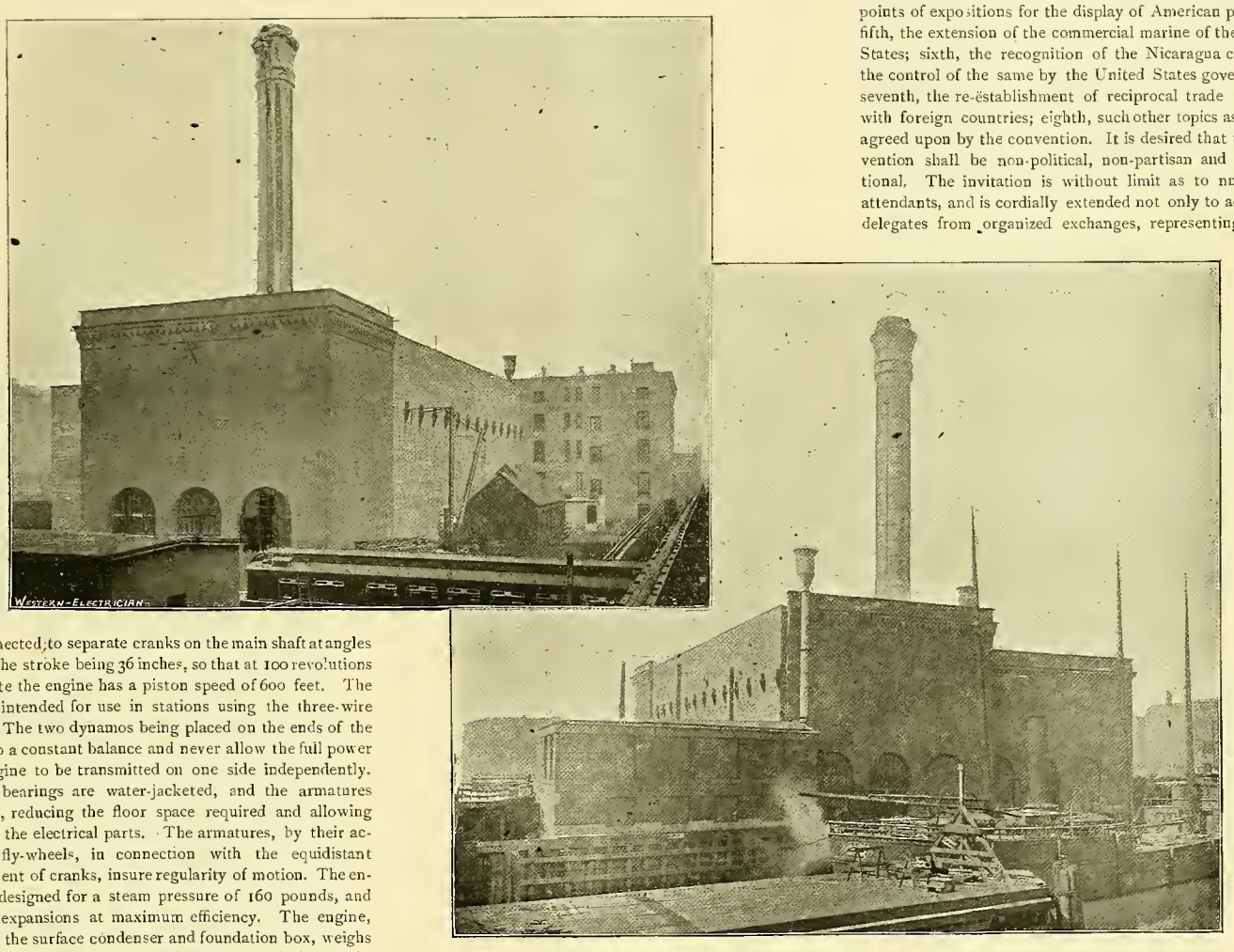
## Economy of Operation at the Harrison Street Station of the Chicago Edison Company.

The new central station of the Chicago Edison company, located on the west bank of the South Branch of the Chicago river, at the Harrison street bridge, is principally of interest owing to the marked economy of operation. The photographic reproductions of the exterior shown in the accompanying illustration are respectively from the east and from the west. The one showing a glimpse of the river and the shipping is taken, of course, from the east.

The plant consists of a battery of Heine water-tube boilers and eight directly connected engine-dynamos. The engines are all upright, with multipolar 140 volt General Electric dynamos keyed to the shafts. The engines were built by the Southwark Foundry & Machine company of Philadelphia. The principal one is the ponderous engine which, painted white, was such a prominent feature of the General Electric company's exhibit in machinery hall at the World's Fair. This is a 1,500 horse power machine, driving two 600 kilowatt dynamos. It is a vertical, triple-expansion, condensing engine, with cylinders 22½, 33⅛ and 55⅜ inches in diameter, connected to separate cranks on the main shaft at angles of 120°, the stroke being 36 inches, so that at 100 revolutions per minute the engine has a piston speed of 600 feet. The design is intended for use in stations using the three-wire system. The two dynamos being placed on the ends of the shaft keep a constant balance and never allow the full power of the engine to be transmitted on one side independently. The end bearings are water-jacketed, and the armatures overhung, reducing the floor space required and allowing access to the electrical parts. The armatures, by their action as fly-wheels, in connection with the equidistant arrangement of cranks, insure regularity of motion. The engine was designed for a steam pressure of 160 pounds, and for 12½ expansions at maximum efficiency. The engine, including the surface condenser and foundation box, weighs about 320,000 pounds. The engine was practically rebuilt after the World's Fair to suit the requirements of the Chicago Edison company.

Crude oil is burned as fuel, and the average cost is .07 cent per kilowatt hour, or .06 cent at full load. These figures do not include the interest on the investment, but simply the cost of the current generated. Still the result is so low as to give warrant to the claim that this is the most economical station in operation in the United States. It is estimated that the oil costs 20 per cent. less than coal at $3.50 per ton. The fuel bill is about half that at the old Adams street station, making a saving, it is said, of some $60,000 per year.

The oil is obtained from tank cars delivered to the station on a railroad side track adjacent to the boiler room.




HARRISON STREET STATION OF THE CHICAGO EDISON COMPANY.

## Appeal from the Berliner Decision.

The American Bell Telephone company has appealed from the decision of Judge Carpenter of the United States Circuit Court, declaring the Berliner patent No. 463,569 void, to the United States Circuit Court of Appeals. Among the errors assigned by it to the rulings of Judge Carpenter are: That the court should have dismissed the bill in equity, which was brought by the United States; that the court should have found that the Berliner patent was for a different invention from any that was patented, and that the court should have found that the Bell Telephone company always intended and always did prosecute its application for the patent in suit with diligence and with intent and purpose to secure the issue of the patent at the earliest practicable day.

## Pacific Cable Project.

The British government has asked the United States to consent to the landing of a British Pacific cable on one of the uninhabited islands of the Hawaiian group. In his letter communicating this intelligence to Congress, President Cleveland says:

The Hawaiian government desires to lease to Great Britain one of the uninhabited islands belonging to Hawaii as a station for a submarine telegraph cable to be laid from Canada to Australia, with a connection between the island leased and Honolulu.

Both the government of Hawaii and the representatives of Great Britain in this negotiation concede that the proposed lease cannot be effected without the consent of the United States, for the reason that in our reciprocity treaty with the king of Hawaii, he agreed that as long as said treaty remained in force he would not "lease or otherwise dispose or create any lien upon any port, harbor or other territory in his dominion or grant any special privilege or right of use therein to any other power, state or government."

At the request of the Hawaiian government this subject is laid before the Congress for its determination upon the question of so modifying the treaty agreement above recited as to permit the proposed lease.

I hope the Congress will see fit to grant the request of the Hawaiian government, and that our consent to the proposed lease will be accorded. It seems to me that we ought not, by a refusal of the request, to stand in the way of the advantages to be gained by isolated Hawaii through telegraphic communication with the rest of the world—and especially in view of the fact that our own communication with that country would thereby be as greatly improved without apparent detriment to any legitimate American interest.

Englishmen naturally applaud the president's friendly utterances, although the London *Post* says that it considers that a Pacific cable might have been laid by the same contrivance as the six Atlantic cables, and thus have avoided the Hawaii difficulty. The proposal for a landing station on Hawaii seems to be at variance with the stipulations that the cable should be free from foreign control. Lord Rosebery committed an absurd mistake, this journal adds, in sending an imperial commissioner to obtain a lease of Hawaiian territory. He ought to have known that it could not be granted without first asking the consent of the United States. If there is anything in the French objection, the *Post* says, the Cabinet ought to move quickly, as there is no chance of two Pacific cables succeeding.

## National Convention of Manufacturers.

The manufacturers of Cincinnati and Hamilton county, Ohio, believing that the prosperity of the manufacturing interests of the entire country may be best promoted by concerted action, have called a convention of manufacturers to be held in the city of Cincinnati, on the 22d day of January, for the purpose of general interchange of views looking to the formation of a National Association of Manufacturers which shall embrace among its purposes: First, the cementing of a national organization of the manufacturers of the United States, for the purpose of considering national questions affecting their interests; second, the advocacy of carefully considered legislation, to encourage manufacturing industries of all classes throughout the country; third, the discussion of ways and means whereby trade relations between the United States and foreign countries may be developed and extended; fourth, the establishment in South American capitals and other desirable points of expositions for the display of American products; fifth, the extension of the commercial marine of the United States; sixth, the recognition of the Nicaragua canal and the control of the same by the United States government; seventh, the re-establishment of reciprocal trade relations with foreign countries; eighth, such other topics as may be agreed upon by the convention. It is desired that this convention shall be non-political, non-partisan and non-sectional. The invitation is without limit as to number of attendants, and is cordially extended not only to accredited delegates from organized exchanges, representing manufacturing interests, but to any individual manufacturer who may have the promotion of the general good by organized effort sufficiently at heart to be willing to join the movement. The committee on invitation and entertainment is composed of W. A. Procter, president Procter & Gamble company; Thos. P. Egan, president, J. A. Fay & Egan company; Edward C. Hall, president Herring-Hall-Marvin company; Chas. Davis, president Lodge & Davis Machine Tool company; Robert Laidlaw, president Laidlaw-Dunn-Gordon company; Jas. E. Mooney, president American Oak Leather company; H. M. Lane, president Lane & Bodley company.

## Steam Railroad to be Transformed into an Electric Line.

The New York, New Haven and Hartford Railroad company is preparing to equip its Nantasket Beach and Warren and Bristol branches with electricity to replace the present steam power. The Nantasket Beach line is ten miles and the Warren and Bristol twenty-one miles in length. The latter starts from Providence, passes through Fall River and terminates in New Bedford. It is stated that the company intends to ultimately equip all its minor branches with electricity.

Western Electrician.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50 with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies 10 cents. When change of address is requested, the old address as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK

CIRCULATION, 16,630.

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THE era of electric railway construction in Chicago has brought with it many incidental benefits. There can be no doubt that many men have secured employment this winter owing to these extensions and improvements who would otherwise have been idle. Building contractors estimate that the street railway companies have expended the sum of $330,000 for building operations alone—that is, for power houses, car barns, stations and the like. This is exclusive of real estate, machinery and line construction. If the total cost of the transformation could be ascertained, the sum would be a surprisingly large one.

TELEGRAPH companies have great responsibilities as well as great privileges. This is illustrated in the case in which State Senator Samuel D. Peterson of Minnesota obtained a verdict of $10,000 against the Western Union Telegraph company. Two years ago during the United States senatorial election, at which Senator Davis was chosen to succeed himself, Senator Peterson voted against Davis, and a number of Republicans sent Peterson a telegram signed simply "Many Republicans," reflecting on his honesty. The Western Union company refused to give the names of any of his traducers. Peterson sued the telegraph company, and at New Ulm on January 12th got a verdict.

THE statistics of electrical fires, as prepared by Mr. Merrill of the Underwriters' Electrical Bureau of Chicago and presented in this issue, are of interest principally in showing what to avoid in electrical construction to preclude danger of fire. As might be expected the great majority of short-circuits are traced to defective insulation on conducting wires. The electrical fire loss of the country is only a very small proportion of the total from all causes, yet it might be much less. The lesson of figures like these is obviously to incite greater care in construction and inspection. The best sentiment of the electrical industry welcomes the co-operation of any agency tending to this end.

THIS is the week of the winter meeting of the Northwestern Electrical association, which is convening its hosts in Milwaukee. This young and vigorous organization is accomplishing much good for the central station men of the Northwest. The meetings so far have been very well attended, and much interest has been manifested in the practical, helpful papers that have been read. Without in any way rivaling the influential National Electric Light association, which has done much for the electrical interests of the country, the young Northwestern association has a membership with a close community of interest which is in some measure lacking in the older society, which draws its support from widely separated centers. The Northwestern has a distinct field, which it is cultivating with notable success. We wish it continued prosperity and usefulness.

FINANCIAL men are disappointed in the annual reports of some of the large street railway companies of Chicago. The West Chicago company's earnings were 4 per cent. below dividend requirements, and a reduction in rate will, in all probability, soon follow. The Lake street elevated road is shown to be on the verge of bankruptcy, and stockholders are informed by the management that reorganization is absolutely necessary. The North Chicago Street Railway statement, although fair, was not up to expectations. All of these companies, however, are adopting, or about to adopt, the use of electrically transmitted power, and with better service and reduced operating expenses may be relied upon to make a better showing in the future, even though the recovery from the business depression be slower than is anticipated. It should be remembered, also, that the reports for 1894 suffer by comparison with the unusually prosperous World's Fair year.

WE hope that our readers will not judge our ideal of technical journalism—about which Mr. Johnston prates so much and cares so little—by the article printed on another page under the heading, "The Case of the *Electrical World*." That class of matter is, indeed, very far from being our ideal of that which a technical journal should provide its readers, and, viewed in one light, an apology should be tendered for the insertion of the article. But we have acted under the belief that heroic measures are necessary to expose and abate what has become to be a tiresome nuisance in the electrical industry—a "pioneer electrical journal" that assumes to foist itself as an Old Man of the Sea on the shoulders of the electrical business of the country. THE WESTERN ELECTRICIAN rejoices in a healthy and honorable competition in its field, but we are sick of the bulldozing pretense and egotistical greed of the *Electrical World*. We have not minced words in characterizing it as it deserves, and we are confident that we are backed by the best sentiment of the fraternity in rebuking the insufferable impertinence of this would-be dictator.

ELSEWHERE in this issue is presented an important decision with the accompanying opinion, of Judge Grosscup in the suit of the Thomson-Houston Electric company against Western Electric company, in which the patent No. 238,315, granted March 1, 1881, to Prof. Elihu Thomson and Edwin J. Houston, is held void on the ground that only the ordinary skill of the electrical engineer was required to adapt what was already known in the art to automatic current regulation, especially in view of the former patent to Thomson and Houston. Judge Grosscup, it will be seen, disapproves of the opinion of Judge Colt in a suit of the same complainant against the Citizens' Electric company of Boston in 1888. This he does with evident reluctance, it is true, but he explains that he could not do otherwise without violating his own sense of judicial responsibility. It will be seen, therefore, that Judge Grosscup's views differed materially from Judge Colt's, and the former felt it necessary to officially record his disapproval in order that full justice might be done.

Another point of interest is the court's remarks on the subject of electrical invention. As applied to the present case it is held that "if there is any mistake in this judgment it is in putting a higher estimate upon mechanical skill in electrical fields than is applied to other fields," but the judge says he "does not see how this can or ought to be avoided. It necessarily requires higher skill to be an electrical mechanic at all. Adjustments and adaptations are there every day made use of. To give to each of these the dignity and consequence of inventions would tie up permanently this whole useful field to monopoly. No new distinct conception or discovery ought practically to go unrewarded. But it certainly would, if its re-adaptations by experiment or adjustment, to the thousand uses the field of electricity discloses were to be regarded as patentable improvements." This view is of special interest to electrical workers.

This litigation involved many abstruse and difficult scientific questions. The judge in his opinion says that he has availed himself of the learning of counsel and experts on both sides upon the questions relating to the laws of electricity, but confesses that he has come back from those abstruse fields more bewildered than enlightened. Whether this may be considered as a compliment to counsel and experts is not apparent. There are some 2,500 printed pages in the record. Prof. Charles R. Cross and Elihu Thomson were the leading expert witnesses for complainant, and Charles E. Scribner, Hiram S. Maxim and Thomas D. Lockwood were the principal expert witnesses for the defendant. The suit was commenced in November, 1890, and more than three years was occupied in taking testimony. The arguments on final hearing occupied several days last June, as was noted in the WESTERN ELECTRICIAN at the time. It may be added that the case was one of the most important that has yet been decided in the electrical field, and the litigation thus far has involved the expenditure of an enormous sum of money.

CONGRESS has been asked to grant the British government the right to land a cable on one of the uninhabited islands of the Hawaiian group, preferably Necker Island. The president, in a letter in which he lays this request before Congress, expresses the hope that consent will be granted, and points out the advantages to be gained by this dountry as well as Hawaii through the establishment of this cable. It is generally agreed that a cable should be established, but in this country it is believed that the project should be an American enterprise. It seems that the same view is entertained by an influential class in Hawaii. The *Chicago Tribune* publishes the following expression of opinion by a man who enjoys confidential relations with the Hawaiian government, and vouches for his authority:

The republic of Hawaii does not want to give up Necker Island to the British government, and allow it to assume political control as a midway station in its international cable between British Columbia and Australia. The republic of Hawaii has not asked the United States to consent to the cession of the island to Great Britain. It wants cable communication with the continent, but it wants it under the auspices of the United States, and with a landing in that country. President Cleveland's recommendation as laid before Congress that the United States give its consent promptly to the lease of Necker Island to Great Britain is a shocking perversion of the real facts in the case. This will appear from the visit of our minister of foreign affairs, Mr. Hatch, who is now in San Francisco, on his way to Washington.

This is not the first attempt that has been made to secure control of this important point. There is, of course, nothing to prevent an English company from establishing an ordinary station at Honolulu, but the British government has refused to give assistance to private enterprises unless guaranteed absolute political sovereignty so that the English could control the cable in time of war. Under the treaty with the United States Hawaii has been unable to grant such a concession, and this country has always refused to entertain any proposition on this basis. Heretofore there has been hope that the line would be established by American capital and controlled by an American corporation or else by this government. In his annual message to Congress in 1888 President Cleveland recognized this sentiment and made the following reference to the proposed Pacific cable: "In the vast field of Oriental commerce, now unfolding from our Pacific borders, no feature presents stronger recommendations for congressional action than the establishment of communication by submarine telegraph with Honolulu. The geographical position of the Hawaiian group in relation to our Pacific states created a natural interdependency and mutuality of interest which our present treaties were intended to foster and which make close communication a logical and commercial necessity." This was followed by similar recommendations from President Harrison and Secretaries Bayard, Blaine and Tracy. In 1891, as the result of these recommendations, a bill to incorporate the Pacific Cable company, which provided for a subvention for a submarine telegraph from San Francisco to the Hawaiian Islands, passed both Houses of Congress. The House and Senate, however, disagreed as to the amount and terms of the subsidy. The matter was in conference for a long time, and the bill finally failed in the closing hours of the session. In its stead an act was passed appropriating the sum of $25,000 to enable the president to cause soundings to be made between San Francisco and Honolulu for the purpose of determining the practicability of the laying of a cable between those points. The survey was a complete success, and the report of the expedition shows the practicability of laying a cable between this country and the Sandwich Islands. It is to be regretted that after such a favorable beginning the work should have been abandoned. There is no doubt that cable communication with Honolulu is desirable, but it is equally true that the line should be controlled by this country.

## The Case of the "Electrical World"

Sordid, impertinent, ingeniously misleading, brutal and vulgar, the *Electrical World* is becoming a stench in the nostrils of the electrical fraternity. To discuss it is an unpleasant duty; one feels like advancing toward the subject with one hand protecting the nostrils and the other armed with a pair of tongs. Yet it is a duty that must be performed, for such is the receptiveness of human nature that some persons may be deceived by the din raised by this journalistic beater of tom-toms, and so take it at its own valuation, which would be unfortunate, indeed—a spectacle to excite laughter in the thoughtless and grief in the judicious. So long as the *World* contented itself with shrill reiterations of self-praise we were well satisfied to let it exert itself and amuse its readers undisturbed. But now that it has chosen to run amuck in the ranks of electrical journalism, striking at random whom it may in a wanton onslaught of reckless misrepresentation, hoping that it can snatch a little booty during the affray, like a hungry street-dog—now that it has deemed it expedient to resort to tactics which would be deemed degrading by a journal that had a reputation to lose, we are impelled to the disagreeable task of pointing out the true position of this disgrace to technical journalism.

The WESTERN ELECTRICIAN cannot afford to do an injustice to any person or thing, or even to the *Electrical World*. We do not apply the descriptive terms used in the beginning of this article merely to "call names;" that would be childish. It is simply the fact that our characterization of the *World* is a true summary of its traits, and will be recognized as such by nine out of ten men who are familiar with the methods of the electrical journals of the country. We are justified in dwelling at some length on this subject, in whatever light it is viewed, because if the *World* is right as to its position of towering pre-eminence, then its qualities are of general interest to the entire industry; the electrical men are entitled to know all about their delectable champion. If, on the other hand, this claim is only a lying and fraudulent pretense, the sooner the exposure is made the better; the electrical fraternity doesn't enjoy being tricked or attempted trickery.

To return, then, to those characteristics which now distinguish the *Electrical World*, we may again speak of that paper as sordid, impertinent, ingeniously misleading, brutal and vulgar. Let us go a little more into detail, as it is right that we should. The *Electrical World* is sordid because it is meanly avaricious and contemptible in its business methods; it is impertinent because it endeavors to pry into the business of those whom it seeks as customers, giving business men impudent advice where it is not wanted; it is misleading because—well, probably because that's its nature, and instances can be found whenever it essays to speak about itself (it will be remembered that the WESTERN ELECTRICIAN was obliged to show the *World* up in a willful misrepresentation in the World's Fair controversy, considerably over a year ago); it is brutal because it has no sense of commercial honor and laughs to scorn the homely old trade saying "Live and let live;" and it is vulgar because it has not the slightest notion of the amenities and courtesies of life which obtain among gentlemen, even in business.

The *Electrical World* is simply one personality—an extremely active, audacious and energetic personality, to be sure, but nevertheless petty, mean, narrow and self-worshiping. It is a personality that is widely known and generally disliked, but that doesn't care so much if it is disliked, so long as it is constantly talked about. It is a personality that arouses instinctive aversion in generous natures and which is liked least by those who know it best. It is exactly the personality, in short, to coolly ask the electrical advertisers of a country with 65,000,000 of people and 3,600,000 square miles of territory to abandon and desert all the electrical journals but its own, for its own selfish gain. It is not an attractive personality, or a broad, generous, likable one.

### "TECHNICAL JOURNALISM."

In a rambling article entitled "The Yesterday and To-morrow of Technical Journalism" in its issue of January 5th the *World* shows its bushwhacking and prevaricating tendencies. It says, for instance, that "other periodicals in the same line" are "slipping and sliding back" while it advances "with rapid strides." This is untrue, so far at the WESTERN ELECTRICIAN is concerned. Taking the *World's* own figures, in a table published in the same issue and which we do not accept as correct, it is shown that, despite the hard times, the number of advertisements in the WESTERN ELECTRICIAN has increased six per cent. over the prosperous World's Fair year. The *World* figures a slight decrease in inches of advertising, if is true, but when taken in conjunction with the increased number of advertisers, no one could fairly claim, on the *World's* own showing, that the WESTERN ELECTRICIAN is "slipping back."

The *Electrical World* is not the "pioneer in its line," as it claims. The *Electrical Review* was the first general weekly electrical paper published in the United States, and is entitled to whatever distinction there is arising from that fact. The *Electrical World* is an offshoot of the old *Operator*, an obscure telegraphic publication with which the present proprietor of the *World*, an ex-telegraph operator—not an electrical engineer or a journalist—became connected while yet employed by the Western Union company. Losing his situation as a telegraph operator, Mr. Johnston gave his entire attention to newspaper publishing enterprises, but with indifferent success, as of the four papers which he has controlled three have been wrecked by the coolness of an unfeeling public and are now but memories. The *Operator* was simply a telegraphic paper for many years, and, if memory serves, it remarked when the *Review* was established that a general electrical journal was surely doomed to failure. We believe that the *Electrical World* has had a separate existence of about ten years. But Mr. Johnston's brilliant plans for a journalistic trust, by securing all the advertising in one branch of trade exclusively for one of his papers, have been put forward by him before. For instance:

He established *Industrial America*, which was to supplant journals of the class of the *Iron Age* and gather unto itself all the advertising in the metal-working line. The scheme failed utterly.

He started *Johnston's Journal*, which was to be a high-class literary periodical that should outdo *Harper's*, *Scribner's Monthly* and similar magazines and get all the advertising of this class. This, too, was an ignominious failure.

He managed the *Operator*, too, with the idea of gathering all the advertising in one net. Now the *Operator* is but a name in the Johnston private burying-ground of journalistic wrecks.

The same old dodge is now being worked by Mr. Johnston for the *Electrical World*. It will fail now as it has in the past. Business men are disgusted at the malice and obtrusive selfishness of the scheme. If precedent is any guide, Mr. Johnston has overshot the mark and is inviting ruin for his present enterprise.

### "A DELICATE SUBJECT."

Mr. Johnston has recently sent out a letter in which he asks an advertiser to discontinue his advertisement in the WESTERN ELECTRICIAN and advertise entirely in the *Electrical World*. This is a piece of despicable impertinence—Mr. Johnston admits that "it may be a delicate subject"—and we have already expressed our opinion upon it and the other methods of the ingenious Mr. Johnston. The subject is of equal interest to our contemporaries, and two of them have spoken out with no uncertain sound. Under the heading "Contemptible Business Methods" the *Electrical Review* has this to say in its issue of the 2d instant:

> An impertinent, many-paged letter, signed by W. J. Johnston, proprietor of the *Electrical World*, is being sent to advertisers in other journals in this field advising them to discontinue. A modest request is made that they concentrate all their advertising in the *Electrical World* and consult with the said Johnston as sole oracle of advertising.
>
> Such selfish ideas never disturb the *Electrical Review* or its patrons. They generally react on the one who sends them forth. Should these un-American methods—these destroy-your-neighbor schemes—gain any footing in this country, we hope to be here to chronicle the fact and name all the factors.
>
> When technical journalism is made the vehicle for the spreading of such contemptible and purely mercenary ideas, the *Electrical Review* will most assuredly expose and properly characterize them.

And this is supplemented by the following note in last week's issue of the *Review*:

> The *Electrical Review's* criticism of the greedy and impertinent methods of the publisher of the *Electrical World* seems to have knocked that publication into the "middle of next week." The padded issue which should have appeared last Wednesday did not show up until Monday of this week. Two issues of our dull contemporary in one week—we presume that this week's issue will be published; we never intended to kill it—is an infliction that cannot be lightly borne at the beginning of this bright New Year. And we should think subscriber and advertiser—the ones who pay—would protest.

*Electricity* goes into greater detail and exposes Mr. Johnston very effectually. The name of the journal left blank is that of the WESTERN ELECTRICIAN. The pleasant reference is appreciated. We quote at some length:

> Mr. W. J. Johnston has recently written a communication to advertisers in competing electrical journals, one of which has come into our hands, which we think deserves a wider publicity than was intended by its author. If there is anything more contemptible in the way of business methods than that displayed in this letter we do not know what it is. Such a letter is an insult to the honor and intelligence of those to whom it is sent, and we are glad to announce, on the best of authority, that several of those who have received it or similar communications from the same source have expressed their contempt and disgust by ordering their advertisements out of Mr. Johnston's paper at once.
>
> We believe and hope that many others will do likewise, for a man who would resort to such methods, and then brazenly attach his own signature to them is a journalistic Breckinridge and cannot be touched by shame. The only way in which such moral lepers, or those so sadly afflicted with business strabismus, can be reached is through the pocket-book. It seems strange that electrical journalism should have sunk so low as to count among its would-be exponents a man so apparently lost to manhood and honor as the signer of this document. The letter is partly as follows:
>
> "Dear Sir: You may like to know what advertisers think of the *World*. I inclose opinions recently received from well known manufacturers and others.
>
> "*I have no desire to dictate how you shall conduct your business*—[The advertiser will appreciate this.—ED.]—nor to ask you to accept my views unless doing so seems to your advantage
>
> "A specialist, however, who has devoted two decades to the study of a particular subject, may understand more about that particular thing than a busy manufacturer who has given little attention to the matter."
>
> We interrupt here to inquire—but how about it supposing that particular matter happens to be the manufacturer's own business?
>
> The letter goes on:
>
> "I think I know how electrical and street railway purchasers can be reached thoroughly and economically and without waste of effort.
>
> "It may be a delicate subject—[It seems that he appreciates this fact, and we agree with him that it *is* an *exceedingly delicate* subject.—ED.]—but in addition to your one-fourth page announcement in the *World* you also have a ten-inch advertisement in the ———. [Here is mentioned the name of one of the best known electrical journals in the country. We presume that this name is changed whenever the circumstances require, so that we might fill in any name we chose and still be right.—ED.]
>
> "How many do you imagine read the ——— and not the *World*?
>
> "Why should one pay over and over again to reach through other journals a few of the same readers he has already thoroughly covered?"

This is certainly philanthropic on the face of it, but does anyone suppose that Johnston is saying this in order to save the advertiser money? If he does he is very much mistaken; he does not want the advertiser to spend less money, but asks him to take his advertisement out of the journal referred to and give it all to him. He continues:

> "Is it not better to do as so many others do—*invest the additional amount in more space* in paper number one; particularly as, circulation considered, the others charge him five times the rate he pays number one."

This language shows that Mr. Johnston is out of place on Broadway—it is the language and the method of Baxter street and the clothing precincts of the Bowery. But even the "puller-in" of those classic localities exercites some judgment in approaching his victim. It is clear, therefore, in what estimation Mr. Johnston holds those whom he thus addresses. It may be all right from his standpoint, but how do the recipients of his letters regard it?

> "Remember Puddinhead Wilson's remark: 'Behold the fool saith put not all thine eggs in the one basket'—which is but a manner of saying, scatter your money and your attention—'but the wise man says, put all your eggs in one basket and WATCH THAT BASKET.'
>
> "You have for years pursued the scattering method of advertising.
>
> "If you will give the one basket and watch-that-basket method a fair trial during 1895, you will change your views radically on advertising."

It appears from this that W. J. Johnston and Puddinhead Wilson are one in philosophy, but does Mr. Johnston think his patrons are all Puddinhead Wilsons? Evidently he does. The question is, How will his patrons regard this estimate?

The whole thing looks very much as though Mr. Johnston is reduced to very great business straits if he finds himself compelled in order to keep going to run around among the electrical public begging them not to patronize his competitors but to give all their patronage to him. Can a self-respecting advertiser patronize a man who would stoop to such methods? Can he by his patronage assist this blot upon the otherwise fair name of electrical journalism to live? Will he, by continuing his patronage, feed the cancer that is gnawing at the vitals of business honor?

We fancy that those who follow Puddinhead Johnston's advice and put all their eggs in *his* basket will also follow that other philosopher's advice and "watch that basket" mighty closely.

## Electric Freight Service at Night.

An interesting contest is now going on in Des Moines, Iowa, between two prominent citizens. J. S. Polk, one of the men, owns the street railway system, covering the entire city of fifty-four square miles, and also a great deal of real estate, and a steam-heating plant. F. M. Hubbell is the other one, and he owns most of the waterworks, the system also having a very profitable monopoly. He is also president of the Des Moines Union and the Des Moines, Northern & Western railways, and of the Equitable Life Insurance company. Some time ago he tried to get permission from the city council to lay a track across some of the principal streets and along the river, through the city, to his coal mines in the northern part of the city. But the council would not let him do it. Now Mr. Polk comes in with his application for a franchise to permit him to carry parcels and freight on his electric railway system. The intention is to run night freight trains, principally to the coal mines and brick yards and to some of the neighboring towns. Mr. Hubbell is seen opposing it. His attorney, Carroll Wright, appears before the council to argue the question with Mr. Polk, who appears for himself, and they are having a hot fight. While Hubbell is keeping out of sight himself, it is pretty generally understood that his and other railway interests are opposed to the granting of the franchise. The teamsters, of course, are delighted to find such a powerful ally in their fight to protect their bread-and-butter.

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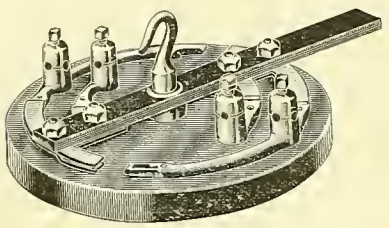
The citizens of Sabetha, Kas., are agitating the question of erecting an electric lighting plant and water works to cost $15,000. The city clerk will gladly receive and answer communications.

## Broman & Stillwell Arc Hanger Board.

A symmetrical and accurate arc hanger board has been patented by J. G. Broman, chief engineer, and Harry O. Stillwell, electrician, at "The Fair," Chicago. The idea of the inventors seems to have been to get the best, simplest and most complete absolute arc switch that has ever been manufactured, the cost being within the reach of all. This switch answers every requirement of the Chicago Board of Underwriters, also of the City Electrical Inspection Department, and was approved by them on October 30, 1894.

As shown by the cut, this is a hanger board for series arc lamps, and it switches the lamp in and out of circuit completely, leaving it and its connections free from current.



BROMAN & STILLWELL ARC HANGER BOARD.

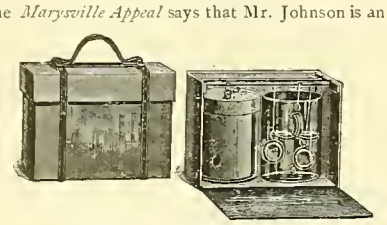
The base is eight inches in diameter, of the best and toughest slate, free from metal veins, and baked in a specially prepared insulating compound, which leaves the slate absolutely water-proof. The castings are of brass, containing a large percentage of pure copper, therefore reducing the resistance until it is practically zero. The hook in the center of the hanger board is of brass, thoroughly insulated from all parts through which current passes, and is placed there for a lamp support, doing away with all circuit breaking devices for hanging lamps upon, and thus relieving the line wires of all the weight of the lamp. The binding posts are drilled from two sides, so that the line wire can enter from any direction. The two inside binding posts for the lamp-terminals are set a little to each side of the center, so as to bring the lamp wires directly in line with the binding posts of the line wires; the lineman is given a chance to draw the line wires very tight, thereby making a smooth job of construction. By removing the set screws, lamps may be suspended from threaded rods.

The connecting combs are of spring brass, shaped perfectly to their slides, so that no dust can accumulate, and therefore a perfect connection is formed with the slides, which are milled. It will be noted that two pathways are provided for the current when the lamp is cut out; the additional spurs divide the voltage and increase the carrying capacity, doing away with all possible chance of heating. Every part of this hanger board is made to gauge, and all parts can be duplicated from stock on short notice. At a test made by the Chicago Board of Underwriters it was found that with as many as five arc lamps connected to the lamp terminals (in series) the switching device showed no sparking when the lamp loop was cut in or out.

## Irrepressible Electricians of the Pacific Coast.

The undaunted electrical inventors of the inland towns of the Pacific Slope are as versatile and chipper as ever. It is to this quarter that the electrical fraternity looks for the very latest novelties, and it is never disappointed. The *Pacific Electrician* gives the late news as follows:

The *Marysville Appeal* says that Mr. Johnson is an electrician, and is ready to repair typewriters and bicycles, and to file saws.



BOSWELL PLATING OUTFIT.

Truly, the field of the electrician is a wide one.

The *Colusa Herald* states that one W. W. Felts, a local inventor, has invented a primary battery that will actually work.

"A small battery of forty cells, each about four and a half by five inches in diameter, will run two 10 candle power ampeare (?) lamps in parallel, above normal incandescence, six 10 candle power lamps, two ampeares, and with half the battery eight 4 candle power lamps of half *amperne* each."

He can also create a dazzling display of arc lighting. The *Herald* is confident that this is a great achievement, and will reduce the cost of lighting by electricity.

The inventor intends to move to Oakland, and gain fame and fortune. It is a little early yet for the new spring crop of primary battery inventors, but we welcome Mr. Felts, and trust that he comes with money in his pants.

## Old Application of a Modern Method of Resuscitation.

This case came under the observation of a writer in the *Quincy Daily Herald* on the 11th of June, 1869. It was near Stanwood, Cedar county, Ia., on a clear and extremely warm day. Theodore Clothier, a carpenter, 29 years of age, was riding along the road bestriding a saddleless horse. In all the sky there was only one cloud visible, and it a comparatively small one. Two men in a light wagon had just passed Clothier when a tremendous thunderclap was heard. Looking back they saw horse and rider prone on the ground. The lightning struck Clothier in the right breast, passed down his body, through the horse, and into the ground. The horse and rider were instantly "killed." The rider tumbled over backward and was apparently as thoroughly killed as ever a lightning-killed man was when the two men reached him. They found his clothing on fire and extinguished it. The vest was found to have been charred from the armhole to the lapel on the right side. The hair was burned from his forehead, and his eyebrows and eyelashes were burned off. From near the shoulder to below the ribs was black, scarred flesh that rubbed off on being touched; below was a wound as large in dimensions as a man's hand, andos deep that when the incinerated cuticle was removed the internal organs were exposed. From this point the lightning shot to a rule carried in a pocket made for it in the trousers' hip. The rule had brass tips that were melted by the heat and were found in the form of a ball in the pocket. His keys and the ring to which they were attached and the nail set he carried in the pocket were likewise melted into a solid mass, as were the blades of his knife.

While the two men were discussing what was best to be done, a local character living in the farmhouse near which Clothier was killed, a veteran of the war, generally regarded as a harmless, well-meaning crank, approached and declared the intention of bringing the man back to life. The group which had gathered was not inclined to consider the crank's proposition seriously, and decided to remove Clothier's remains to his house, and aid in preparing them for burial. But the fellow was a determined character, and exhibited such capacity for having his own way that the crowd surrendered and let him have it. He rolled the body over on its left side, and as he did so the burned flesh from the right side fell off. The people who had congregated begged him to desist, but he didn't.

"If he's dead I guess it won't hurt him," was his reply, and he continued to rub the body vigorously where it had not been burned. He never let up, and in three or four hours the man showed signs of life. Water was sent for and his face was bathed. He was removed to a house near by and turned over to three doctors who had been summoned.

When restored to full consciousness he was in such excruciating pain that he had to be placed under the influence of opiates. This course was continued for nearly four days. He suffered greatly even after that, but his burns healed and he recovered his health.

He is now 55 years old and is proprietor of a boarding house at Olin, Ia. In two senses he still suffers from the effects of his experience when he was "killed" by lightning. Before the approach of an electric storm, sometimes as long as four days, he suddenly becomes drowsy, and all efforts to awaken him are futile until after the storm has passed and the electrically-charged air has given way to a clearer atmosphere. His eyesight has never been strong since, and he is obliged to wear a cap that comes well down over his forehead and is provided with a peak.

The flash that struck him killed the horse after it had passed down his body, leaving scars—dark, red, angry scars—as plain to-day as they were 25 years ago.

The course pursued in restoring him to life was very similar to that pursued with artificial respiration as a basis. Had this not been resorted to, there is no manner of doubt that Mr. Clothier's body would have been lying in its grave for a quarter of a century. He would not have returned to consciousness.

## Boswell Plating Outfit.

Of the many ways there are of earning a living, perhaps there is none that is more pleasant than gold, silver and nickel plating, which is also quite profitable. The cost of an outfit, which was once very high, is now within the means of persons with small capital. The simplicity of the Boswell plater is such that anyone can do plating at home as well as the large plating establishments in the cities. The demand for a compact and convenient plating outfit, with which fine plating of all descriptions can be done at small cost by anyone, without experience, has grown to be an actual necessity. The Boswell plater supplies this demand. It plates the finest jewelry, either new or old, the maker claims, as good as can be done by manufacturers who spend bundreds of dollars to prepare for this work. The plating, too, can be made of any desired thickness.

These plating outfits are put up in a neat traveling case with connections permanently made and ready to work when received. All to be done to plate is to open the case, put the articles to be plated in the plating solution, and see the work being done in a few minutes; a boy or girl can do plating as well as an adult, as inside each plater will be found printed instructions for everything one wishes to know, including pieces of material; also recipes for charging battery.

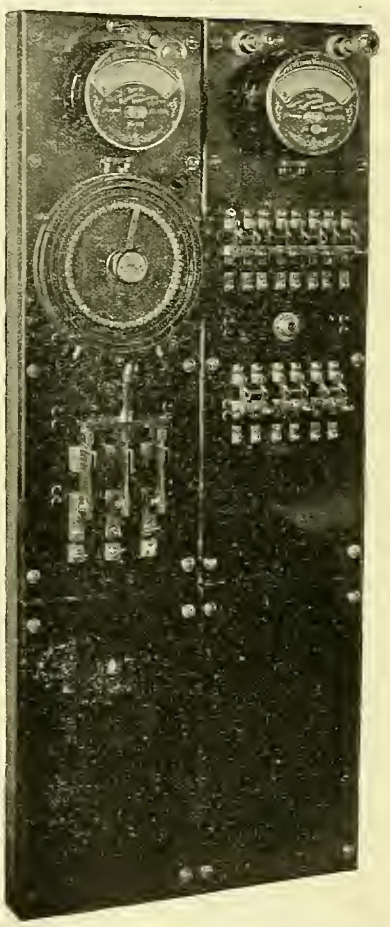
This outfit, illustrated in the accompanying cut, is handled by D. E. Boswell & Co., 154 Lake street, Chicago.

The Thirty-first street cross-town line of the Chicago City Railway company is now operated by means of electrical power

## New Panel Switchboard.

The General Electric company has standardized a form of switchboard of panel type similar to those used in railway work. The panels are of two kinds, one for the generator and one for the feeders. They are of black enameled slate in two finishes mounted on a steel frame. Flanges on the frames permit of the panels being connected side by side to form one uniform whole. The generator panels are built in eleven capacities, running from 3 to 100 kilowatts at 125 volts or from 24 to 300 amperes maximum, and are 4 feet high and 16 inches wide. Each generator panel carries one triple-pole single-throw switch with fuses, one Carpenter enamel field rheostat, one round dial ammeter and a pilot lamp, all being electrically connected behind the panel. The common bus-bars on all the panels being the same distance apart, connection of the bus-bars by a copper tie-bar connects the panels together electrically. Except in the method of connection the three and two-wire panels do not differ.

The feeder panels are made in two sizes, 48 inches high by 16 inches wide for the two-wire and 48 inches high and 25 inches wide for the three wire system. The two-wire panel carries double-pole feeder switches with fuses, one round dial voltmeter reading to 125 volts, one two-wire push button ground detector. The three-wire panel carries triple-pole single-throw switches with safety catches, two voltmeters



NEW PANEL SWITCHBOARD.

and one ground detector. All the connections are complete and immediate installation is effected by soldering in the feeder ends and generators leads and connecting the two bars together with tie-bars.

These switchboards are made for support either by brackets upon a hollow pedestal, or the framework may be continued down to the floor and the open space filled by blank panels, as shown in the illustration.

The simplicity of construction and ease of installation of these panels, together with the advantage of increasing the capacity without impairing the uniform appearance of the switchboard, have already commanded a wide appreciation among electricians.

The Electric Railway company of Savannah, Ga., has passed into the hands of John R. Young, as receiver, under appointment by the United States Court on the petition of H. A. Pevear of Lynn, Mass. The petition charges that over $1,000,000 worth of stock has been issued by those controlling the combined companies and parceled out without any fair valuation being received in return. The Electric Railway company absorbed two years ago the Savannah Street Railroad company, which owned property worth $200,000. It is said that but $5,000 cash was paid. The value of property in the receiver's hands is placed at a half million of dollars.

## Some Rejected Abstracts.[1]

It is difficult to account for the following "Abstracts," but we print them as they seem suitable for Christmas week, a season ignored by most technical journals. It is possible that a competition has been held by the Council of the Physical Society for a standard pattern of abstract of the new journal. Having come to us by post, possibly by mistake, instead of to Messrs. T*yl*r and Fr*nc*s, we cannot do better than use them for our Christmas number.

1. *The Suppression of Sense in Demented Units.* Prof. K*ck*r.—A herring and a half costing 1.5 pence, the herring-per-penny is obtained. It is not a number, but a thing got by dividing a fish by a disc of impure copper. Its physical nature is investigated, and how the bones got there, and it is hoped an improved herring, with no bones, may be evolved which will be edible. Another investigation in collaboration with Prof. R**n*ld shows how thin an empty argument may be without bursting when gently blown upon.

2. *Interference with Alternate Currents.* Prof. A*rt*n and Dr. S*mpn*r.—Transformers are coupled up in a tangle not contemplated by their makers, and queer measurements with queerer instruments of the authors' design are made. The 15 wattmeter method gives the largest number of divergent results to choose from. The authors have also tried the effect of dressing with their legs through the sleeves of their coats, and their waistcoats buttoned down behind, getting results not easily foreseen by the makers. No justification for the author's interference with alternate currents is given.

3. *The Masslessness of Matter.* Prof. F*tzg*r*ld.—If a massless body is immersed in a frictionless massful medium any movement will necessitate momentum of the massful medium, and an observer, suitably devoid of sense, will be unable to tell whether the inertia belongs to the matter or the medium. If the matter is porus, the smaller the pores and canals the greater the kinetic energy of the massful ether going through, so that the more massless matter and the less ether there is in a given space the greater the volume energy, which, it will be noted, is transferred in the wrong direction—a great merit. By choosing suitable postulates and employing the right mathematical reasoning it can be shown that the effect is the same as if the matter had mass. When a working hypothesis shows the least intention of working it is the truth. Matter has no mass. Ether, with which we are so much more familiar, has.

4. *The Theory of Dynamos.* Prof. P*rry.—In order to have a mathematical theory of dynamos data must be assumed; it does not matter what data as long as they are amenable to mathematical treatment. It is therefore assumed that the output varies as the reciprocal of the speed, and the efficiency periodically with the time, so that it can be expanded in a Fourier's series. A maximum is then calculated which gives the worst dynamo possible. As the results are calculated mathematically, they are rigidly true of real dynamos.

5. *A New Proposal for Uniformity and Simplicity of Nomenclature Regarding the Poles of Electro and Permanent Magnets by a Comparatively Obvious and Easily Learned Mnemonic Rule.* Prof. S. P. Th*mps*n.—(This paper is short and given in full.) Call north N and south S and there you are.

6. *Head Splitting Dynamometers.* T. H. Bl*k*sl*y.—Has previously shown that if $n$ central stations, giving different pressures and various frequencies, some being direct current, are put in parallel through $n-1$ split dynamometers, the powers developed by each can be measured. Has tried to get engineers to try the experiment, but they do not understand alternating currents, and all refused except Messrs. Brock and Pain.

7. *The Use of Gravity.* Prof. V. B*ys.—$g$ [what is $g$? Abstractor] can be measured by letting a useless body fall a known distance and pulling it up suddenly by a quartz fiber and noting its elongation. Proposes, in the interests of science, to carry out the experiment on his own body with a drop of as nearly 9 feet as can be obtained in centimeters. A series of instantaneous photographs will be taken and a radiomicrometer of small sensitiveness will be used afterward.

8. *Some South Kensington Weather.* S. B*dw*ll.—Took a chunk of mental fog produced by the discussion on the foundations of dynamics, and tried to dissipate it by electricity. It got tougher.

9. *The Storage of Energy.* Prof. *. L*dg*.—Has taken to heart the homely American warning against monkeying with a buzz saw. Has obtained the equation to a new metal from Dublin, which is as good as getting the metal itself. It is a perfect conductor of electricity and of magnetism, infinitely elastic and a non-conductor of heat. It is thus impervious to energy. Difficulties arose in working it, as it could not be melted, as its temperature is unalterable and cannot even be determined and no tool will touch it. Bottles and force pumps were made by electrolysis, and energy can be stored. The stoppers are apt to leak and work oozes out like fumes from an iodine bottle. Energy, being a compressible fluid, has been got in liquid form. The interior, being painted with an ether-tight varnish, ether can be pumped in, too, and on shaking an emulsion is formed. On stirring a little matter, the mess conducts electrolytically. It is beneath the dignity of a man of science to make money out of his knowledge unless he knows how; but it is hoped Keeley will come forward.

10. *A Short Way With Standard Ohms.* By Tom, Dick and Harry [first, second and third years sample "Finsbury" student.]—A Cambridge ohm is coupled to a voltmeter, after the latter has been thoroughly stripped and carefully twisted. The ohm is then made to fit the voltmeter. A first approximation is got by roughly filing the ohm, accurate adjustment being subsequently attained by a liberal use of the finest calibrated sandpaper [$10.19 \times 10^9$ grains to the square centimeter]; the determination, within 13 per cent., can be made in 7.349 minutes. The students merely press the button and the professor does the rest.

11. *The Specific Gravity of Monoxide of Hydrogen.* By J*ck Sm*th, T*m Br*wn and J*m R*b*ns*n [first, second and third year sample "Central" students.]—To eliminate errors due to a containing vessel the substance was used in the solid state. The weight was determined from Messrs. A. and S. Gatti's invoice, by dividing the price (less discount for cash) by the price per cwt. A check weighing was made in the laboratory, the block being slung by chains on the testing machine, temperature being kept constant by wrapping it in demagnetized asbestos saturated with ether. The determinations of mass agreed within the necessary limits of error. The volume was measured by melting it down, and observing the velocity of approach of the stream to a V notch, by means of a new form of ohmmeter. The result, which was communicated verbally to the society in the authors' reply to the discussion, was not caught by the reporter.

12. *The Mechanism of Electrolysis.* Dr. B*rt*n.—Discusses the convection of charges of electricity in a universe composed, like ours, of frogs' eggs moving on one another without friction. Too deep to be abstracted.

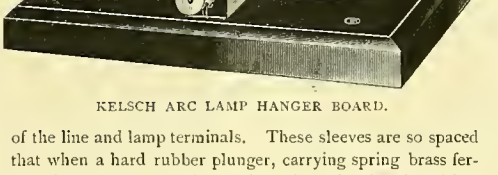
13. *The Efficiency of Transformers.* Prof. J. Sw*nb*rn*.—Has invented a transformer which takes such a large primary current at no load that the addition of the secondary load makes no appreciable difference. It is thus impossible to notice the load, and this is as good as having an efficiency well over 100 per cent. Has also invented a wattmeter which measures twice the loss in other makers' transformers, but ignores that in his own. States that he alone understands real alternating currents.

[1] From the London *Electrician*.

## Kelsch Arc Lamp Hanger Board.

The hanger board for arc lamps illustrated by the accompanying cut was devised by R. S. Kelsch of the Chicago Edison company for the purpose of providing an absolutely fire-proof board with a switch that should allow the lamps to be completely cut off from the circuit, and not merely shunted. This hanger board has been approved by the Board of Underwriters and by the Electrical Inspection Department of the city of Chicago.

The board consists of a rectangular plate of marbleized slate with four binding posts, two for the line and two for the lamp terminals. The two outside posts are the prescribed eight inches apart, and are for the mains, the lamp being suspended from the two inside posts. In the center of the board is a series of four brass sleeves, which are part



KELSCH ARC LAMP HANGER BOARD.

of the line and lamp terminals. These sleeves are so spaced that when a hard rubber plunger, carrying spring brass ferrules is pushed to one side or the other, the ferrules either complete the circuit from the mains to the lamp or entirely separate the main and lamp circuits, without, however, opening either. All the metal parts have ample carrying capacity, so as to stand 50 amperes without heating, and the brass contact ferrules being split and made of spring brass insure absolute contact at all times. At a test made by the Board of Underwriters it was found that with as many as five arc lamps connected to the lamp terminals (in series) the switching device showed no sparking when the lamp loop was cut in or out. The binding posts are drilled from two sides so that the line wires may enter from either direction. Instead of the lamp being suspended by wires from the lamp posts, the binding screws may be removed and a brass suspension rod, properly threaded, screwed into the post. The board is patented and is handled by the Chicago Edison company, which has bought the entire rights to the invention, and is prepared to fill orders promptly. Charles Holmes, the purchasing agent of the company, has this specialty in charge.

## Train Lighting by Car-axle Connection.

Permission has been granted the American Railway Electric Light company by the Pennsylvania Railroad company to run a car equipped for electric lighting over its system from Jersey City to Washington. The trip will probably be made in a few days, and will be run with a view to determine the success of this method of lighting railroad trains by electricity. The system provides a plain gear wheel attached to the car axle, connecting by intermediate gearing with the shaft of a small dynamo, which is securely placed on the car truck. Each car is independently provided with its generating and illuminating apparatus, so that cars can be detached from through trains when necessary. Even when not in motion the supplementary storage batteries, it is claimed, are capable of supplying sufficient current to operate the lamps from four to six hours. One of the strongest claims for the new method of lighting is that in case of a collision or wreck, there is no danger of the coaches catching fire from the lamps. The car to be used on the trip was built by the American Railway Electric Light company and, it is said, has already made several successful trial trips.

## Electric and Steam Railways in Connecticut.

In the course of a rambling article the *New York Herald* gives some interesting facts about the competition of steam and electric railways in Connecticut. Following is an abstract:

All Connecticut went trolley-mad something more than a year ago. A few of the larger cities had adopted the trolley some time before that, and these experiments had results that astonished. It was found that the profits of this business, owing to the immediate popularity of the trolley car and its inexpensiveness of introduction and operation, were altogether surprising. It was quite astonishing how conservative Connecticut straightway grabbed for this new means of locomotion.

For many years it has been notorious that the state was owned by the Consolidated road. No steam rival of any sort could so much as lay a tie within its boundaries without the consent of the magnates of the Consolidated. And, of course, these magnates never gave consent, but clung to the monopoly with deathlike grip.

But if the monopoly could not be met with other steam roads it was now seen that it could with trolley roads. There was a great outcry for the trolley. Every town of any size whatever determined to have its electric rapid transit, and villages demanded to be connected with one another and with nearby towns and cities.

Here is a list of the electric roads chartered by the last Legislature:

Bristol & Plainfield Tramway company, four miles; Bridgeport Traction company, to operate existing lines in that city; Dixville Avenue Electric Railroad company, from New Haven to Hamden; Derby & New Haven Electric Railway company, from Derby to New Haven, eight miles; East Haven & Morris Cove Railroad company from New Haven to East Haven; Enfield & Somers Tramway company, between points named, about ten miles; Enfield & Long Meadow Electric Railroad company, from Enfield to Long Meadow, Mass., about six miles; Greenwich Tramway company, various lines in that town; Groton Bank Street Railway company; Hartford, Manchester & Rockville Tramway company, from East Hartford to Rockville, twelve miles; Hartford & Middletown Electric Railroad company, from Wethersfield to Cromwell, eight miles; Hartford Suburban Railroad company, authorized to consolidate various roads in Hartford and vicinity; Lake Saltonstall Railroad company, from New Haven to Lake Saltonstall, about three miles; Lisbon, Griswold & Voluntown Street Railway company, to connect the places named, about fifteen miles; Manufacturers' Street Railway company, to build in various streets in New Haven; Moodus, Marlborough & Glastonbury Electric Railroad company, to build between places named, about twenty miles; Mystic Street Railroad company, from Old Mystic to Groton, about five miles; New Haven & Centerville Street Railway company, from New Haven to Centerville and Hamden; New Haven Street Railway company, to build in various streets in New Haven; New Haven & North Haven Street Railway company, between points named, about five miles; New Milford & Lake Waramaug, between New Milford and the pleasure resort, about ten miles; Mevington Tramway company, to build in that town; People's Tramway company from Killingly to Brooklyn, three miles; Portland Street Railway company, from Portland to South Glastonbury, three miles; Port Chester & Glenville Tramway company, from Port Chester to Greenwich; Putnam & Thompson Street Railway company, between points named, about five miles; Quinebaug Valley Traction company from Jewett City to Moosup Central Village and Wauregen, ten miles; Rockville & Ellington Street Railway company, between points named, about three miles; Rockville, Stafford & South Bridge Tramway company, from Rockville, Conn., to Southbridge, Mass., about ten miles; Shelton Street Railway company, from Shelton to Derby and Bridgeport, about ten miles; Stonington Borough Street Railway company, from Stonington to Mystic, four miles; West Side Street Railway company, from Stonington to Paweatuck village, about four miles; Willimantic Street Railway company, from Willimantic to Sprague, ten miles; Windsor & Suffield Tramway company, from Windsor to Suffield, about eight miles; Winsted Street Railway company, to build local road; Woodbury & Southbury Electric Railway company, to build between points named, about six miles.

The last Legislature also authorized many existing roads to extend their lines. The principal extensions authorized were:

Hartford Street Railway company, to Windsor and South Windsor, four miles each; Hartford & West Hartford Horse Railway company, to extend to Farmington and Collinsville, ten miles; Middletown Horse Railway company, to Cromwell, Meriden and Portland, aggregating thirteen miles; Meriden Horse Railway company, to Wallingford, four miles; New Britain Tramway company, to Plainville, Southington and Newington, about sixteen miles; New London Horse Railway company, to East Lyme and Waterford, about seven miles; Norwalk Horse Railway company, to Stamford, Darien, Westport and New Canaan, about fifteen miles; Stamford Street Railway company, to Darien and Norwalk, about eight miles.

The various New Haven, Bridgeport and Waterbury roads were also allowed to extend tracks within those cities. All street railroads may now use electricity, under various restrictions, in the general law of the state.

It was another case of David and Goliath. The Consolidated road in these early days had paid no attention to the diminutive antagonist who so suddenly appeared on the scene. It did not regard the trolley as a rival. In its indifference it permitted the electric motor to make its way into every corner of the state and to win the warm and lasting regard of the people.

Thus it came about that last year the Connecticut Legislature was asked to grant a phenomenal number of trolley franchises. Now the allegation is made that the Consolidated road owns the Legislature and has done so for years. The road managers certainly knew all about these franchises before they were granted, for there is a state law—and a

very convenient law, too, for the monopolist—that compels every company wishing to build a railroad of any description within the state to declare its exact intentions at least fifteen days before the session begins. In this way the Consolidated road is always warned well in advance of the plans of intending rivals, and the fact that it permitted all the trolley legislation of last year to go through unchecked shows that it did not at that time appreciate the powers of its then diminutive foe.

Goliath is awake now, but it is too late. David has arrived at sturdy manhood and is beginning to gather his pebbles in the brook, preparatory to the conflict.

In other words, the trolley companies, having effected an organization among themselves, have decided that they are strong enough to go to Hartford this winter and fight the Consolidated in its own home. They have openly announced that they intend to do some lobbying on their own account, and that the Consolidated Goliath is not half big enough to scare them.

The tendency is at once apparent. Before the year is out the Consolidated road will be paralleled from north of Hartford to west of Stamford, a distance of more than forty miles, by a powerful and popular electric rival. There remains but little to connect this line with New York lines on the south and Massachusetts lines on the north.

In fact, some of those who are pushing the trolley in Connecticut look forward to seeing through trolley transportation between Harlem Bridge and Springfield, Mass., before the dawn of 1897. Nor is this all. Within three years from now these energetic schemers expect to see the great monopolistic steam lines between New York and Boston paralleled by electric lines for every mile of the way.

What its developments may be at the next decade no one can possibly predict. Even the most enthusiastic supporters of the trolley do not say openly at this time that they hope to run through cars from Hartford to New York or even to Stamford when the continuous line is completed and ready. There is no knowing what may come, of course, and even this proposition may not sound ridiculous half a dozen years from now.

While still affecting to dispise the trolley, the Consolidated road is fully alive to the situation. Persons situated so as to know are confident that the local traffic of the road—that is, the travel between points separated no more than six or seven miles—has fallen off almost altogether in the last year, as between stations connected by trolley. Now, when every town and village for seventy-five miles of the most thickly populated country that the road taps is similarly paralleled by trolleys, as is promised this year, the steam road's short local traffic seems to be critically located.

Hence we may expect to see rather lively times in the Connecticut Legislature this session, for the Consolidated will scarcely be disposed to allow the necessary connections to be made without some effort to frustrate the trolley men's designs.

Anyway, there is an indication of a similar extension of the trolley along the Shore line in the direction of Providence, R. I. In the eastern counties a syndicate, of which ex-Governor Thomas M. Waller of New London, Solomon Lucas of Norwich and E. P. Shaw of Newburyport, Mass., are members, has secured franchises for connecting Norwich and New London by a trolley along the east bank of the Thames, and eventually reaching Westerly, R. I. The same syndicate has asked for permission to connect Lisbon, Griswold and Voluntown, and to run a line from Willimantic southward, connecting Sprague, Franklin and Baltic.

So it is all over the state; but the war of the winter will be over the central line of trolley tracks from Hartford south and west.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, January 12.—At this writing it looks very much as though an amicable settlement of the difficulty between the companies and the men on the Brooklyn trolley-car lines were out of the question. The men seem anxious to strike, as it is reported that the employers refuse to make any concessions. Doubtless by the time that these lines reach the eyes of the readers of the WESTERN ELECTRICIAN the daily papers will have published full accounts of the final decision of the men, who demand $2.25 a day for motormen and conductors, an advance of 25 cents, and ask the companies to comply with the state ten-hour law, requesting that all disputes between companies and employes should be left to arbitration if amicable settlements can not be obtained by conference.

The trolley system of Brooklyn is under investigation by the state railroad commissioners, who have held one session in the city hall. It is claimed that the cars are run at dangerously high speed and are recklessly handled. The testimony so far shows, for one thing, that a satisfactory car fender has not been invented. The most interesting fact brought out was that about 75 per cent. of all the accidents on the electric roads in Brooklyn happened to children. In some parts of the city it was said that children would often stand directly in front of a car and compel the motormen to stop to avoid an accident. Immediately after the adjournment of the state commissioners the local committee met in the mayor's office. The state commissioners attended this meeting. It was decided that the committee and the commissioners should carry on their investigations independently, and at the end compare notes and agree upon such recommendations as were deemed necessary. When both have finished their work the people of Brooklyn will be invited to a public meeting to hear what has been accomplished. Before the mayor's committee adjourned Secretary De Freest of the commission read a statement, giving the total mileage, the total number of passengers carried and the total number of persons killed, passengers and others, on the surface roads in the state. Summarized, it is as follows: Roads in Albany, Rochester, Buffalo, Syracuse, Utica, Elmira and Binghamton—Total mileage, 234.20; total number of passengers, 80,850,686; total number killed, 25. On all the Brooklyn lines—Total mileage, 162.94; total number of passengers, 141,822,300; total number killed, 45. On all the cable and electric lines in New York—Total mileage, 72.75; total number of passengers, 152,309,254; total number killed, 8. Ditmas Jewell has taken the place of John H. Schumann on the local committee.

In his annual message Mayor Schieren had this to say of the trolley question: "The question of speed of the trolley cars and a proper fender has received considerable attention and is being carefully investigated. It is hoped to present to your honorable body recommendations prescribing proper rules and regulations governing the entire question. It is also hoped that a device will be secured to automatically shut off the electric current when the cars exceed a certain proper speed—for instance, ten miles per hour. The trolley companies are desirous apparently of conforming to proper regulations and have requested the police department to assist them in detecting unlawful fast running. There can by no question but what the enhanced speed is resulting to the city's good in that it is a more rapid transit than the old horse cars, and as such is bringing the outlying districts nearer to the city. However, with it is the corresponding danger to life and limb, and it is absolutely necessary that some positive and decisive action be taken to regulate the speed of trolleys." W. F. O.

### Northwestern Notations.

MINNEAPOLIS, January 11.—The annual meeting of the People's Power company was held in Rock Island, Ill., recently, and it was decided to reduce the rate on both electric lights and gas about 10 per cent., taking effect February 1st for gas and January 1st for electricity. The company supplies Moline and Rock Island and is in a flourishing condition. The old officers were reëlected.

A former employe of the Standard Telephone & Electric company of St. Paul has been passing forged checks, by representing himself to be connected with the company. The police are hunting for him. A telephone exchange has been put in operation at Spring Valley, Minn. The Chippewa Falls, Wis., Telephone company is re-wiring all buildings, stringing new wires and making other improvements at a cost of $800.

George H. Campbell, general manager of the Winnipeg Electric Street Railway company of Winnipeg, Man., has been inspecting the plant of the Minneapolis Street Railway company.

Centerville, S. D., is pushing work on its electric light plant and the machinery is now arriving. A telephone system will be put in shortly.

It is proposed to have a telephone line connecting Montgomery, Minn., with Le Sueur Center. It is estimated that it would cost $500 to equip the line. Already $450 worth of stock has been subscribed. It is probable that a meeting will be called after New Years to take active steps in the matter.

It is reported that the company seeking a telephone franchise in St. Paul is the United Electric company of Minneapolis. The ordinance offered is quite liberal, giving the city service at a nominal price and subscribers service at a rate considerably lower than the present company. M.

## PERSONAL.

Chas. E. Bibber, vice-president of the Cutter Electric Manufacturing company, is in Chicago in the interests of his company, and he is taking advantage of the occasion to look up his many friends here.

F. P. Little of Buffalo, well known to the electrical fraternity for his practical work in developing the electrical business in the western portion of New York state, is dead. Mr. Little was thoroughly conversant with all the details of the electric lighting industry, and was one of the most prominent electrical men in his section.

J. H. Gibson has accepted the position of superintendent of motive power of the Baltimore City Passenger Railway company of Baltimore, Md. Mr. Gibson will be remembered by the electrical fraternity through his long connection with the Edison and Short Electric companies, which foreshadows a successful future in his new line of work.

The memory of Frederick E. Degenhardt has been honored by the Standard Underground Cable company by a little memorial sheet which shows the real feeling of regard in which Mr. Degenhardt was held by his business associates. With the ring of true esteem, the company says: "He enjoyed, as indeed he merited, the unbounded confidence of his official associates, the relations between them having always been the most cordial that a high mutual regard and close personal friendship could produce." The memorial is executed in excellent taste and will, upon application be sent to all of Mr. Degenhardt's friends who have not received a copy.

## NEW INCORPORATIONS.

Watseka Automatic Telephone company, Chicago, Ill.; capital stock, $10,000; W. H. Harry, Chicago, Ill.

Fulton Electric Light & Power company, Fulton, Ill.; capital stock, $20,000; C. C. McMahon, Fulton, Ill.

California Electric Light & Power company, California, Mo.; capital stock, $6,000; W. H. Mengel, California, Mo.

Electric Purifier company, Chicago, Ill.; capital stock, $300,000; to operate purifiers; George H. Reynolds, Chicago, Ill.

Grand Island Light & Power company, Grand Island, Neb.; capital stock, $50,000; W. H. Thompson, Grand Island, Neb.

Kings County Electric Light & Power company, Jersey City, N. J.; capital stock, $1,000,000; Edwin C. Low, Brooklyn, N. Y.

Cushman United Telephone company, Chicago, Ill.; capital stock, $20,000,000; to manufacture telephone appliances and to construct and operate telephone and telegraph exchanges; I. M. Cushman, Chicago.

Tillamook Electric Railway, Power & Light company, Tillamook, Ore.; capital stock, $500,000; to operate an electric railway from a point on the line of the Oregon Central railroad in Yamhill county at or near North Yamhill station, westerly, following the course of the North Yamhill river, the Nestucca and the Tillamook rivers to a point on the shore of Netarts bay in Tillamook county at or near the residence of William O'Hara; W. H. Cary, Tillamook, Ore.

## ELECTRIC LIGHTING.

The new electric light plant at Marblehead, Mass., is about completed.

Webb City, Mo., will probably erect an electric light plant having a capacity of 100 arcs and 2,000 incandescents.

The Aurora, Ill., Gas & Electric Light company contemplates extensive improvements in its plant in the spring, involving the expenditure of about $50,000.

The new electric light plant built by the Standard company of Chicago, and owned by the city of Logansport, Ind., is now in operation. It embraces 152 arc lamps and cost a trifle over $50,000.

The electric plant of the Commercial Electric Light & Power company and the gas plant of the Tacoma Light & Power company of Tacoma, Wash., have been purchased by eastern capitalists and will be operated under one management

The directors of the Chillicothe, O., Electric Street Railway & Lighting company have decided to make an issue of $50,000 in 20-year 6 per cent. bonds to equip the road, and the balance remaining to be kept on hand as an emergency fund.

The plant of the York, Neb., Gas & Electric Light company was sold recently for $5,205. The original cost of the plant was $12,000. It was knocked down to John R. Pierson, cashier of the City National Bank, who is supposed to represent the leading stockholders in the old company. It is understood that a new company will be organized immediately to place the plant, which has greatly depreciated, in first-class order.

The plant and extensive equipment of the Fond du Lac, Wis., Light, Power & Railway company were sold at sheriff's sale on December 28th to Elihu Colman, whose bid was $4,670.92. It was sold on judgments of foreclosure of several liens on the plant. The property is worth over $100,000. The report is that Mr. Colman represented the First National Bank of Chicago, whose attorney, Orville Peckham, was in the city all day. The bank has mortgage bonds on the property, which were given as security for indebtedness amounting to $100,000. Mr. Colman and Mr. Peckham refused to make any statement relative to this report.

The people of Hancock county, Ill., are greatly interested in a proposition made by J. C. Hubinger, a capitalist, to the city council of Keokuk, Iowa. He says if the city will grant him a contract to light Keokuk with electricity for twenty years he will agree to build a high bridge to extend from Fourth street in that city to the Illinois bluff at Hamilton, over a mile distant, the bridge to cost $400,000. He will, if properly encouraged, put a railroad track under the wagon track on this bridge, and also run an electric line across it, extending the lines to Carthage, Warsaw, Elvaston and Nauvoo, thus giving those towns freight, mail and passenger service, and supplying them with heat and light. This would revolutionize business affairs in Hancock county.

## ELECTRIC RAILWAYS.

R. H. Yates and C. F. Taylor, representing a Chicago syndicate of capitalists, were in Decatur, Ill., recently examining the property of the City Electric Street Railway company with a view of purchasing. The capital stock is $350,000.

A dispatch from Albion, N. Y., states that a car containing 25 persons has been run on Beecher's single-rail electric railroad at Waterford at a speed of 25 miles an hour, a three horse power storage battery being used. A road to Lake Ontario will be built.

A $600,000 mortgage has been filled by the Akron, O. Street Railway company to secure the issue of 6 per cent'

bonds, thus insuring the construction of electric lines from Akron to Cleveland, Akron to Kent, and Akron to Barberton, a total of fifty-seven miles.

By a majority of 43 the proposition to aid in the construction of an electric railway from Indianapolis to Franklin, Ind., was carried in Columbus, Ind. The amount of aid voted was $34,000. The road is now said to be assured to parallel the Louisville division of the Pennsylvania line.

On the morning of January 12th fire broke out in the carhouse of the Lima, O., Electric Street Railway company, and the entire building and all the cars were destroyed, leaving no rolling stock for the company to continue business with. The loss is nearly $35,000, with less than one-half that amount of insurance.

The various electric traction companies of Dayton, O., have consolidated, and the Cincinnati, Hamilton, Middletown & Dayton Street Railroad company has been incorporated. The new corporation is capitalized at $500,000, which may be increased. The road will run through a well-populated district and will be in operation by June next.

The Burlington & Mount Holly, N. J., Electric Railway company has filed articles of incorporation in the office of the secretary of state at Trenton. General William J. Sewell of Camden is one of the incorporators. The road is about seven miles in length and is now operated as a steam road by the Pennsylvania Railroad company.

Shortly before seven o'clock on the evening of January 10th the main feeder pipe, which supplies all the water for the big boilers in the power house of the Rochester Railway company at the corner of Mill and Center streets burst. This necessitated shutting down the power and pulling the fires. The leak was quickly found and repaired with all haste possible. But it was not until 9:15 P. M. that a sufficient head of steam could be gotten up to start the engines which run the dynamos.

The town of Kiew in Russia has a small electric street railroad only about two miles long—the only one in that country—which affords an admirable illustration of the appreciation with which gas engines meet in Europe. The plant at the power station consists of two generators rated at 30 kilowatts each, and these are driven by two double-cylinder Otto gas engines through direct belt connection. Each of the engines is of 60 horse power capacity, and runs at a speed of 140 revolutions per minute. The gas is furnished by the local works.

The Manitou, Colo., Electric Railway company has commenced work. This corporation was organized some time ago for the purpose of building an electric railroad through the town of Manitou. The project was delayed from time to time, but construction work has at last been commenced and is being rapidly pushed. The road will form the connecting link between the Rio Grande railroad and the Pike's Peak cog road and will extend from the terminus of the former to the depot of the latter, near the iron springs at the entrance to Engleman's canon.

The Ottawa., Ill., Electric Street Railway company served notice on the mayor that it would cease operating its line after January 12th on account of alleged bad treatment by the city and business men. The road, the first of its kind in the state, was built as an exhibition plant by the General Electric company in 1889, and, save for the panic of 1893 and city improvements, which cost it large sums, has done as well as roads in other small cities. About two years ago its officers began a suit for damages against the city for tearing up its tracks to build a sewer, and in order to compromise the suit the city abated its tolls for 1893. Six weeks ago the company asked permission to discontinue running until June, as operation in the winter is very expensive. This was refused and overtures were made by citizens to purchase the plant at a reasonable figure. The company refused the offer. If the company refuses to operate, its franchise will be forfeited.

## MISCELLANEOUS.

In describing a new electric carriage a Kansas City writer for the daily press states that the power is obtained from a storage battery which "furnishes a current of 67½ ohms."

It is proposed that an electrical exhibition be held in Austin, Tex., next spring to mark the first utilization of the great water power now made available to the residents of that city.

In the article descriptive of the electric lighting plant in the Cook County Criminal Court building in the WESTERN ELECTRICIAN of December 29th, it should have been stated that the building is wired almost entirely with Simplex wire.

The Buffalo Electrical society has secured the services of Prof. Albert L. Arey of the Rochester Free Academy for a course of ten lectures on "Practical Electrical Engineering" to be given at the rooms of the society, in the Library building, commencing January 19th and continuing every alternate Saturday evening, until the course is completed.

Through the efforts of Prof. H. S. Carhart a class of professional men has been formed in Evanston, Ill., for the study of electricity and its effects upon nervous diseases. The class will meet in the west front room of the Mann building. A course of lectures will be given by Dr. W. G. Herdman, professor of electro-therapeutics at Ann Arbor, Mich.

Peter Peterson, an electrician at the city lighting station at Tacoma, Wash., was instantly killed on January 5th. In making changes on the switchboard he grasped two plugs at the same time, his thumbs touching them too far up and on the non-insulated portion. There was a flash and he fell back dead. He had been in the employment of the company six years.

On Christmas Eve at nine o'clock a fire broke out in the factory of W. H. Fleming, manufacturer of patent woven wire dynamo brushes, 393 Pearl street, New York. The damage amounted to about $1,700, only partially covered by insurance. It is stated that the work will be carried on without interruption during rebuilding, other premises having been secured.

J. W. Marsh, vice-president and general manager of the Standard Underground Cable company of Pittsburg, was in Baltimore recently in consultation with the promoters of the Susquehanna River Electric company. Mr. Marsh has accepted the presidency of the latter company and will be elected at the next meeting of the incorporators. He is closely connected with the Westinghouse company. Surveys of the route to be followed by the Susquehanna River Electric company are now being made by a corps of engineers. The company will be capitalized for $6,000,000, of which $3,000,000 will be issued in stock and about the same amount in 5 per cent. interest-bearing bonds.

Passengers riding on the electric railway between West Farms and Mount Vernon, N. Y., have the privilege of listening to an acoustic manifestation that in a remarkable manner illustrates some of the earlier experiments in developing the telephone. The track is a single one, and when a car is waiting on a switch for one coming in an opposite direction, the approach of the latter is audible at the distance of a mile to the passengers in the waiting car. The sound vibrations are carried along the wire, through the trolley, to the wooden roof of the car. This acts as a diaphragm, which faithfully reproduces the rumble of the approaching car. A mile away the noise of the wheels is distinctly audible, and at the distance of 1,000 feet the sound becomes a loud roar. Outside the car, however, practically nothing is heard until the moving car is within a few hundred feet of the switch.

Linemen of some of the telegraph and telephone companies centering in Reading, Pa., have just made a discovery as to the destructive propensities of woodpeckers that almost surpasses belief. The costly cedar poles brought from Canada, these birds have discovered, are soft through the center to the top. They first hunt for a knot near the bottom, and around this they peck with their long, sharp bills until they extract it. They work all around it until it is dislodged. They then continue pecking until the center of the pole is reached, after which the softer material is removed. In some cases the interior of the pole at the point attacked is nothing more than a mere shell, and any sudden gale is apt to snap it off. The birds sometimes build their nests inside the hollow pole, and have been known to be killed by its breaking. The cedar poles taken out after they are ruined by the birds are generally replaced by chestnut poles, which are seldom attacked. Linemen are instructed to keep an extra sharp lookout for poles damaged in this way, and when they find they have been used as hatcheries to renew them. A number of poles south of Reading have been condemned, nearly all having been hollowed out by the mischievous little pests.

## TRADE NEWS.

The Phœnix Carbon company of St. Louis is now fully equipped and is running to its full capacity, with a constant flow of orders. This company is not, it is stated, connected with any trust.

The Canadian factory of the Whitney Electrical Instrument company at Sherbrooke, Quebec, was badly damaged by fire on December 29th. The factory will be immediately rebuilt, and arrangements have been made whereby there will be no delay in the shipment of orders.

The Washington Carbon company of Pittsburg has had ample evidence that the public appreciates its enterprise in being the first American carbon company to produce a cored carbon equal to the best made abroad. Central station men have been quick to see the advantages of buying at home when equally high-class goods can be made here. The Washington company is in the front rank, and is pushing in every direction to give its customers the best in every line.

C. J. Butler of the Indiana Rubber & Insulated Wire company was a visitor to Chicago last week. This time, however, Mr. Butler did not see much of his electrical friends, as he was busily engaged in pushing the new branch of the rubber business which has been undertaken at his company's factory. Mr. Butler is now manufacturing in addition to his large wire output a very novel bicycle tire. Those who know Mr. Butler's business-like methods and energetic work in the wire business prophesy that the tire department of the Indiana company will attain as great a success as has attended the aggressive exploiture of Paranite.

The Nowotny Electric company of Cincinnati made a shipment last week of 50 telephones and a 75-number switchboard, with all the necessary accessories for the completion of a telephone exchange to be erected in the northern part of Ohio. This makes the third complete telephone exchange equipment that this company has turned out of its factory in the last three months, beside having sold hundreds of telephones for short lines ranging from one-half mile to 50 miles. The company has telephone instruments adapted for exchange service as well as for long and short private lines, which, if not superior, are unsurpassed by any other telephone in use.

David E. Evans & Co., electrical and mechanical engineers, 7 Harrison street, Baltimore, Md., have been awarded the contract for the Edmondson Avenue, Catonsville & Ellicott City electric railway, also the contract for lighting the belt tunnel for the Baltimore & Ohio railroad. Mr. Evans himself has been appointed electrical engineer for the city of Lynchburg, Va., for which he is preparing plans and specifications for a lighting plant. He will be ready to receive bids within the next two weeks. D. E. Evans is one of the best known and most energetic electrical engineers of the East. His splendid record in Baltimore, Md., has made him many friends, and it may be said to his credit that not a few of these are the young men who, from time to time, have been in his employment and learned the electrical business under his direction.

The latest catalogue issued by the Western Electric company of Chicago is a masterpiece of the printer's art, and reflects no less credit on the company presenting it to the trade. It contains over 300 pages, profusely illustrated, and the matter is arranged to serve the convenience of purchasers. The attention of the trade is called to the fact that this catalogue covers only such material as is specially adapted to electric light work, and that in addition to the material listed the company carries a complete stock of both bell and railway supplies. An electric railway supply catalogue is issued by the company for that branch. The present catalogue will be of special interest to electric light companies, and is particularly timely in view of the conventions of the Northwestern and National associations. An important feature of the work is the telegraph code, which is conveniently arranged, which will be found of great value to the trade. A number of code-words are given, representing business phrases and sentences, which may be used in connection with code-words designating articles in the catalogue. Regarding the specialties enumerated in the catalogue it is only necessary to say that they cover the entire field of electric lighting specialties, and represent a most complete line of standard goods.

## BUSINESS.

The Partridge Carbon company of Sandusky, O., says that the electrical public is discovering the value of the Partridge brush. The company is running full time and begins the year with bright prospects. January will be its banner month.

The Metropolitan Electric company, 186–188 Fifth avenue, Chicago, has recently been making some changes in its store and has put in some new counters and shelving, thus adding to the attractiveness and furnishing better facilities for the display of an increased line of goods.

Energy in starting a new business is usually expected, but some men surprise even their friends and competitors by commendable activity that should insure success. The quickness with which President T. C. Rafferty of the Dearborn Electric company, 19 Quincy street, Chicago, has prepared and published the first catalogue of electrical supplies of the new company entitles him and his efficient staff to much credit. With 128 pages and fully illustrated, the Dearborn company's catalogue should be on the desk of every purchasing agent. Mr. Rafferty will handle the well-known Bishop wires and cables.

The second edition of P. S. Dingey's "Machinery Pattern Making" is now being advertised. This book contains 417 fine illustrations. Its object is not so much to teach pattern making, for that cannot be done entirely through a book, but merely to encourage a study of the practical. Mr. Dingey is well qualified to teach pattern making, being an associate member of the American Society of Mechanical Engineers, and also one of the instructors at the Armour Institute, Chicago. His daily intercourse with students fits him excellently to prepare a work of this character. "American Pattern Making" is published by John Wiley & Sons, New York.

Every enterprising advertiser is continually on the lookout for something original in the line of an advertising novelty. The novelty advertising field is so thoroughly worked, however, that it is not at all an easy matter to bring out something new, and when such an article does appear it is quite sure to attract considerable attention. The Electric Appliance company, Chicago, claims to have something entirely original in this direction, in an advertising novelty which is something that every electric light man in the country has been in need of ever since he went into business, but an article which the market has failed to supply. The "cat will be let out of the bag" at this week's convention of the Northwestern Electrical association at Milwaukee.

The Mather Electric company of Manchester, Conn., reports a bright outlook for the year 1895; in fact, the company has at no time during its existence had so many orders on its books as it has now. The company now has in course of construction in the works at Manchester five 200 kilowatt, twelve 100 kilowatt, one 80 kilowatt, eight 60 kilowatt, three 45 kilowatt, three 30 kilowatt belted generators of its new multipolar type; also three 100 kilowatt, one 80 kilowatt, two 65 kilowatt, two 50 kilowatt and one 30 kilowatt direct connected generators of the new multipolar type, as well as 31 ring type dynamos and 70 Manchester motors of various sizes. Notwithstanding the extensive additions in the way of new tools and facilities which have been added recently to the Manchester plant, the company has found it necessary for the last two months to operate the entire plant 24 hours a day with two shifts of men, but so far has been unable to keep up with the orders. On the first three days of January the Mather company closed contracts for ten generators, aggregating 1,300 kilowatts, for railway and power work.

Secretary H. C. Vansant of Morris, Tasker & Co. of Philadelphia reports that during the past year their sales of electric light and railway poles has been nearly four times as large as any preceding year and that the poles have been sent all over the country, a large portion going to the western states. The concern has recently made preparations for increasing its manufacturing facilities in this department, and from orders now booked the indications are for even a larger year than the one past. Special gun metal castings for all styles of fittings for electric station and power plants are now being made by this firm, and are also made to meet special requirements for heavy work. The firm of Morris, Tasker & Co., was established in 1821, and is known as the pioneer in its line of business, which has grown to its large proportions under the careful guidance of its officers, but under no management has success been more fully attained than since H. C. Vansant was made its secretary. Many friends take pleasure in extending to him the wish for the continued prosperity and growth of Morris, Tasker & Co,

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued January 8, 1895.*

532,016. Electrically Propelled Vehicle. Henry C. Baker and John R. Elberg, Kansas City, Mo. Application filed April 6, 1894.

The invention consists of a wheeled frame, a motor carried thereby, a bracket carried by the rear axle of the frame, a spring carried by the bracket, a motor yieldingly supported upon the spring and electrically connected to the battery, small friction wheels mounted upon the motor shaft, and large friction wheels carried rigidly by the wheels of the frame journaled loosely upon the axle, as shown in the cut.

532,031. Self-adjusting Trolley. John Corcoran, Harrisburg, Pa. Application filed August 29, 1894.

In this arrangement there is claimed the combination with two shells, having recesses to receive the standard, of a standard fitting the recesses in the shells, and provided with a collar, having stops formed thereon, and a pin on one of the shells and between the stops.

532,057. Motor Suspension for Electric Street Cars. Samuel Harris, Cleveland, O. Application filed May 19, 1894.

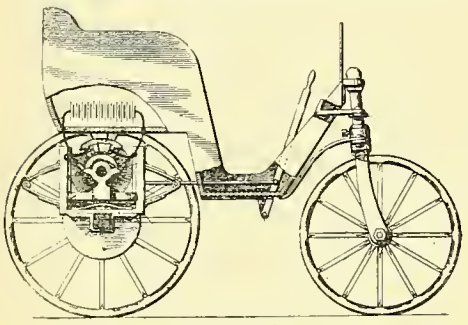
In an electric street railway car truck the combination with the axles, the motors attached to and intergeared therewith, and the framework of the truck, the bars pivotally connected at one end to each of the motors and pivotally supported on the truck by a rocking spring-bearing, with their free ends meeting in the center of the truck, springs above and beneath the meeting ends of said bars, and a support for said springs rigid with the truck frame.

532,095. Electric Arc Lamp. Amos W. Richardson, Patricroft, Eng. Application filed March 2, 1894.

In an electric arc lamp there is the combination of the main solenoid, the shunt solenoid and the central supporting core of the armature, the contact-making piece the tube carried by the armature, through which the carbon passes, the positive carbon, the carbon holder attached to the tube, the short tube, the prongs, runners and clutch box.

532,101. Insulator for Electric Wires. Daniel M. Rothenberger, Lancaster, Pa. Application filed April 4, 1894.

In an insulator, the combination with a wire, of a curved or angular groove formed in the outer surface of the insulator and constructed throughout its whole extent to receive the wire, and a retainer located by the side of the groove and having one end permanently secured in the insulator, and the other end adapted to bind the wire in place.



NO. 532,016.

532,103. Electric Lamp Support. Frank Schefold and James Nortney, New Albany, Ind. Application filed March 1, 1894.

An electric lamp is provided with automatically actuated hooks constituting its electrical terminals, hangers secured above the lamp and in the electrical circuit, conductive plates connected with the hangers respectively, a movable contact plate and a yielding head upon the lamp arranged to hold the contact plate out of contact with the conductive plates when the lamp is raised.

532,113. Converter System for Electric Railways. George W. Swartz, Florence, Ala. Application filed October 12, 1893.

The claim reads as follows: In a system of electrical distribution for railways, the combination of a bare conductor in sections insulated from each other, an outgoing circuit, a return circuit and transformers, each having its primary permanently inserted between the outgoing and return circuits, and having one pole of its secondary connected to a section of the bare conductor and the other pole to the rails, and a switch included in one of these connections, having an electro-magnet which is traversed by the secondary circuit when closed, and the armature of which constitutes the movable switch member, whereby the secondary coil and coil of the switch magnet are in series.

532,122. Railway Signal. James Wayland, Newark, N. J. Application filed January 24, 1894.

The invention comprises the combination with the home and distance signaling stations, and means for operating the signals thereof on the passage of a train, of a connecting rod and springs arranged at the opposite ends of the same, each of which is normally under tension or compression, and capable of drawing upon and operating the rod when the other has its normal tension or compression disturbed.

532,126. Supply System for Electric Railways. Albert G. Wheeler, Chicago, Ill. Application filed January 21, 1893.

In an electric traction system there is a generator, a working conductor or trolley wire connected with one pole of the generator and consisting of a plurality of separately insulated sections, all of which are constantly in circuit with the generator, an auxiliary or feed conductor also connected with the same pole of the generator, and constantly in circuit therewith, independently of the working conductor, and metallic connections embracing contact breakers or switch devices between the auxiliary conductor and each end of each section of the working conductor, and separate contact breakers or switch devices between adjacent ends of the insulated sections of the working conductor.

532,133. Trolley Wire Clip. Johan M. Anderson, Boston, Mass. Application filed July 9, 1894.

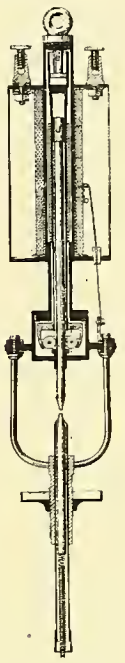
The last claim reads as follows: In a trolley wire hanger, the combination with an "ear" provided on its under side with arms integral with the said "ear" and extended from the central portion toward the opposite ends of the said ear, a substantially U-shaped clip secured to the sides of the said "ear," and threaded adjusting bolts carried by the "ear" and acting on the said arms to force the trolley wire against the said clip.

532,157. Underground Trolley Arm. Paul C. Just, Chicago, Ill. Application filed January 4, 1894.

A flat supporting bar provided with a recess at its edge, a wearing block inserted in the recess, the bar and the block having interlocking recesses and projecting separable from each other by a movement of the block in a direction edgewise of the bar, and means for detachably securing the block in the recess, are the features of the invention.

532,160. Insulator. Myron D. Law, Washington, D. C. Application filed August 29, 1893.

An insulator comprising metallic parts, means for clamping the same together, and insulating material interposed between the parts, which material, in the portions thereof subjected to strain in the use of the insulator, consists of rubber fiber or other homogeneous insulating material, and in the portions thereof subject to the clamping action of the metallic parts, by which moisture is excluded from the interior of the insulator, is formed of sheet mica.



NO. 532,095.

532,161. Conductor. Myron D. Law, Washington, D. C. Application filed September 28, 1894.

One claim is as follows: An electric conductor comprising a plurality of L-shaped rails, each having a contact flange and supporting web, and having the end portions of its contact flange half the width of the main portion thereof, and the end portions of its supporting web extended to form contact fingers or brushes, said rails being connected together with their ends overlapped and the adjacent rails being reversely arranged.

532,163. Conduit Tramway. John C. Love, Philadelphia, Pa. Application filed September 5, 1893.

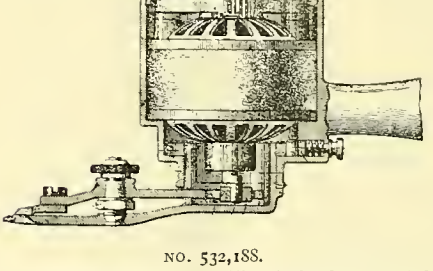
The combination includes a slot rail having a depending flange of a yoke provided with an upwardly projecting support for the slot rail, which is provided with a recess to receive a nut and a bolt hole extending horizontally into the recess, a nut in the recess, and a bolt inserted through the rail flange and bolt hole and engaging the said nut.

532,164. Conductor Support. John C. Love, Chicago, Ill. Application filed May 9, 1894.

There is claimed a supporting device for electric conductors provided with a clamp comprising two separable plates, between the margins of which the conductor is gripped and held, one of which is apertured and the other provided with a loop which projects therefrom through the apertured plate, and a wedge or tapered key driven through the loop and engaging the outer face of the apertured plate to force the plates toward each other.

532,165. Conduit for Electric Railways. John C. Love, Chicago, Ill. Application filed May 9, 1894.

The invention comprises track rails, a slotted conduit and a man-hole, yokes for supporting the rails, provided with integral tubular sections located below the rail seat, and pipe sections engaged at their ends with said tubular sections and passing through the man-hole, said pipe sections being provided with openings within the man-hole.



NO. 532,188.

532,166. Tension Device for Electric Conductors. John C. Love, Chicago, Ill. Application filed May 9, 1894.

The combination comprises the yokes of a conduit and a conductor, of a guide rod or rods attached to the yokes, an insulating block sliding on said guide rod or rods, a clip for supporting the conductor secured to the insulating block, a second insulating block also sliding on said guide rods, a plate secured in said second insulating block, an adjustable coupling rod connected at its ends with the said clip and plate, and a compression spring applied between the said second insulating block and an opposing surface of one of said yokes.

532,168. Trolley Wire Clamp. John C. Love, Philadelphia, Pa. Application filed July 11, 1892.

The combination with a grooved wire and an insulating block, of a clamping device consisting of two flat plates provided with lips or flanges at their lower edges to engage the grooves in the wire, and one of which is embedded at its upper edge in the insulating block, and means for securing together the plates, consisting of a single centrally arranged integral, screw threaded stud on one plate, passing through a hole in the other plate, a nut applied to the screw threaded stud, and one or more smooth studs in one of the plates fitting holes or sockets in the other plate, comprise the claims of the inventor.

532,185. Conductor Bond for Meeting Ends of Rails of Electric Railways. Peter Rieth, Chicago, Ill. Application filed June 14, 1894.

The device consists of a given length of conducting material, a plurality of perforated contact studs projecting therefrom, thimbles within the studs, perforations in the meeting ends of the rails, and means for upsetting the metal of the studs within the perforations or holes of the rail ends within which the studs are located.

532,188. Electric Hair Clipping Machine. Peter Shannon, Chicago, Ill. Application filed April 27, 1894.

In an electrical hair clipping machine, the combination is claimed with the stationary and vibrating clipper plates, of a lever secured to the vibrating clipper plate, and having a slotted yoke at its rear end, a sliding block moving in the yoke, an electric motor supported on a rearward extension of the stationary cutter plate, the armature thereof carrying a crank pin engaging the sliding block, and an inclosing casing attached to rearward extension of the stationary cutter plate, and supporting the electric motor in a plane at right angles to such cutter plate.

532,195. Trolley Support. Lucius T. Gibbs, Milwaukee, Wis. Application filed July 28, 1893.

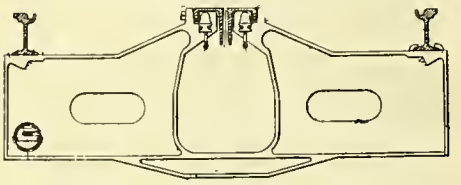
The stand is adapted to be secured to the car, and is provided at its front and rear with cylindrical bearing surfaces, the base adapted to sustain the pole and provided with semi-circular grooves to receive the cylindrical bearing surfaces, the inner surface of the grooves being curved downward at their centers, and means tending to yieldingly hold the base in an upright position, whereby the base and pole sustained thereby may swing back and forth, and also laterally in rounding curves.

532,200. Trolley for Electric Railways. John C. Henry, Westfield, N. J. Original application filed September 27, 1889. Divided and this application filed March 8, 1893.

The device consists of the flat ribbon working conductor, the trolley frame on one side thereof, and the removable contact and wear plates fixed to the frame and bearing against the opposite sides of the conductor.

532,260. Cross Arm for Support of Electric Wires. Edward J. Bullock, Wallingford, Conn. Application filed November 19, 1894.

This cross-arm is formed from sheet metal, of inverted U-shape, and constructed with holes through its top portion for the insertion of insulator pins.



NO. 532,165.

532,261. Conduit Electric Railway. Albert M. Burgher, Clay City, Ky. Application filed April 17, 1894.

In an electric railway system, the conduit comprising a track rail, a timber laid parallel with the rail, a top plate secured to the timber, and an insulating plate on the web of the rail adapted to support a line wire, are the principal features.

532,291. Electric Burglar Alarm. Horace M. Scholes and George M. Myers, Kansas City, Mo. Application filed April 17, 1894.

In an electric burglar alarm system, the combination is claimed of a protection circuit of a balanced relay, a switch mechanism, connections whereby the circuit may be shortened, and a polarized relay and a resistance coil, with a conducting standard, an alarm mechanism, electric conductors connecting the standard and the alarm mechanism with the ground, a spring contact plate normally out of engagement with the standard, and in engagement with an insulated point of the armature of the polarized relay, an electric conductor connecting the spring contact plate with the electric connection leading from one coil to the other of the polarized relay, a test relay located in the office and electrically connected to a contact plate, and a battery connected to the relay and to the ground, so that the proper operation of the switch mechanism will reverse the operation of the current in the protection wire, will shunt one coil of the polarized relay and the resistance coil out of the protection circuit, and will complete the protection circuit through the alarm mechanism of the building by the operation of the armature lever, and will cause the synchronous operation of the alarm mechanism and the test relay located in the office.

532,302. Closed Conduit for Electric Railways. Frank Windle, Philadelphia, Pa. Application filed March 8, 1894.

One claim reads: In an electric railway, the combination with a slotted conduit, a conductor arranged therein, and spring plates adapted to make electrical connection with the conductor, of a flange wheel, arms in which the axle of the wheel is mounted, hollow insulating hangers into which the arms project, a supporting plate provided with arms projecting also into the hollow hangers, and springs arranged in hangers between the said arms.

532,353. Lightning Arrester. Alexander Wurts, Pittsburg, Pa. Application filed February 28, 1894.

This is a lightning arrester, comprising a pair of insulating plates, a pair of sparking terminals and an interposed discharge wedge, one or both blocks or plates having a plurality of grooves extending outward laterally from the wedge.

532,354. Lightning Arrester. Alexander J. Wurts, Pittsburg, Pa. Application filed August 3, 1894.

The device consists of two plates or blocks of insulating material, the inner face of one being provided with sparking terminals and an interposed discharge wedge formed in a block of fine grained hardwood, the grain of which extends in a direction transverse to the face of the plate, and the other having an opposing block or slab of similar material, the grain of which extends in the same direction, the plates being glued together and clamped.

532,391. Electric Lamp Support. James Nortney, New Albany, Ind., and Frank Schefold, Parkersburg, W. Va. Application filed October 18, 1892.

The last claim reads as follows: In an electric lamp support the combination with the fixed part carrying a fixed support and a movable support adapted by its movement to make and break circuit with the fixed support, of a lamp provided with a pair of vertically movable pivoted hooks electrically connected with the lamp to operate it, yielding locking mechanism for retaining the hooks temporarily in a fixed position, guide pieces in front of the hooks to latch the hooks upon the supports when pressed against them.

# Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, JANUARY 26, 1895. No. 4.


## Henry C. Thom.

Henry C. Thom, the newly elected president of the Northwestern Electrical association, whose portrait is herewith presented, has always taken an active interest in the affairs of the society, having filled the office of secretary ever since the organization was perfected. He is the secretary and manager of the Four Lakes Light & Power company of Madison, Wis., and is an energetic, many-sided man who is well known throughout the state by reason of his activity in commercial, political and educational affairs.

Mr. Thom was born in Rock county, Wis., in 1856, and received his elementary education in the public schools of the neighborhood. He was afterward graduated from the Clinton High School, and he went from there to the Normal School at Oshkosh, from which he graduated in 1879. He was appointed principal of the city schools of Oshkosh soon after completing his education, and he served five years in that capacity. Resigning, he purchased a farm in Rock county, but he continued to exhibit an interest in educational matters, and he was twice elected as superintendent of schools of his native county. During the World's Fair Mr. Thom served as a member of the educational committee from Wisconsin.

The new president of the Northwestern Electrical association is a versatile man, as is shown by his prominence in the dairying industry, in politics, and later in electric lighting, as well as in educational pursuits. He was appointed state dairy and food commissioner by Governor Hoard and served two years. Mr. Thom was also honored by election as president of the National Dairy Commissioners' association, which has headquarters at Washington, D. C. He has been a member of the county Board of Supervisors and was twice elected chairman of the Republican State Central Committee of Wisconsin. For several years Mr. Thom has been manager of the Four Lakes Light & Power company of Madison, Wis., and he was active in organizing the Northwestern Electrical association, of which he is now president.

## American Institute of Electrical Engineers.

At the meeting of the Institute on Wednesday evening, January 16th, Prof. Macfarlane of Ithaca, N. Y., read his paper "On the Units of Light and Radiation," which was discussed by Messrs. Kennelly, Wolcott and Burnett. It was voted subsequently that the paper be referred to the committee on units and standards for consideration.

The paper by Alton D. Adams of Boston was read by the author and was discussed by Messrs. Crocker, Richard Fleming, Sheldon, Ashley, Burke, Waldo, W. L. Bliss and Gano S. Dunn.

At the council meeting in the afternoon the following named associate members were elected:

Henry S. Anderson, Springfield, Mass.; H. W. Buck, New York; Edmund V. Cox, New York; Sylvester P. Denison, New York; Arthur J. Farnsworth, Mamaroneck, N. Y.; Henry W. Fisher, Pittsburg, Pa.; Henry Leslie Fridenberg, New York; Edward B. Gallaher, New York; J. Henry Klinck, Ithaca, N. Y.; Burton S. Lanphear, Ithaca, N. Y.; Edward A. Leslie, New York; William B. Lester, New York; John Clifford Rennard, New York.

The following named associate members were transferred to full membership:

Peter Wright, Philadelphia, Pa.; Arthur V. Abbott, Chicago, Ill.; Louis B. Marks, New York; Edward V. Baillard, New York; Francis Broadnax, New York.

The press dispatches tell of a queer lawsuit in Muncie, Ind. As a result of the death of Leroy Wright, a telegraph operator, by taking hold of a live wire last August, a suit for $10,000 damages was filed against the city by the young man's widow. In the complaint it is alleged that John Singleton, superintendent of the city electric light plant, agent for the city, invited Wright to take hold of the wire.

## Northwestern Electrical Association.

"Were you at the convention?" This question will doubtless be asked many during the coming week, and it is safe to say that there will be not a few who will experience a sense of disappointment at their failure to attend when they are informed of the success of the Milwaukee meeting of the Northwestern Electrical association. A success it was, without question; and it is fair to say that, while many expected to see a growth in this now thriving organization, few were prepared to witness such an indication of favorable sentiment as was evidenced by the number present and money spent by those exhibiting. There is no question that the great West is a section thoroughly capable of taking care of itself, and the manner in which the western electrical light, power and supply men came to

HENRY C. THOM.

the front at Milwaukee was indicative of the fact that they thoroughly realize that union is strength and that good fellowship and exchange of ideas in convention constitute a strong stimulation to trade and facilitate greatly individual business success. Any thinking man will see that the growth of the Northwestern association is due mainly to the feeling that the western people look to one another largely for support. They appreciate fully the fact that the Northwest and West is a section far apart from, and really in many things independent of, the East. And with a knowledge that the East usually looks to its own interests first, and the West must therefore do the same, the Northwestern association was organized to bring the men of the West and Northwest into closer intercourse. While it was advanced at the recent meeting that it might be well to broaden the scope of the association and make it more national in character, this idea was decried, as it seemed clear that the association's strength lay in its remaining a Western organization and thus more sectional rather than national in its scope. A very noticeable feature of the Milwaukee convention was the business-like manner in which the delegates kept in touch with their work. Three sessions a day, morning, afternoon and evening, was the rule, and the members adhered to it with a strictness which would have astonished many members of the National Electric Light association. The delegates seemed to understand that they were there for "business," and every moment of the few days was utilized.

The convention proper opened in earnest on Wednesday morning, January 16th, soon after the special cars bringing the Chicago delegation had arrived and the late arrivals had registered at the Pfister Hotel. After a resolution had been introduced and carried, to the effect that the reports of committees and the election of officers be deferred until Thursday morning, January 17th, President C. C. Paige's address was delivered.

### President's Address.

The history and the development of electric lighting is short but crowded with famous results of the enterprising people who have been giving it their attention for the last few years.

In your deliberations and discussions of the topics which will come before you, I feel assured that you will bear in mind the magnitude and importance of the electrical industries in our country, there being now over two hundred million dollars invested in electric lighting and power plants. This vast amount of capital, engaged as it is in a business so wonderfully beneficial to the public, should demand from it at least a fair and honorable consideration. Every honest government, every honest municipality, every honest man, whether in authority or not, should have due regard for every dollar of this enormous investment made for the public welfare; but instead of doing so there has been instituted an unholy, infamous, communistic warfare on these enterprises, and not on those alone but upon kindred enterprises, although this policy is antagonistic to the true principles of our institutions, to our government, and to fair minded business equity. If such principles are suffered to get a foothold in this country, they will shape and control legislation and management of public affairs to the extent of paralizing if not wholly destroying this great interest.

As investors of the money in this public enterprise, I trust you will all see the necessity of a united and vigorously pursued effort to head off, by shaping public opinion or by legislation if necessary, the advance in this country of those communistic European theories of government ownership of all the public service. Municipal ownership of electric lighting plants seems to be foremost of all other public service in securing its advocates, some of which, I presume, are honest in the belief that it would be in the interest of economy. This is the watchword of all enthusiastic aldermen and ward steerers who are seeking place, particularly those desiring enrollment on the city's payroll. These exceedingly earnest advocates of municipal ownership you will find pay very little, if any, taxes, for the reason that they own no property. Other strong advocates of municipal ownership are some manufacturers of electrical apparatus, who after having induced capital, by their flowery representations of wonderfully remunerative business, to invest with them and put in operation all the electrical apparatus that any city or place could possibly support, have then turned their active energies to work promoting and encouraging competition, either a municipal or so-called citizens' plant. This class of men will tell the public that the old company is robbing them, that their machinery is old and worthless and that the old company "would not be in it" in competing with the new machinery with which they could now equip a plant. This class of operators, I trust, will receive from your hands their just deserts—"be turned down."

I am pleased to see so large a number present at this meeting, and I must congratulate these early members, who made the first efforts to organize this association, on its success, although several of our first meetings were rather discouraging. Now, I feel assured in saying that we have the strength to exert an influence that can be beneficial to all.

The programme prepared for your consideration is replete with good things, and I hope the members will avail themselves of the privileges of discussing of papers and topics fully.

The afternoon session was devoted to the discussion of a paper entitled "Hints Upon Daily Work About a Dynamo Plant," by Pliny Norcross of Janesville, Wis. Mr.

Norcross' paper was followed by one on "Interior Conduit and Interior Wiring," by Charles E. Burton of Chicago.

In the evening a paper was read by William Goltz of Milwaukee on "Incandescent Lamps versus Welsbach Burners," and one by John R. Markle of Chicago on "Some Characteristics and Economies of Accumulators as Applied to Central Lighting and Power Stations."

The time on Thursday was taken up chiefly in reading and discussing the following papers and addresses: "Incandescent Lighting on the Meter System Compared with the Contract System," by G. L. Cole of Beloit, Wis.; "Auxiliary Adjuncts to Electricity," by Thomas R. Mercein of Milwaukee; "Competition," by John Schuette; "Water Power," by Geo. A. Davis, and "A Storage Battery Experience," by G. Herbert Condict of Philadelphia.

It may be said the association has decided not to publish the address on "Competition."

Prof. D. C. Jackson of the University of Wisconsin was to have read a paper on "College and Station," and P. H. Korst of Racine, Wis., was also to have presented an address on "Common Councils," but neither of these papers was read.

Friday's meeting was called to order by President C. C. Paige, and after the reports of committees were received, the following named officers were elected unanimously for the ensuing year:

President—H. C. Thom of Madison, Wis.

First Vice-president—George Grimm of Jefferson, Wis.

Second Vice-president—Pliny Norcross of Janesville, Wis.

Secretary—William Goltz of Milwaukee.

Treasurer—George Schuette of Manitowoc, Wis.

Directors—F. Copeland of La Crosse, Wis., chairman; O. M. Rau of Milwaukee, E. M. Highlands of Clinton, Iowa.

On the announcement of Mr. Thom's election to the presidency, he was called upon for an address, and said:

"Gentlemen of the Association:—I keenly feel the generous endorsement you have bestowed. I thank you for it. I trust that the conduct and the administration of the chair in behalf of this organization will be of such a character that it will merit this mark of appreciation. I am keenly interested in the progress and development of and the good results that can be brought about by this organization. We have been wandering about in a nameless kind of a way, but we are getting down to business, and I believe that the association's influence will grow continually until the organization will be looked to as a potent factor in shaping the policy of investments and the methods of business. Again I heartily thank you."

After considerable discussion, Chicago was selected as the place for the next semi-annual summer meeting.

At this point of the meeting it was suggested that the first name of the association be dropped, in order to induce residents of other and more distant states to become members; but this motion was not favorably received, because it was shown that the interests would be much more varied and diversified and that the members would be apt to lose enthusiasm—in fact, the sentiment of the association seemed to be strongly against so radical a change as would follow this proposed action.

## The Banquet.

At 8 o'clock on Thursday evening the rotunda of the Pfister Hotel presented a lively appearance, and the crowd of delegates there assembled was of a number calculated to impress one as to the magnitude of the now thriving association. Some of the harder working members had availed themselves of the hotel table to partake of a light lunch, but the majority kept their appetites with them until the hour when all care and business should be laid aside. At 8:30 the word was passed, "To the banquet," and in five minutes the rotunda was empty. The Stadt Theater was the rendezvous, and it must have been with considerable pleasure that the organizers of the association counted or tried to count the throng that assembled in the ante-room preparatory to the grand march into the banquet hall. It was not until 9 o'clock that the doors were thrown open, and the order was given by the toastmaster, Thomas R. Mercein, to "file in." The opening of the doors was a signal to the musicians, and to the strains of a string orchestra the party took their seats at a U-shaped table, seating over 100 delegates.

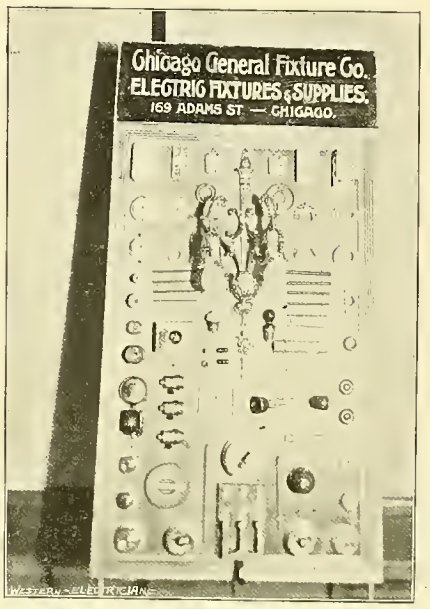



FIG. S. EXHIBITS AT THE MILWAUKEE CONVENTION.

Waiting had whetted the appetite, but it was not until the corks had popped and the juice of the vine began to flow that the fun commenced.

To the credit of the entertainment committee, which was composed of Thomas R. Mercein, chairman, A. C. Bunce and T. F. Grover, assisted by S. F. B. Morse, it should be said that the most dignified and elaborate programme of toasts had been prepared. It was with difficulty, however, that the good-natured and strenuous efforts of the eloquent toastmaster controlled the high spirits and good-natured fun and raillery which would burst forth at the slightest provocation. A number of good speeches were made, however, and received with much applause. C. H. Ruggles, in place of Mayor Koch, who was unable to be present, spoke on the "City of Milwaukee," and there was no question that his knowledge of conventions in general enabled him to fit himself to the temper of the banqueters, through his apt appreciation of the value of that which is unquestionably the soul of wit on occasions where dignity is desired but good-fellowship and jollity prevail.

President H. C. Thom, as an old politician, in his response to the toast "Central Stations," demonstrated to the convention that while in name they were central station men, they were by no means monopolists in so far at least as their characterization was concerned.

C. D. Wyman, for the Milwaukee electric railway system, made a happy and witty address on the subject "Nearest His Heart," and, as he hinted several times, very intimately connected with his pocket. Fred DeLand of Chicago did the honors for his brethren of "The Press."

The jolliest feature, though, of the entire entertainment, and the one apparently most appreciated by the hard-worked and now thoroughly fatigued delegates, was a special performance on the stage at the end of the banquet hall. This feature of the banquet was undertaken by the committee, and through the energetic personal work of S. F. B. Morse made a most enjoyable climax of a most successful banquet. A number of variety performers had been engaged after considerable trouble and expense, and their fun-making kept the members entertained until a late hour.

FIG. I. EXHIBITS AT THE MILWAUKEE CONVENTION.

## The "Western Electrician's" Special Circulation.

Those who have a curiosity to know something of the policy of the WESTERN ELECTRICIAN in the matter of giving itself a special circulation should have been among the early arrivals to board the 8:30 C., M. & St. P. train which left the Union depot, Chicago, last Wednesday morning, for the Northwestern Electrical association convention at Milwaukee.

Without going into details, it may be said that for a week all the staff of the paper had been busily engaged preparing the special convention issue. As is now thoroughly understood, the time of a convention is one during which the paper can give its advertisers a certain peculiar and special circulation which, if the matter be carefully looked into, will be seen to be of great value.

On the morning of the convention train's departure from Chicago two of the WESTERN ELECTRICIAN'S staff were early at the train with a large bundle of this issue of the paper, each paper being tagged or labeled so as to call particular attention to its being a special issue. The moment a delegate arrived at the train, the paper was pressed into his hands, and, as no other paper had yet appeared on the scene, the enterprise of the WESTERN ELECTRICIAN was highly appreciated and many were the kind remarks evoked.

It is no exaggeration to say that the special car in which the Chicago delegates had congregated presented an appearance highly gratifying to the paper's representatives. Just before the train moved away from the depot and when the car was full, with not a seat vacant, it is no exaggeration to say that there wasn't an occupant that did not hold the WESTERN ELECTRICIAN in his hand (and was not smoking WESTERN ELECTRICIAN cigars), either reading the paper or talking about it and complimenting the management for its handsome appearance and energy in thus taking care of its advertisers.

In addition to this, it may be said that the WESTERN ELECTRICIAN was the first paper to be put in circulation at the Pfister House. Within three minutes after the arrival of the special issue in the rotunda of the hotel, the paper's representatives had personally placed the paper in the hands of every man in the hotel who claimed to be "interested in electricity." Five minutes after arrival, and just before the opening of the first convention session, the WESTERN ELECTRICIAN was seen everywhere and in almost everyone's hands.

In addition to all this, with the idea of still further looking after the interests of advertisers, an arrangement was made with a carrier through which the specially tagged papers of this convention issue were circulated throughout the city of Milwaukee. A carefully selected list of names of concerns was made out, with which it was deemed a copy of the special issue of the paper if presented would do the most good, and the carrier was engaged to personally place the "blue papers" in the hands of the managers of every one of these concerns. Not only was the WESTERN ELECTRICIAN placed in the hands

of manufacturers, supply men, etc., in Milwaukee, but the paper was likewise placed in every city editor's office in Milwaukee.

Further than this, with a view of thoroughly covering the situation, a special newsboy had been placed on board the Chicago & Northwestern train which left the city about the same time as the St. Paul train, with instructions to place a copy of the special convention issue in the hands of any interested person that might have gone by way of this route.

In addition to the above the whole country was covered in the usual thorough manner.

## The Exhibits.

Contrary to the expectations of those who went to the Milwaukee convention with the remembrance fresh in their minds of its first meeting, two years ago, the exhibits at the Pfister House were of a number and character that could not be other than gratifying. Ten concerns presented displays, two concerns making two separate exhibits each. The specialties were spread on tables in the convention hall proper, and also on stands in the gallery and in rooms on the second floor of the Pfister. Some of the exhibits, too, were of a character that indicated that their designers had given much time and thought to their origination, and several were remarkable on account of their uniqueness and decided novelty. Without a doubt the western supply men have awakened to the fact that the Northwestern association has "come to stay." The money spent and the time that was put in on these exhibits did a great deal toward gaining the association the increased membership, as shown by the list of new members presented elsewhere, and will contribute to make a much greater success of the coming semi-annual meeting, which takes place in Chicago next summer.

FIG. 7. EXHIBITS AT THE MILWAUKEE CONVENTION.

Following are brief descriptions of the exhibits at the Pfister:

Those who are intimately acquainted with S. F. B. Morse, who has recently succeeded, under the name of S. F. B. Morse & Co., to the business of the well known firm of Cushing & Morse, will not be surprised to learn that he displayed more than his usual amount of advertising originality in the preparation of what was generally considered to be one of the most unique convention exhibits ever presented to the electrical men of this country. As is well known, it is a hard matter to advertise so simple a specialty as a good wire and cable; but Mr. Morse's methods were radical, and he proposed that the Northwestern fraternity should see that, after all, there was not only something in a name but a man of originality and brains behind it. On the way to the convention, Mr. Morse had promised his friends a surprise, and as he brought no samples with him, there was no little curiosity displayed to learn how "Kerite" would this time be made prominent. The door in parlor 7 at the Pfister was kept closed until the last moment, and when it was finally thrown open after a convention session, and the delegates crowded in—for it was a crowd, and no mistake—to witness what was not only a unique and beautiful performance, but a thoroughly electrical one as well, the sight was of a character that will impress "Kerite" for a long time most firmly upon the minds of those present. In front of a screen, and arrayed in a costume of tights such as displayed his handsome and athletic figure to good advantage, stood "Professor" G. W. Patterson, well known throughout the United States as an expert manipulator of electrical Indian clubs, but now retired from the stage and associated with Mr. Morse in the wire business. It is impossible to properly picture the color effects produced by the swinging of Prof. Patterson's illuminated clubs in the darkened room. It may be said that few can realize their beauty without seeing the entertainment. By means of electric wires running up his back and out to his hands, connection was made from an improvised switchboard on a table to the electrical clubs. "Assistant Professor" Morse manipulated the switches, illuminating the clubs in variegated colors as "Professor" Patterson swung them into symmetrical circles and curves. A pianist accompanied the swinging with "The Star Spangled Banner," and as the air filled with the glow of red, white and blue lights, flashing and dying away in unison with the notes of the music. The effect was "electrical" in every sense of the word. Other clubs with musical attachments were swung while electric lights were flashed or mellowed in harmony with the tune played. In addition to this, "Professor" Patterson gave an exhibition of electrical flash writing. By means of an iron point on a metal surface the names and sentences were written in flame. A fair idea of the general appearance of "Professor" Patterson, as he appeared in his costume, swinging the illuminated clubs, may be had from Fig. 1. In addition to the club swinging exhibit, Mr. Morse royally entertained his customers and friends, and a punch bowl outside the door capped with good fellowship the pleasant impression made on the inside. Messrs. Morse and Patterson were a whole entertainment committee in themselves, and it is safe to say that future conventions will hardly be complete without their presence.

The Central Electric company, Chicago, turned out in full force in the persons of Chas. G. Burton, H. D. Latimer and Irwin C. Hoon. These gentlemen certainly did credit to their company in original exhibition work. Mr. Latimer managed to capture for his supply exhibit one of the most prominent corners in the convention hall, and his energetic and persistent work kept the Central company ever in the minds of those present. Chas. G. Burton did a very neat piece of advertising for the Helios arc lamps. On the main stairway, leading from the rotunda to the convention hall proper Mr. Burton had set up a large white screen and upon it, thrown from Helios arc lamps set on the rotunda balustrade, images of the arcs between the carbons of the Helios lamps. These lamps were kept constantly burning, and the carbons, enlarged to about 10 inches in diameter, showed an arc not only beautiful in appearance but remarkable for steadiness of feed. It was really next to impossible to see the feed of the lamps. Fig. 3 shows the rack carrying the Helios arc lamps, both for direct and alternating currents. The screen is shown in the picture back of the lamp rack, but owing to the fact that a flash light was necessary to secure the photograph, the beautiful image of the burning carbons does not appear on the photograph of the screen. Direct current constant potential lamps were shown in operation. It is claimed for the Helios lamp that it is independent in feed and that there is no "see-sawing" in operation, and certainly the arcs on the screen seemed to prove this. The Central Electric company's supply exhibit, Fig. 2, in the convention hall included a line of specialties too numerous to mention in detail. Lundell motors for fan and power work were presented, likewise construction material of all sorts, incandescent and arc light supplies, central station, fire alarm, telephone, telegraph and house goods; Okonite wire, too, was kept to the front in a way which convinced the other wire men that "competition was the life of trade," and that "Okonite" proposed to have a goodly share of said trade. As one purpose of the Northwestern Electrical association meetings is to aid in the introduction of the highest grades of electrical work and goods, Mr. Latimer presented the highest class of his large line of specialties. The entire Central company's force, including Mr. Hoon, also lent its energies to a strong advocacy of the further introduction of interior conduit. Garton lightning arresters were also prominently displayed, as was also the Sweet automatic limit switch. W. R. Garton, the inventor of the Garton switch, it may be said, is now the railway manager for the Central company.

The Metropolitan Electric company, Chicago, did not make any special effort for a large display of its extensive line of specialties, but Representative L. W. Burch, the Northwestern agent of the company, did most energetic work in enlarging upon the merits of "Xntric" switches, Metropolitan sockets, Metropolitan lamps, Mack tape, I. X. L. weather-proof and N. I. R. rubber covered wires, porcelain cleats and tubes, knife switches, P. & B. products, and other equally valuable supplies. Mr. Burch reported a lively inquiry in trade, and also that he had recently taken some substantial orders, and, further, that prospects for good business in '95 were excellent. Fig. 4 shows the Metropolitan Electric company's table.

J. A. White did the honors, and did them well, for the Peoria Automatic Filter company of Peoria, Ill. Mr. White has an office at 355 Dearborn street, Chicago, and he thought enough of the Northwestern association convention to make the extensive display of filters shown in Fig. 5. The Peoria Automatic Filter company, under the management of Austin F. Johnson, secretary, has been pushing quietly to the front, and it is now in a position to take care of its rapidly increasing trade throughout the West. Mr. White was indefatigable in extolling the many advantages—or "the few advantages," as he put it—of the Peoria filter. In this device the oil is never disturb in the filtering vat, and there is nothing to force impurities into the wicks. Foreign matter goes to the bottom of the filtering vat, making it, the manufacturers claim, the easiest filter to clean ever invented. This is but one of the advantages, and those interested in filters may obtain some interesting details as to its operation from Mr. White, who stated, it may be said, that he had not only done good business in the line of introducing his filter among the convention delegates, but had also sold certain territorial rights to Milwaukee parties.

FIG. 5. EXHIBITS AT THE MILWAUKEE CONVENTION.

Electrical Specialist Geo. Cutter of course found it im-

possible to stay away from the convention, and with Mrs. Cutter went to Milwaukee over the Northwestern railroad Wednesday morning. Mr. Cutter, with his usual foresight, took good care to capture one of the best "stands" in the convention hall. Fig. 6 shows the great variety of Cutter specialties there exhibited. Mr. Cutter also exhibited his inevitable lamp-supporting pulley and its mate the swivel-pole pulley, which seems to meet general approval. He also had a new windlass which combines all the good points of a plain, geared and locking windlass in a simple manner, and a simple hanger-board for arc light work. His main switches and voltmeter switches were also present in a variety of sizes, and the latest version of his street-hood attracted a good deal of attention.

Of course President Willard W. Low of the Electric Appliance company, Chicago, was on hand. Mr. Low joined the delegates at Union depot, and went with the crowd over the St. Paul railway to Milwaukee. The Electric Appliance company's exhibit, Fig. 7, in the convention hall, although not a large one, was most prominent, and the little souvenirs, to say nothing of the fine "Paranite" cigars so generously distributed by Mr. Low, added many to the large number of friends who stood ready to reply to that easily answered question—"We've prospered—Why?" Mr. Low's genial character and straightforward business-like policy in all his dealings with the central station men throughout this country have been one of the strongest influences that have contributed to bring the Electric Appliance company to its present prominent and prosperous position. It was a matter of regret to the friends of the firm that Secretary Thos. I. Stacey was unable to be present also. But as Messrs. Low and Stacey constitute the life of the Appliance company, it was impossible for both officers to be away from the helm at the same time. No one knows, but someone whispered that, although Mr. Low did not make a very extensive exhibit and said nothing about what he was doing, still a number of good orders found their way into his pocket. As will be seen from the unique exhibit made by Mr. Low, shown in Fig. 7, this concern came in among the first as far as making itself thoroughly and happily known was concerned.

The Chicago General Fixture company's exhibit, Fig. 8, will no doubt be recognized by those who attended the convention. It occupied a prominent position at the door of the club room, where, from the good taste displayed in the arrangement, and the energetic work of Representative C. O. Baker, it became an object of general interest. This exhibit comprised a representative line of electric and combination fixtures and electrical supplies carried in stock by this firm. Particularly noticeable were the two-light electric brackets at the top of the board. The general outline of this fixture is unique and is characteristic both in design and workmanship of the individuality displayed in the manufacture of this company's fixtures. Samples of "Excelsior," the brand of high-grade rubber covered and

a table in the convention hall proper and another of arc lamps on a rack in the corridor outside of the hall. Messrs. M. C. Wheaton, A. C. Bunce and W. J. Ferris told of the merits of the various goods presented. Fig. 9 shows the arc lamp exhibit in the corridor. On the rack was the Thomson '93 arc lamp recently designed by Prof. Elihu

FIG. 2. EXHIBITS AT THE MILWAUKEE CONVENTION.

Thomson, to be used on direct, alternating, railway and other power circuits. In addition to this, on the same stand, there was exhibited in action a Thomson wattmeter. Messrs. Wheaton, Bunce and Ferris had plenty to do outside of describing the merits of the new arc lamps, for the table in the convention hall contained a handsome line of specialties, among which were the Edison new spiral incandescent lamps, the new Edison oval filament lamps, double-

FIG. 4. EXHIBITS AT THE MILWAUKEE CONVENTION.

weather-proof wire handled by this firm, were also exhibited. The insulation on the rubber-covered wire consists of an inner core of rubber absolutely free from sulphur and an outer core of pure vulcanized rubber with a weather-proof braiding over all. Besides these were to be seen standard cut-outs, switches, sockets, line wire, glass and porcelain insulators, tubing, bell and telephone supplies, etc, representing a complete line of electric supplies.

The General Electric company made two exhibits, one on

pole knife-blade switches, single and double-throw, double-pole snap switches, cut-outs, ceiling rosettes, porcelain insulators, cleats, carbons and the latest General Electric improved double-pole primary cut-out for the alternating system.

The Washburn & Moen Manufacturing company, Chicago, was represented by Channing T. Gage and George S. Whyte. These gentlemen exhibited a complete line of wires, Fig. 10, including their fire and water-proof insulated wire,

the "Salamander," "Crown" and "Globe" rubber insulate wires. Weather-proof, solid and stranded, incandescent lamp cord, office, annunciator and magnet wires, also extra flexible cord for raising and lowering arc lamps, suspension strand, bare copper wire, and the "Chicago" rail bond. Mr. Gage proved to those present by actual tests the fact that "Salamander" wire was absolutely fireproof, although as a result of these demonstrations, the genial electrician of the hotel, Mr. Fischer, commenced a still hunt for a short-circuit and "the man that did it."

## Convention Notes and Personals.

Electrical Inspector G. S. McLaren of the Milwaukee Board of Fire Underwriters was a familiar figure in the Pfister House rotunda.

Manager E. D. Haven of the Badger Typewriter & Stationery company made friends of the newspaper men by his prompt response to persistent demands for "copy."

H. F. Boggis, treasurer of the Edison Electrical Illuminating company and the Badger Illumioating company of Milwaukee, was in daily attendance at the sessions.

President F. J. Morawetz of the Wisconsin Electrical Construction company, Milwaukee, "did" both the convention and the banquet, and his genial manner won the hearts of the supply men.

The electrical newspaper men present were: Carl Kammeyer, *Electrical Engineer;* M. J. Sullivan, *Electrical World;* Fred De Land, *Electrical Engineering;* C. W. Forbrich and Frank L. Perry, WESTERN ELECTRICIAN.

J. R. Allen of the well known firm of Ball & Allen, consulting electrical engineers, Monadnock building, Chicago, went to Milwaukee on the C. M. & St. P. train and was in daily attendance in the Pfister House rotunda and at the convention sessions.

Electrician and Manager A. A. Forman of the Iron Mountain Electric Light & Power company, Iron Mountain, Mich., was present in full force, and it was easy to see that Mr. Forman was an "alternating" man right through, and his card illustrated this fact.

Among the late comers were "Joe" Stedman of the Page Belting company, Chicago, and the well-known electrical specialist, Geo. S. Searing, also of Chicago. Messrs. Searing and Stedman were none the less welcome from their late arrival, and it did not take them long to make up for lost time.

The story of "Electric Light Fixtures and Supplies" was ably told by C. O. Baker of the Chicago General Fixture company. Mr. Overbagh was unable to attend, but it is needless to say that Mr. Baker kept "169 Adams street, Chicago," and its fancy stock well in view before the many Wisconsio delegates.

The Dearborn Electric company, Chicago, was unable to make a display at the convention, owing to its having been so busily engaged in the preparation of its new catalogue. The Dearborn Electric company enters the field most energetically, and purchasers of supplies will find the new Dearborn catalogue worth perusual.

Electrical Engineer G. Herbert Condict of the Electric Storage Battery company, Philadelphia, read a paper at the convention. Mr. Condict has just installed an extensive storage battery plant for railway and lighting service at Merrill, Wis. He is a thorough believer in the future of the storage battery, especially in the West.

Manager F. E. Drake of the Standard Electric company, Chicago, owing to urgent business, was prevented from once more laying before the convention delegates the merits of that machinery which is now considered "Standard" in more ways than one. It was a matter of regret that Mr. Drake was unable to be present, for he has many friends,

not only among central station, and isolated plant men, and other buyers of electrical machinery, but among the supply men as well.

Electrical Engineer B. J. Arnold was prevented at the last moment by a sudden call out of town from joining the Chicago delegation on the C., M. & St. P. train. It was a matter of regret to many of Mr. Arnold's friends that he was not at the convention, as he is looked upon as one of its most enthusiastic and energetic members. It will be recollected that Mr. Arnold read a very interesting paper at last year's meeting.

FIG. 6. EXHIBITS AT THE MILWAUKEE CONVENTION.

A. E. Carrier told the story of the excellency of "Faraday" carbons. The Faraday Carbon company's headquarters are at Jeannette, Pa., where it manufactures electric light carbons, motor brushes, battery materials and other carbon specialties. Being in the vicinity of Pittsburg, this concern has the advantage of Pittsburg freight rates.

C. B. Case appeared in good form, and if there is any member of the association that is not now thoroughly informed as to the value of a proper combination of gas engine and accumulators, he failed to put in an appearance at the Milwaukee convention. Mr. Case is doing excellent work in introducing gas engines and the chloride accumulator.

Western Manager G. W. Conover of the Perkins Electric Switch Manufacturing company sent his full page "ad" to the convention to represent him, and stayed at home to take in orders for the Waterhouse incandescent lamp, the Gibbs snap switches, the Perkins sockets and receptacles, and the Perkins dove-tailed ceiling cut-out. A full stock of these goods is carried by Mr. Conover in Chicago.

Joseph M. Hill, the energetic special agent of the Columbia Incandescent Lamp company, St. Louis, left his Chicago office to be with the boys at Milwaukee and discourse upon the many merits of the Columbia lamp. Mr. Hill has been the hard worker for the Columbia company in Chicago and the surrounding territory, and it is safe to say has made many new friends for the Columbia lamp.

President John Valentine of the Valentine-Clark company, which handles poles, etc., in the Rookery, Chicago, couldn't resist the temptation to telephone for "Clark," and Mr. Clark's arrival a few hours later was one of the best indications that the late comer was afraid he would miss something if he remained "tied" up quietly at home in Chicago while "the other fellow" took advantage of a splendid opportunity to "post" the convention on "poles." Messrs. Valentine and Clark were warmly welcomed.

The Stanley Electric Manufacturing company, whose western office is at No. 307 Dearborn street, Chicago, as noted elsewhere, was represented at the Milwaukee convention by William S. Hine. Business may not be as lively in some quarters as in others, but when the western representative is obliged to utilize his mealtime in figuring on a high pressure long-distance transmission plant, it is not hard to imagine that the good name of Stanley transformers gives Mr. Hine plenty to do in making new estimates and filling orders.

William Goltz of Goltz & Sinclair, electrical engineers and contractors, Milwaukee, read an interesting paper before the convention. Mr. Goltz is well known as one of Milwaukee's most popular manufacturers' agents, handling Ideal engines, curved blade exhaust fans, and barrel switches for advertising displays, etc. Mr. Goltz's office is in the Academy building, Milwaukee, where he carries a large stock. His pleasant countenance and hearty handshake made him many new friends among those who came to the Pfister.

"Oh, yes; Charlie Gregory was there." And this time he came very near bringing his entire company. Manager F. J. Baker of the Chas. E. Gregory company did the honors with Mr. Gregory, but even the light of these two distinguished electrical men dwindled into absolute insignificance in comparison with the four handsome "stockholders" who, as Mr. Gregory stated, were most vitally interested in his business. A handsome group the four little Gregorys made, and it is needless to say their father will find, some day, in them his strongest "backing," and very "positive" backing, too.

J. H. Cooke of the Buckeye Electric company, 753 Monadnock building, Chicago, thought the convention of enough importance to warrant bringing company in the shape of his associate, F. J. Stafford. Messrs. Cooke and Stafford were "everywhere" and in contact with everybody, at least as far as the convention was concerned. Although no extensive exhibit was made, the few sample Buckeye lamps on a table in a handsome parlor on the second floor, backed by that ever-present personality whose kind consideration and unvarying courtesy is too well known to make anything beyond mere mention necessary, made a Buckeye "exhibit" in perfect harmony with the lamp, viz., a perfect success.

No man at the convention was received with greater congratulations than was C. B. Fairchild, editor of the *Street Railway Journal*, New York. As the majority of street railway men in the country, as well as electrical men in general, well know, Mr. Fairchild for some months has been on the sick list, and it must have been gratifying to him to receive the good wishes and considerate greetings of his friends, many of whom were astonished to find him once again in practically perfect health. Mr. Fairchild is now traveling about, and expects shortly to return to New York, stopping over on the way home to see a few friends in Chicago.

The Butler Manufacturing company, Chicago, was without a representative at the convention, but its full page in the "western newspaper" told the story very nearly as convincingly as could a clever personal representative. The Butler Manufacturing company makes what it claims is the best line of electric specialties to be found anywhere. It manufactures lamp shades, ceiling boards of all sorts, switches, headlights, lamp guards, screens, and a line of electrical novelties and specialties too numerous here to mention. Catalogue "1894," however, which will be sent by this concern on application, will interest every buyer of such fixtures.

M. B. Austin also formed one of the party which left Chicago on the convention train from the C., M. & St. P. depot at 8:30 Wednesday morning. Mr. Austin, as is now pretty generally known, is general western agent for the Safety Insulated Wire & Cable company, New York, and also for Holmes, Booth & Haydens of Waterbury, Conn., with office at 1533 Monadnock building, Chicago, and warerooms at 271-273 Franklin street. Mr. Austin is one of the best known young men in the western electrical circles, and his good record will undoubtedly insure for his companies many new customers. Mr. Austin made no display in the way of samples, but someone said he took it out to good purpose in "fine work."

Mr. Nashold, designer and manufacturer of the Nashold cleat, now being handled by the Nashold Cleat company, 934 Monadnock building, Chicago, was prevented from presenting his new quick selling specialty to the men of the Northwest at the convention. The Nashold cleat, which is patented in the United States, Canada, England, and in France, and for which a patent has been applied for in Germany, is said to be one of the most practical cleats made. It is formed of the finest glazed porcelain, in one piece, which gives it strength; it will lock the wire firmly and not break in putting up; it will never hold moisture, also never hurt the insulation; the wire can easily be put in place and removed without loosening the cleat.

General Manager Franklin S. Terry of the Sunbeam Lamp Manufacturing company, Chicago, in his usual convincing manner demonstrated the value of his Sunbeam "Vapor" lamp. As there wasn't a man at the convention who did not see the Kerite club-swinging exhibit, it is safe to say that there was no one who did not know that the two brilliant lamps on the end of the Indian clubs swung by "Professor" G. W. Patterson were "Sunbeams" in more senses than one. Mr. Terry said he had but one thing to discourse upon, and that was the Sunbeam "Vapor" lamp. It may be stated, though, that although Mr. Terry spent most of his time talking lamps, he was at the same time energetically pushing the well known "C-S" specialties, the C-S automatic magnetic cut-out receiving considerable attention.

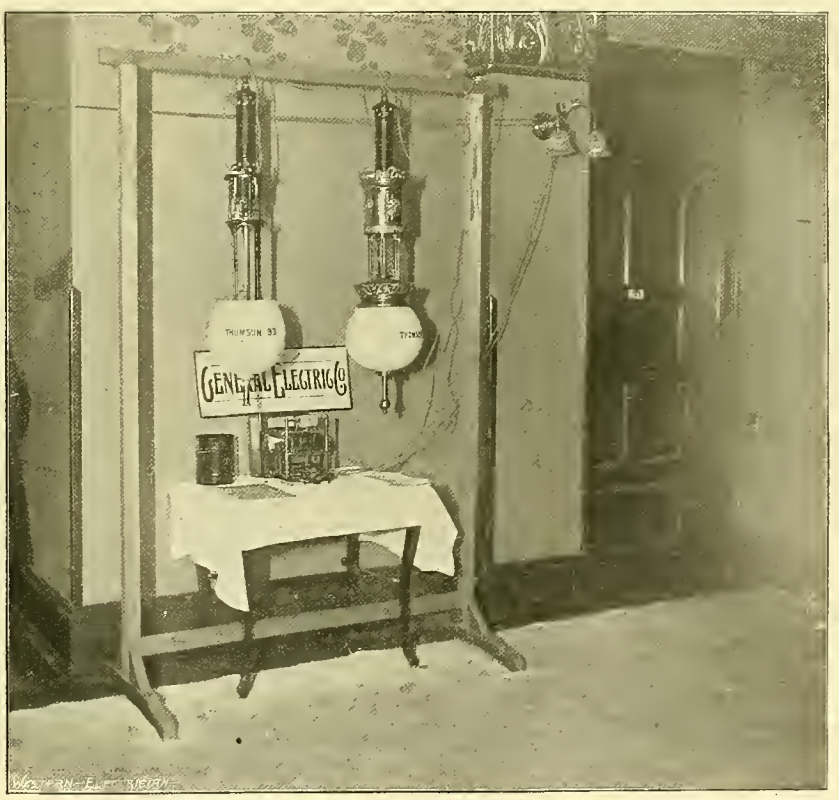



FIG. 9. EXHIBITS AT THE MILWAUKEE CONVENTIOT.

The New York Insulated Wire company was ably represented by its western sales agent, James Wolff. It is safe to say that if an unwary central station man ventured into the confines of the convention quarters at the Pfister House with an unfilled order in his pocket, or in his mind, he would have been a man of remarkable firmness, or perhaps, prejudice, had he been able to escape without giving the whole, or at least a part, to the "hustling" representative of

[*Continued on page* 43.]

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EXCELLENT judgment was displayed in selecting Chicago as the place of meeting of the mid-summer convention of the Northwestern Electrical association. Unequaled railroad facilities and hotel accommodations, as well as opportunities for seeing the latest advances in electrical engineering, are advantages that Chicago affords. There is no doubt that the local members of the association will provide ample entertainment for the visitors.

THE people of Chicago are accustomed to ride in cold street cars in the most severe weather. It is true that there are stoves in many cars, pipes and gasoline burners in others, but in all the cable and horse car lines there is no serious attempt made to properly heat the cars. This condition of affairs no doubt explains the complaint made by a contributor to the *Tribune*, who says that the electric cars on North Clark street are warm. They are heated by electricity, it is explained, and the passengers, so it is claimed, find them uncomfortable on account of the heat. This is really a most unique complaint and is worthy of notice.

COMMENTING upon the unfortunate condition of affairs in Brooklyn, the *Rochester Herald* inquires: "Isn't it a little absurd that the Brooklyn trolley companies should think that they know quite as much about their own business as the Board of Arbitration?" and it adds: "Any way, they ought to know that it isn't exactly polite to treat such omniscient dignitaries with contempt." The members of the board are well-meaning gentlemen, no doubt, but inasmuch as they have no power to settle the controversy their attempts to impress their importance upon the company and the strikers is really a grand-stand play for public effect. There is absolutely no excuse for the existence of the board as at present constituted, and it should be reorganized on entirely different lines, or, better still, it should be abolished.

IT seems to be the purpose of the advocates of the Pacific cable project to lose no further time in making the proposed enterprise an accomplished fact. The opposition manifested in this country to the granting of permission to lease Necker Island to the promoters of the enterprise has aroused the Canadian and English authorities to a realization of the conditions that prevail. According to a dispatch from Ottawa, Premier Bowell, speaking of the project, said that while there would no doubt be certain commercial advantages by the connection with Hawaii, the success of the enterprise was by no means dependent upon the United States consenting to the landing on Necker Island, as the alternative route by the way of Fanning Island would be adopted if the other route was dropped. The government had received tenders for both routes, and was not asking for any exclusive rights to land on Necker Island. As far as Honolulu was concerned, the advantages offered by the Australian-Pacific cable were important, for while it would not prevent the laying of a cable to San Francisco, it would give the Hawaiians the advantage of a connection direct with Australia, and thence to Asia, which the San Francisco route alone cannot offer.

Of course the English and Canadian governments recognize the fact that the establishment of a cable line connecting Hawaii with this continent and Australia will settle the question of controlling the Pacific cable for many years. It would not be practical to operate another line between Honolulu and this country, and the presence of the British on Necker Island would of itself be enough to keep other enterprises out. An "exclusive" franchise would not be required, for any franchise would prove practically an exclusive right.

WHATEVER the merits of the claims of the strikers on the Brooklyn street railway lines may be, there can be no doubt of the result of the controversy if the leaders countenance the violent measures to which individual strikers and misguided sympathizers have resorted. Public opinion, will not uphold any party to a controversy in resorting to such methods. Law and order must be maintained, and it is the duty of the government—municipal, state and national—to preserve the peace and protect life and property. There is no excuse for disorder, as the police force of the city is strong and the militia of Brooklyn is well disciplined and effective, consisting of four regiments and a battery numbering about 3,000 men. Then, too, there are in the city of New York several regiments that can be called out within a few hours. Surely if the authorities do their duty they can preserve order and enforce the law. The city government has nothing to do with the merits of the controversy. Its duty is to preserve peace, enforce the law and see that the public interests are protected. This can only be done by requiring the company to operate its cars according to the provisions of its charter and its franchises, and to see that it is afforded ample protection in doing this. Any attempt to molest or interfere with traffic should be summarily dealt with, and any person found obstructing tracks, disabling machinery or interfering with workmen should be punished. It is to be regretted that the strikers have been allowed thus far to have full swing. On Saturday last, according to the press dispatches, there was rioting in the streets The companies attempted to operate some of their lines and resorted to the expedient of sending out cars carrying United States mail. The only result was that the cars were surrounded and stopped and the drivers and conductors driven from their posts. The mob then commenced to wreck cars, the efforts of the militia to drive it back being only partially successful. Several pitched battles resulted, and, notwithstanding an order for more troops, the violence increased. There can be no excuse for such scenes of disorder and lawlessness; they are wholly unnecessary. The strikers themselves will be the sufferers, for the community will not tolerate such methods.

LIKE the former meetings, the convention of the Northwestern Electrical association at Milwaukee last week was an enthusiastic gathering and proved beyond doubt that assemblages of this character when properly conducted are both interesting and instructive to the participants and of vast importance to the industry. The report of the proceedings and the papers read before the convention, presented elsewhere in this issue, show that the members of the association attended strictly to business until the programme had been exhausted and then turned their attention to the amusement provided by the committee on entertainment with a keen appreciation that can be experienced only by those who have earned their holiday by hard work. Every feature of the meeting was thoroughly enjoyed, from the opening address of the president to the banquet, and it is needless to say that the visiting members fully appreciated the efforts that were required to arrange and successfully execute the plans of the several committees.

During the meetings several important topics were discussed. In the address of the retiring president attention was directed to the subject of municipal ownership of lighting plants and the abuses which their establishment entailed. A more appropiate subject could not have been selected, all things considered. It is to be hoped that the conservative business men of Milwaukee will consider carefully the words of warning and the protest which this address contained, remembering that the same standard of fair dealing and good faith should be maintained in all transactions with corporations that obtain between individuals. It is true that corporations at times overlook this fact, and there is considerable ground for the charges which Mr. Paige made against manufacturing or "parent" companies. But this does not excuse a city council from observing these requirements. Another subject of interest was the discussion over the advisability of enlarging the field of the organization, extending its scope and making it in a measure a national association. The objection that was successfully raised to this proposition was that the present organization was of much greater benefit to the members than it would be if it were to be developed on the lines of the National Electric Light association. The latter organization, it was pointed out, filled the field so far as a national association of lighting interests was concerned, and the American Street Railway association filled a similar place in its field. Under the present system and organization the Northwestern association did not conflict with the National association or the American association, but really receives much encouragement and aid from them. It was decided to continue as the Northwestern association, and during the ensuing year it is hoped that the new administration will enlarge the influence of the organization and make it an important factor in defending the rights of corporations in the legislatures and city councils whenever they may be attacked.

TWO states have already passed laws providing for the equipment of all street railway cars with vestibules, front and rear, and in both states the constitutionality of the law has been tested. Minnesota was the first state to pronounce in favor of this humane measure and Ohio soon after followed this example. Now New York, Wisconsin, Michigan, Indiana and Colorado have under consideration similar laws. Assemblyman Wilcox of Cayuga county has introduced into the New York Legislature a bill requiring street railway companies to have the front platforms of all cars propelled by electricity or cable inclosed or screened during the months of November, December, January, February and March, except cars attached to the rear of other cars. The purpose is to shield the motormen from wind and storm while in the performance of their duty. The bill provides that any corporation or person operating a car in violation of the law shall be fined $25 a day for each car so operated. In all the states the essential features of the bills are the same. The street railway companies, it is expected, will comply with the law without contest, although in some instances it is known the companies will fight the measure. General Manager Wyman of the Milwaukee Street Railway company announces that his company will oppose the bill. He says that in most cities where vestibuled cars have been tried they have been found impracticable and have been removed. Cars with vestibules are too heavy and cumbersome, and are objectionable because the view of the motorman is obstructed by the window in the vestibule. Mr. Wyman declares that partially vestibuled cars used by his company, are unsatisfactory. Not a day passes, he reports, that one of these cars is not disabled and taken to the repair shops or breaks down on the line and causes delay. Special extension trucks are required for them, as their weight is too great to run them on the longest trucks now in use. Mr. Wyman's statements are not corroborated by the reports from cities in which a fair trial of vestibule cars have been given. In Rochester, N. Y., for instance, where a liberal policy has been adopted by the company, the principal lines have been equipped with vestibule cars for several years, and now more than 100 cars of this description are in daily operation. The company will equip the remainder of its cars in a similar manner as soon as the work can be done. It may be observed for the information of street railway managers who oppose this law that the objections raised by the Milwaukee company, which practically covers the case of these companies, do not appear to be well founded and that practice has shown that there is really no ground for this opposition. On the contrary the cars are much more comfortable, and passengers as well as the employes of the company are better satisfied. The best sentiment of every community favors the improvement. It is a reasonable demand, and the companies will find that they will have considerable trouble convincing the public that the improvement is impracticable.

## Convention Notes ane Personals.

(*Continued from page 41.*)

the New York Insulated Wire company. Mr. Wolff was always "there," and his smiling counteoance and courtesy to all with whom he came in contact, to say nothing of the "jolly good fellow" in bis nature, made him a hard man to resist. It is safe to say he made an impression that will revert strongly to the benefit of his company.

Vice-president Herman Andrae of the New Andrae company, which recently succeeded the pioneer electrical house of Julius Andrae, was in constant attendance at the convention sessions and was also a steady frequenter at the Pfister House rotunda. Mr. Andrae found many con-

FIG. 10. EXHIBITS AT THE MILWAUKEE CONVENTION.

genial spirits and his courtesy in taking care of the transportation matters for stranger delegates was much appreciated. At the banquet Mr. Andrae was at the "proper end" of the table, and entered most heartily into the spirit of fun which prevailed at the festive board. During the last year Mr. Andrae's business increased so rapidly that he was almost prostrated from overwork, but under the new organization the concern will be able to take care of the even greater trade that came to it through its business-like methods of treating all customers.

M. M. Wood, the prolific young inventor, so well known through his being the sole owner and manufacturer of Wood's electric light and railway specialties, No. 1536 Monadnock building, Chicago, went to Milwaukee with the large party on the convention train over the St. Paul railway. Mr. Wood, in addition to his factory in Chicago, has an experimental laboratory at Berwyn, Ill., at which he is developing some highly interesting and unique novelties. One of his latest productions is the Eureka porcelain cleat. He claims for this that it is the only straight line self-locking cleat made. As he aptly expresses it, "You pull the wire; the cleat does the rest." This specialty is made in one piece, is light, strong, ornamental, thoroughly glazed, and never lets a wire slip. Mr. Wood is a keen advertiser, and his business card, distributed throughout the convention, speaks of this for itself.

While not making any display in the way of samples, President and Treasurer William S. Hine and Secretary Max A. Berg of the Wallace Electric company, Chicago, allowed no grass to grow beneath their feet. Mr. Hine, as is well known, is also western representative of the Stanley Electric Manufacturing company, with factory at Pittsfield, Mass. In his dual capacity he had his hands full. Mr. Hine arrived at the convention after the opening, but Mr. Berg represented the Wallace company on the Chicago, Milwaukee & St. Paul convention train from Chicago to Milwaukee, meeting Mr. Hine afterward at the Pfister. As is well known, the Wallace Electric company has pushed itself to the front with remarkable rapidity, and no little credit for the concern's present success is due to the energy of its officers, whose courteous treatment of all with whom they have business dealings has done not a little toward making many firm friends.

Carl K. MacFadden of the Nutting Electric company, 128-130 South Clinton street, Chicago, was unable, owing to very pressing business in Chicago, to present his new wax wheel arc lamp to the convention. He sent, however, a very loud talking representative in the form of a full page "ad." in the WESTERN ELECTRICIAN, which excited considerable notice, especially from the fact that the Nutting wax wheel arc lamp is now used to illuminate "the best lighted tunnel in the world." For the benefit of those who have never investigated the Nutting wax wheel lamp, it may be said that this lamp operates without magnets, springs, clutches or escapements; it is simplicity itself. The Nutting company is now turning out its perfected lamp for series constant current circuits, direct current constant potential circuits, alternating circuits, and for 500 volt street railway circuits. Buyers of lamps will find it worth their while to send to the Nutting Electric company for a copy of "The Wax Wheel Lamp."

C. D. Wilkinson represented the Western Electric company, Chicago, which is now pushing more energetically than ever before its supply business. Messrs. E. M. Scribner and C. D. Wilkinson are the men in active touch with this branch of the trade. The Western Electric company is now carrying a complete stock of Bryant specialties, and has put out a special catalogue covering these goods. It is also selling and carrying a large stock of Pass & Seymour's china specialties. A special catalogue covering this material is also obtainable from the company. As the company is thoroughly in earnest in pushing this branch, the supply men of the West will bave to look to their laurels. Mr. Wilkinson took no samples to the convention, and therefore attempted no display. It was whispered, though, that while he made no attempt at show, he had something very interesting in the line of "new prices." Without doubt the Western Electric company is remarkably well equipped for the general supply business. With its immense factories, both East and West, and likewise abroad, it certainly has facilities which should enable it to prove a most important factor in the consideration of purchasing agents desirous of a high class of goods and prompt shipments.

## National Electric Light Association.

The Trunk Line association has granted a rate of a fare and a third for the round trip, on the certificate plan, for members and delegates attending the eighteenth conve nti on of the National Electric Light association, to be held at Cleveland, O., February 19th, 20th and 21st. Negotiations are now pending for a special train from New York to Cleveland, notice of which will be given as soon as the route is selected and schedule arranged.

The indications now point to a large attendance at the Cleveland convention of the National Electric Light association. Hotel accommodations should be reserved early to insure comfortable quarters. The headquarters will be at the Hollenden Hotel, the rates being: On the American plan, $3 to $5 per day; European plan, $1 to $3 per day. Other hotels in close proximity to the Hollenden are: The Weddell, $3 to $5 per day; The Stillman, $3 to $5 per day Forest City, $2 to $3 per day; Kennard, $2 to $3 per day; American, $2 per day.

## Underwriters' National Electric Association.

At the recent meeting of the Underwriters' National Electric association in New York the following named officers were elected: President, C. E. Bliven of Chicago; vice-president, W. A. Anderson of New York; secretary and treasurer, C. M. Goddard of Boston; electrical committee, F. E. Cabot of Boston, Wm. McDevitt of Philadelphia. Geo. P. Low of San Francisco, A. E. Van Geisen of New York, E. A. FitzGerald of Syracuse, N. Y., Edward Leloup of New Orleans, W. H. Merrill of Chicago, A. M. Schoen of Atlanta, A. E. Braddell of Philadelphia.

The electrical committee reported as follows on the carrying capacity of wires and fuses:

It must be clearly understood that the size of the fuse depends upon the size of the smallest conductor it protects, and not upon the amount of current to be used on the circuit. Below is a table showing the safe-carrying capacity of conductors of different sizes in Brown & Sharpe gauge, which must be followed in the placing of interior conductors:

| | Table A. Concealed Work. | Table B. Open Work. |
|---|---|---|
| B. & S. G. | Amperes. | Amperes. |
| 0000 | 218 | 312 |
| 000 | 181 | 262 |
| 00 | 150 | 220 |
| 0 | 125 | 185 |
| 1 | 105 | 156 |
| 2 | 88 | 131 |
| 3 | 75 | 110 |
| 4 | 63 | 92 |
| 5 | 53 | 77 |
| 6 | 45 | 65 |
| 8 | 33 | 46 |
| 10 | 25 | 32 |
| 12 | 17 | 23 |
| 14 | 12 | 16 |
| 16 | 6 | 8 |
| 18 | 3 | 5 |

By "open work" is meant construction which admits of all parts of the surface of the insulating covering of the wire being surrounded by free air. The carrying capacity of 16 and 18 wire is given, but no wire smaller than 14 is to be used except as allowed under the rules.

An interesting set of resolutions on the subject of grounding the neutral wires on Edison three-wire systems was also adopted. Following is the essential portion:

*Resolved*, That the practice of grounding the neutral wire in the Edison tube system is a constant menace to the properties lighted thereby.

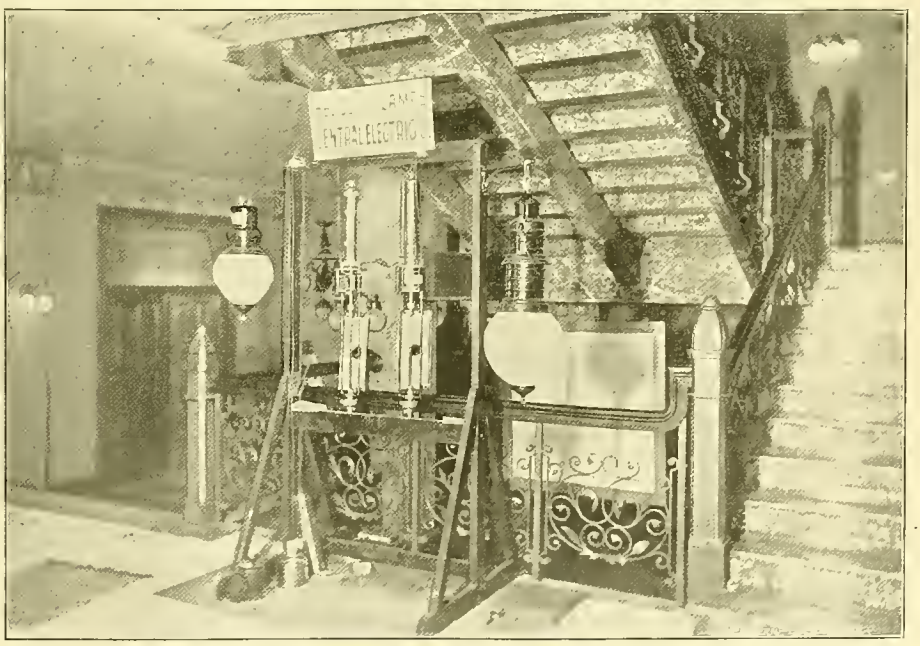


FIG. 3. EXHIBITS AT THE MILWAUKEE CONVENTION.

*Resolved*, That the practice followed by some Edison stations of blowing out or burning out grounds occurring either on the positive or negative sides of the underground system is extremely dangerous, and evinces a wanton disregard for the safety and welfare of property interests.

*Resolved*, That a copy of this resolution be furnished each board of fire underwriters having primary jurisdiction, with recommendation that such steps be taken as may be necessary to avert this great hazard.

It is probable that Tampa and Port Tampa, Fla., will be connected by an electric railway.

## Members and Visitors.

Following is a list of the members, active and associate, who were present at the meeting:

ACTIVE MEMBERS.

W. B. Baker.....Waupaca, Wis.
G. L. Cole.....Beloit, Wis.
E. L. Debell.....Sheboygan, Wis.
George A. Davis.....Neenah, Wis.
Edward Engebretsen.....Whitewater, Wis.
E. G. Mullen.....Milwaukee, Wis.
George A. Farwell.....Waukesha, Wis.
P. H. Korst.....Racine, Wis.
I. P. Lord.....Waupaca, Wis.
M. Nippert.....Lake Geneva, Wis.
C. C. Paige.....Oshkosh, Wis.
T. A. Pamperin.....Oconto, Wis.
John Schuette.....Manitowoc, Wis.
W. H. Thorp.....Beaver Dam, Wis.
H. C. Thom.....Madison, Wis.
J. F. Wiley.....Stevens Point, Wis.
Pliny Norcross.....Janesville, Wis.
William Goltz.....Milwaukee, Wis.
Herman Andrae.....Milwaukee, Wis.
Lucius T. Gibbs.....Milwaukee, Wis.
T. F. Grover.....Wauwautosa, Wis.
S. G. Coleman.....Milwaukee, Wis.
George Grimm.....Jefferson, Wis.
O. M. Rau.....Milwaukee, Wis.
T. R. Mercein.....Milwaukee, Wis.
H. Amundson.....La Crosse, Wis.
W. P. Fitch.....Mason City, Ia.
Edward Daniell.....Menominee, Mich.
J. H. Harding.....La Porte, Ind.
Fred De Land.....Chicago, Ill.
Charles Cuno.....Oconomowoc, Wis.
H. F. Boggis.....Milwaukee, Wis.

ASSOCIATE MEMBERS.

A. C. Bunce.....Chicago, Ill.
W. W. Low.....Chicago, Ill.
M. L. Stevenson.....Cleveland, O.
H. D. Latimer.....Chicago, Ill.
S. F. B. Morse.....Chicago, Ill.
George Whyte.....Chicago, Ill.
Loren W. Burch.....Chicago, Ill.
C. E. Gregory.....Chicago, Ill.
M. J. Sullivan.....Chicago, Ill.
John R. Markle and wife.....Chicago, Ill.
J. Stedman.....Chicago, Ill.

NEW MEMBERS.

Ft. Atkinson Electric Light company.....Ft. Atkinson, Wis.
James Montgomery.....Wausau, Wis.
Lewis Brittan.....Waukegan, Ill.
G. H. Strang.....Richland Center, Wis.
F. A. Copeland.....La Crosse, Wis.
C. H. Ruggles.....Milwaukee, Wis.
George S. McLaren.....Milwaukee, Wis.
H. C. Higgins.....Marinette, Wis.
A. A. Forman.....Iron Mountain, Mich.
C. D. Wilkinson.....Chicago, Ill.
W. F. Collins.....Wausau, Wis.
Willis D. Jameson.....Chicago, Ill.
J. A. White.....Peoria, Ill.
Richard A. Dix.....Wauwautosa, Wis.
E. P. Ingham.....Fargo, N. D.
J. E. Heaton.....Reedsberg, Wis.
Charles L. Rodman.....Ravenna, O.
J. H. Cooke.....Chicago, Ill.
Hiram Stedman.....Berlin, Wis.
Channing T. Gage.....Chicago, Ill.
John Valentine.....Chicago, Ill.
M. A. Warren.....Baraboo, Wis.
M. B. Austin.....Chicago, Ill.
R. H. Pierce and wife.....Chicago, Ill.
E. M. Highlands.....Clinton, Ia.
John D. McLeod.....Milwaukee, Wis.
Charles G. Burton.....Chicago, Ill.
C. D. Wyman.....Milwaukee, Wis.
Max A. Berg.....Chicago, Ill.
John C. McMynn.....Chicago, Ill.
J. A. Wolff.....Chicago, Ill.

The following named visitors were in attendance:

F. J. Stafford, Jos. M. Hill, F. L. Perry, Ernest L. Clark, F. J. Baker, W. J. Ferris, Irwin C. Hoon, George S. Searing, J. R. Allen, C. O. Baker, William S. Hine, Franklin S. Terry, Charles W. Forbrich, M. C. Wheaton, G. W. Patterson, M. M. Wood and George Cutter, Chicago; E. D. Haven, F. J. Morawetz, C. B. Case, A. C. Bunce, Milwaukee; C. B. Fairchild, New York; G. Herbert Condict, Philadelphia, Pa.; A. E. Carrier, Jeannette, Pa.

Several years ago a party of eastern capitalists who are interested in the Leadville, Colo., Water company figured on putting up a large electric power plant at Leadville, to run the mines and smelters. Mr. Priddy, president of the water company, received word from these capitalists recently that they would now put up the money to erect the plant already marked out. The gentlemen interested are Governor Cleves, the newly elected governor of Maine, William Hanks, a capitalist of Vermont, W. W. Mason, a banker of Portland, Me., and Mr. Priddy of Leadville. The necessity of an electric power plant to run the mines and smelters has long been felt in Leadville, and the news is received with welcome by the mining camp. The pipe line and the power plant together will cost between $150,000 and $175,000, and most of this money is already raised. The line will be twelve miles long and the pipe laid will be 36 inches in diameter. The line will tap the Arkansas river at Bird's Eye gulch and will be run along the Oro & Fluming company's ditch into the city and will then turn down Leiter avenue to Front street, where the power plant will be put up. The construction of the pipe line will cost $100,000. It will require nearly 100 carloads of iron bands for the work.

## Death of A. H. Bauer.

Alexander H. Bauer, chief electrician of Pullman's Palace Car company, died in New York on January 15th. Mr. Bauer had been afflicted with Bright's disease for some time, but a speedy termination of his illness was not anticipated, and as he had been in better health of late his death was comparatively unexpected. He passed away without pain and in full possession of his faculties. Mr. Bauer was probably the foremost authority on electric train lighting in the United States, and he was well known to electrical men. He was also an old-time telegrapher and was for several years identified with the storage battery business.

Mr. Bauer was a native of Baltimore, and was born on August 9, 1846. He was of the type of men known as "self-made," the success that he attained being solely the result of his own ability and energy. At the age of thirteen he entered the service of the Baltimore & Ohio Railroad company as a messenger boy. He became a telegraph operator, and at the outbreak of the war, in 1861, he was assigned to the office at Annapolis Junction. He continued in the service of the railroad company until 1864, working in several offices in western Virginia and frequently acting as a government operator during the campaign in that section of the country. In 1864 he took a position with the United States Telegraph company at Philadelphia. After the war Mr. Bauer joined the Western Union force in Baltimore, filling various positions, from operator to manager of the "gold and stock" ticker service. Afterward he was made manager of the Mutual Union Telegraph company, on the collapse of which he permanently retired from the telegraph business. At one

A. H. BAUER.

time he was connected with the Edison Telephone company at Baltimore.

From 1882 to 1888 Mr. Bauer was engaged in the storage battery business. He filled responsible positions with the Electric Storage company of Baltimore and the Electrical Accumulator company of New York and became well known to the electrical fraternity. On February 18, 1888, he was appointed electrician of the Pullman company, and he remained in this responsible position to the time of his death. Mr. Bauer devoted much thought and experiment to the electrical lighting of steam railway trains. He prepared several papers on the subject, with which he was thoroughly conversant, and made many valuable improvements in this line. Of late years he had made his headquarters in Jersey City, where he could oversee the operation of the lighting plants on through trains running south and west from New York, but he was often at the general offices of the company in Chicago, where he was well known.

Mr. Bauer was respected for his practical electrical attainments and well liked as a man. He leaves a wife and an adult son, the latter being also engaged in the electrical business. The interment was at Baltimore.

## La Roche Electric Works.

Official notification is made under date of January 18th of the assignment of the La Roche Electric Works of Philadelphia. It is said that at the annual meeting of the stockholders on January 9th it was decided that it would be advisable for the company as a corporation to go into liquidation. The reason assigned for this action is "insufficient capital to meet the demands of an increasing trade; and as the condition of the financial world to-day is such that it is a practical impossibility to obtain capital for a manufacturing corporation, it was deemed advisable to liquidate while the company was still solvent and accept certain propositions which have been made them." An assignment was made to J. Franklin Stevens, formerly secretary and treasurer of the company. The assignee announces on behalf of the company that there are ample assets held in trust by him to liquidate the claims of all creditors in full and leave a surplus for the stockholders.

F. A. La Roche has secured new financial support, and he proposes to purchase the entire equipment of the La Roche Electric Works and continue the business with increased facilities under the title of F. A. La Roche & Co. For the present the business will be continued at the factory of the La Roche Electric Works, American and Diamond streets, Philadelphia, until more commodious quarters can be obtained.

## The Stadt Theater Fire.

Fire destroyed the Stadt Theater in Milwaukee on Tuesday, January 15th. The work of destruction occupied only about two hours, and the loss aggregated something like $70,000.

The circumstances afford the electrical constructor as well as the user of electric current a valuable object lesson. The theater had been elaborately dressed and arranged for a charity ball, which was to take place in the evening, and the final touches to the very extensive decorations were being made. In the center of the stage was a temporary chandelier put in for the purpose of supporting the word "Charity" in illuminated letters. This chandelier was draped in tarleton and from it were looped streamers of gauzy parti-colored and highly inflammable material. About 11:30 A. M. the committee, desiring to see the effect of the preparations, which were just about complete, had the current turned on the chandelier, and according to the account of a Milwaukee gentleman, "the light blazed up brightly and then with a hissing sound a wire snapped, sputtering flames ran swiftly down the streamers and out toward the scenery that ran up to the roof."

All are agreed that the origin of the fire was electric current, but there are several ways by which this might have caused the disaster, and which should never have been permitted to pass the eye of an inspector: First, overloading the wire, so that an excess of current would heat and burn it off; second, an imperfect contact, either at a lamp or at an unsoldered joint, might have caused an arc; and third (which is probably the true explanation), an uncovered fuse wire or strip melted, and the molten metal, from want of a protecting cover, struck and lighted the inflammable material which surrounded it.

The excuse offered for poor construction in similar cases is that it is only temporary and consequently does not require as much care as permanent work, and there is a widespread belief among consumers of electric light and power currents that anybody can run a wire and "tap on" to an electric conductor as well as an expert, and there are those believing this who leave no stone unturned to evade an inspection of their plants by electrical experts. Too often, in temporary work, joints are left unsoldered, fuse blocks are left uncovered, insulators are omitted, second-hand and imperfect wire is used, wires are overloaded, opposite poles are bunched together, flexible cords are twined around grounded gas fixtures, the very cheapest of material of all kinds is used, and then—"there is no use to pay for having it inspected, for it is only temporary," is what the constructor tells the consumer.

## Track Sweepers for Philadelphia Trolley Cars.

All the passenger railway companies are prepared for snowstorms, and with new electric sweepers expect to keep their tracks clear, says the *Public Ledger* of Philadelphia. The Philadelphia Traction company used electric sweepers last winter on the Thirteenth and Fifteenth, Twelfth and Sixteenth, and other lines which were then operated by electricity.

Additional sweepers have been obtained for the lines on which the trolley system has been put in operation since last winter.

Electric sweepers are propelled by motors of the same power that the cars are provided with, and in a cab there another motor to drive the revolving brooms. The broom of the old horse sweepers were driven from the axles to which they were geared.

The People's Traction company has purchased sweepers from the Lewis & Fowler company of Brooklyn. These sweepers are of a somewhat different type than those purchased by the Philadelphia Traction company. The cabs cover the entire sweeper and protect the 25 horse power motors for driving the brooms and the various levers which are necessary to change the positions of the brooms. There is a 25 horse power motor on each axle to move the machine. The People's Traction company has purchased six of these sweepers, and they have been sent to the depots of the various lines.

Twelve sweepers have been purchased by the Electric Traction company from the Lewis & Fowler company and from the J. G. Brill company of Philadlphia. They are similar to those mentioned and have been sent to the depots of the different lines of the system.

The Central New York Telephone & Telegraph company is about to erect a five-story stone building on Montgomery street in Syracuse. The company is also preparing to place its wires underground.

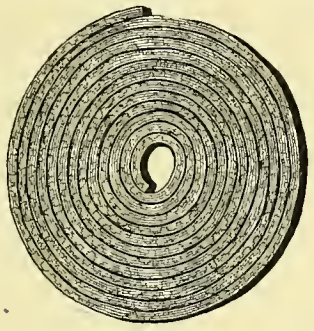
## A Storage Battery Experience.[1]

By G. Herbert Condict.

The city of Merrill, with a population of about 9,000, is situated on the Wisconsin river in the lumber regions of Northern Central Wisconsin, 255 miles north of Milwaukee. The city is divided by the Prairie river (which here flows into the Wisconsin) into two parts, the east side and the west side. The Merrill Railway & Lighting company operates the trolley road running between the two extremes of the city, a distance of 1¾ miles. The road was built for three cars with two turnouts, but only two cars are run ordinarily. The cars are run without schedule, making the round trip in from 20 to 30 minutes, according to demands of travel. Power is supplied from a water wheel at the east side plant of the company, situated near the track, about one-half mile from the east end. The water wheel is run without governor, as that was found to be useless owing to sudden variations of load. As can be readily understood the running of cars under these conditions was not at all satisfactory.

The electric lighting of the city is divided between two stations, the east side being run from the water power plant before mentioned, situated at the center of the east side light distribution, the west side from a steam plant. The east side equipment consists of two 25 kilowatt Edison dynamos, on the three-wire system, carrying a maximum of 1,000 lights, and a United States machine for municipal lighting carrying 150 lights, 500 volts, five lamps in series. The west side equipment comprises a 20 kilowatt Edison machine, carrying a maximum of about 400 lights on the two-wire system, a Weston 150 light 500 volt dynamo and a 30 light arc Thomson-Houston machine. There are no gas works in the town.

The storage battery plant recently installed is situated midway between the east and west side stations, on the line of the trolley road, about three-fourths of a mile from the east side power house and one-fourth mile from the center of west side light distribution. The plant consists of 240 11"E"chloride accumulators with a capacity of 500 ampere hours at 50 ampere rate. The batteries are divided into four series of 60 cells each, connected to a switchboard, so arranged that the cells may be connected to the railway, 240 in series, or to the lighting circuits in two parallel series of 60 cells each on each side of the three-wire system, capable



GARLOCK'S WATER-PROOF HYDRAULIC PACKING.

of supplying nominally 400 16 candle power lamps for ten hours, or, at maximum discharge, 600 lamps. An independent feeder connects the battery with the east side power house three-fourths mile distant. A variable resistance is placed in circuit between battery and railway so that when the battery is fully charged, requiring a voltage of 600, the voltage on the railway may be cut down if necessary.

The operation of the east side lighting and the night running of cars (or rather car) was most unsatisfactory before the battery plant was installed. Owing to lack of power it was necessary to couple together railway and lighting water wheels, so that the slightest variation in railway demand was apparent in light. Only one car could be run during lighting hours. That the dwellers in Merrill's east side should consider electric lighting a failure and that the traveler in the slow traveling, dimly lighted car sighed for the return of the ancient horse car, is not to be wondered at. On January 4, 1895, the battery was connected to the railway circuit. A great improvement in running of cars was immediately noted by all, but it was at night that the contrast was most apparent. The two water wheels were connected together as usual, but the railway generator charged the battery at a steady rate of 20 amperes instead of running a car with its ever varying demand of from 0 to 120 amperes. Instead of one dimly lighted, slow running car, two brilliantly lighted cars were operating at the highest speed allowable on the streets; instead of a succession of sharp peaks the voltage "curve" of the lighting circuit became practically a straight line; instead of 9 volts variation on each side of three-wire system as at first, there is practically no variation, demonstrating most clearly the capability of the battery to respond to all demands of railway, no matter how severe. On several occasions the two cars were operated by the battery alone for several hours at a stretch, thus in the daytime allowing the entire shutting down of the power plant and at night of the use of the two water wheels exclusively for lighting.

The company intends to increase its power at the east side plant by the addition of a wheel to operate the railway generator. By this addition the two wheels now in use may be utilized for east side lighting while the battery carries the west side incandescent lighting. The battery will be charged during the day as at present, from the railway generator, at the same time keeping voltage even on the railway circuit. This plan will enable the company to do away entirely with the west side steam plant, there being surplus water power sufficient to run the arc and 500 volt incandescent machines now at the west side.

1. Address at the meeting of the Northwestern Electrical association, Milwaukee, January 16-18, 1895.

## Electrical Business.

During the discussion at last week's convention of the Northwestern Electrical association in Milwaukee, Chas. E. Gregory of Chicago made the following remarks on "Electrical Business:"

"To the station superintendent I would say, cheapen the cost of your product by practicing true economy, and a few suggestions along this line may not be amiss. The production of steam being the chief item of expense, the operator should know what furnace boiler and grate afforded the greatest evaporation for the dollar expended. The engine for transforming your steam into power, the generator which is to transform the initial horse power into the watt which you sell to your customer, the workmanship employed in your distributory system, the efficiency of the lamp furnished—are all worthy of very careful consideration.

"Sentiment is often a barrier to good business, and I have no doubt that many of you are in the dark on some of the salient points mentioned. Would it not be good business to enlist the services of an engineer competent to advise you if such is the case? If you cannot overcome the ever-present scale in your boilers, would not a chemical analysis of the water you are using and a prescription for counteracting the scale-forming ingredients therein contained lessen the cost of producing steam? I think it would.

"From the standpoint of a supply man, I can voice my opinion as to what constitutes good electrical business, and am prepared by facts to answer any criticism. Sell only such material as you can stand behind with an absolute guarantee that it is suited to the work contemplated. When you have obtained the confidence of your customer you have paved the way to a profitable business with him. Turn orders down, or buy of a competitor with which to fill an order, rather than ship an inferior article. In purchasing electrical material, quality should be first considered, then the price. First earn the reputation of being trustworthy and you are sure to earn the dollar.

"As the electrical business takes on age and the novelty of the new invention wears off, we find ourselves very near to the plane upon which we find the iron and woodworking industries. There was a time when we paid $100 for a series arc lamp, $80 a thousand for carbons, charged $1 per night for commercial arc lights and 50 cents admission to our wonderful little engine rooms. Then it could be truthfully said that we were nursing the infant, but the advertisement—"For Sale: 500 horses. We have adopted electrical equipment. Apply to Chicago Street Railway company"—which appeared in the *Chicago Tribune* of last Sunday will aid in convincing you, if necessary, that we are no longer nursing an infant, but a giant who requires at least $600,000,000 per annum for his supplies and expenses."

## High Potential Switch.

A new type of high potential knife switch has been designed by Charles H. Herrick, E. E., and is manufactured by the W. S. Hill Electric company, No. 133 Oliver street, Boston, Mass.

The cut shows one of a group of six switches now in use at the station of the Narragansett Electric Lighting company of Providence, R. I., where they are successfully carrying currents of 400 amperes at 1,000 volts alternating current.

With the advent of large direct-connected generators a need for a switch to handle and transfer the heavy currents was felt, and Mr. Herrick has successfully met the demand. It will be seen that the switch is very quick break, has a flash guard between its opposite poles, breaks both machines and circuit and has its yoke at a point of absolute safety, both to operator and switch. In operation there is no flash when the switch is thrown and the slightest possible "wink" in the lamp to which it supplies current. It will also be seen that the illustration shows a switch adapted for use on the front of switchboards, but designs have been completed for the same type of switch to be placed on the rear of the board. This type is operated by a lever and handle extending through a slot cut in the switchboard. The switch has solid cast copper blades, micanite insulations on yoke and the well-known Hill reinforced contacts, and will be given a carrying capacity of 50 per cent. in excess of its regular duty to allow for all reasonable overloads. It is adapted for all varieties of duty, from 110 and 500 volt circuits to those carrying 2,000 volts alternating current.

It is the intention of the Hill company to build these switches in all sizes and types as demand may arise for for them, and it will design this switch to perform any special duty and guarantee results. The Hill company has given it the name of "Herrick high potential switch."

As noted, the illustration shows the switch in use on the alternating switchboard designed by Mr. Herrick for the Narragansett Electric Lighting company, which is capable of handling 50,000 to 100,000 16 candle power lamps. The design of this board is such that all changes of machines and circuits are made instantly and without the use of plugs or cables of any sort. The generators can be arranged to run in multiple or independently as desired, provision being made in the design of the board to admit of this feature. This board was also the product of the Hill company's shops and is strikingly handsome, being 22 feet by six feet in size and constructed of Italian marble.

The Hill company will be glad to answer all inquiries and make quotations to all who may be interested.

## Garlock's Water-proof Hydraulic Packing.

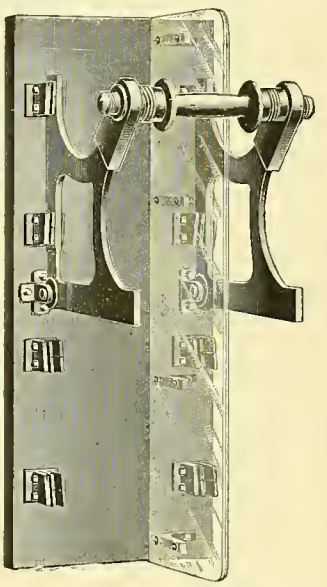
The constant demand for a superior packing for the plungers and pistons of pumps, pumping and hydraulic machinery induced the Garlock Packing company of Palmyra, N. Y., to produce a packing to meet all requirements. The water-proof hydraulic packing is the outcome of numerous experiments and practical tests, in the water ends of pump plungers, pump pistons, hydraulic elevators and hydraulic machinery, and the results, it is said, fully justify the company's claim that it has produced a first-class water-proof packing for light or heavy duty, made of the best flax and thoroughly lubricated with a water-proof compound which is strictly free from acid. This packing is made in all sizes up to two inches, and is placed on the market in the form shown in the illustration.

Heretofore the best rawhide hydraulic packing answered the purpose well for a time, but soon became water-soaked and soft from the use of oils, losing its strength; and piston plungers were sure to leak badly, requiring constant repacking. This packing is intended to resist excessive pressures and retain its solidity. One of the principal claims for this packing is that it is absolutely water-proof and oil-proof. Engineers who daily experience the difficulties of leaky pump plungers will no doubt greatly appreciate the advantages claimed for this article.

## Cincinnati Telephone Service.

At the recent annual meeting of the Cincinnati Telephone company General Manager Stone made the following statement:

| | |
|---|---|
| Average number of connections per day (week days, 24 hours) | 52,110 |



HIGH POTENTIAL SWITCH.

| | |
|---|---|
| Average number connections per day (Sundays, 24 hours) | 10,000 |
| Connections made during the year (week days, 313 days) | 16,310,430 |
| Connections made during the year (Sundays, 52 days) | 520,000 |
| Total number of connections for the year ending December 31, 1894 | 16,830,430 |
| Average number of connections per subscriber per day | 13 |

The average cost to subscribers is a fraction less than two cents per message, including answers thereto. There is no fraction of a cent small enough to estimate the cost per message to the majority of large users of the telephone, and there is no service that gives as much value for the amount expended as the telephone.

The low rental fixed by this company for copper metallic circuits, equipped with long-distance instruments, has been appreciated so highly by our patrons that about half of our subscribers have availed themselves of that class of service. All trunk lines between the different exchanges, and most of our toll lines, have been changed to copper metallic circuits. The advent of the long-distance lines in this city makes it possible for a local long-distance subscriber to talk to more than 100,000 other subscribers in the United States using the long-distance telephone. This class of service has proved so satisfactory that we have several hundred orders on file to change subscribers' lines and instruments from grounded to metallic circuits, and it is reasonable to assume all local subscribers will avail themselves of this perfect service during the year 1895.

The total number of toll messages sent and received over toll lines during the year 1894 was 102,141, an increase of 5,933 messages over 1893.

Our records show that the per cent. of profit to the company from metallic circuit subscribers is less than the per cent. from grounded line subscribers. This comes from the fact that two copper wires, three cells of battery and a bridging bell must be maintained to properly operate a metallic circuit equipped with long-distance instruments, while less than half that equipment is required to be maintained for

grounded lines. The constant extensions of electric street railroads and electric lights have increased the noise on grounded lines until it is impossible to give satisfactory service over them, and there is no alternative but to change them to metallic circuits (two copper wires) equipped with long-distance instruments.

## Incandescent Lighting on the Meter System Compared with the Contract System.[1]

By G. L. Cole.

In taking up the subject of incandescent lighting on the meter plan, I shall state my own experience from the date of my going to the city of Beloit in September, 1893. At that time I found my customers divided, some on the contract and others using meters. Now the question arose, whether I should furnish this current on the European, meter plan—pay for what you receive—or the American plan by contract—take all you can get. Two questions came up for consideration in changing from contract plan to meter system. First—A considerable outlay in meters. Second—Would the additional returns warrant the change?

To compensate me for the extra investment in the meters, I charge meter rental, which pays a good percentage. As showing the additional profit in the meter over the contract system, I will give an example. I had a customer on the contract plan who was paying $3.50 per month for the electric current in his residence. I changed him to meter basis and his bills, run on the meter plan, for seven months, were $53.49, an average of $7.64 per month. There is a good deal of satisfaction to feel that what current the customer uses I am receiving pay for, and not is wasted, as is generally done on the contract plan. When I furnish current on the metter plan and the customer leaves his residence for a short time, I make a minimum charge of $1 per month in addition to meter rental, while if this service were furnished on contract the usual cry would be raised, "We have not used the lights." Unless a discount were made dissatisfaction would arise.

Another advantage was that I could use a smaller transformer to supply the customer on meter plan than I could on contract plan, for I felt assured that the customer would not use at any one time the entire number of lamps wired unless for special occasions, when we could temporarily install a larger transformer. To illustrate: For a factory wired with 95 lamps I only use a 50 light transformer, and the bills run, at 20 cents per 1,000 watts, $459.10 for eight months, an average of $57.38. Another example: We have 180 lights in one factory; these are only used until 6 P. M., so we put up a 50 light transformer, and from the same transformer we connect an additional 40 lights for a lodge room. Both of these customers are on the meter basis, and I will say that the income on the investment has been very satisfactory to me; and this manner of furnishing the current has given entire satisfaction to the consumer, for he pays for what he uses and no more. Another advantage is the large number of lights we can wire from a medium sized dynamo. I feel assured the customer will turn off all the lights he can possibly spare to keep his bills down as low as possible. I now have 3,300 incandescent lights wired, an average increase of 151 lights per month.

My dynamos are one of 750 lights and one of 1,000 lights. When I purchased the plant I found the entire number of incandescent lamps wired was 1,029, and the average daily load was 550. It is my opinion, based on former experience, that where there were 825 incandescent lamps wired entirely on the contract plan the average daily load was 450. This shows that over one-half the number wired were being used. On the meter plan I can calculate on about one-third the number burning that I have wired, or about 850 on an average for 10 hours.

Still another advantage is the profit in wiring residences, for I find that people will put in more lights when they are to be used on the meter system than they would when on the contract system, where the basis of furnishing current is so much per lamp. It follows that our customers feel better satisfied to have their houses thoroughly equipped with lamps from garret to cellar and in the stables as well, knowing that after they are once installed they are no expense to maintain unless they are used.

The following points are self-evident in favor of the meter: The station receives pay for current furnished; the customer pays only for the current received; service is more satisfactory to the customer because it is more complete, and investment under the meter system commands a larger field than is possible to obtain under the contract system. It stimulates economy on the part of the customer and induces study on the part of the owner. The meter system is eminently fair to both parties, and soon after installation commends itself to the public.

1. Address at the meeting of the Northwestern Electrical association, Milwaukee, January 16–18, 1895.

# CORRESPONDENCE.

## New York Notes.

New York, January 19.—Readers of the Western Electrician must be fully acquainted with the progress of the great strike on the surface railways in Brooklyn, and I shall not attempt to retell the story that has occupied so much space in the columns of the daily newspapers. It is one of the greatest street railway strikes in the history of the country, and after a week's struggle the end does not seem to be in sight. Mayor Schieren has made every effort to settle the strike, but thus far his exertions have come to naught. The State Board of Arbitration and Mediation has tried its hand, but also without avail. The matter has been taken into the courts by merchants whose business has been affected, and it has also been brought up before the State Board of Railroad Commissioners. The whole city is in a measure demoralized. Men from other cities have been imported by the companies to take the place of the strikers, and scenes of rioting and violence ensued when the non-union men endeavored to take out the cars. The police force of Brooklyn consists of 1,700 men and is unequal to the task of coping with the 5,000 angry men who have left the employment of the street car companies. The Brooklyn militia has been called out, and the New York regiments soon will be. Soldiers are seen at every turn, and the situation is growing serious. Travel on the elevated railroads has enormously increased, and it has been found impossible to handle the crowds that apply for transportation. The mail trolley cars are run with difficulty.

At Tuesday's session of the State Board of Railroad Commissioners, which is investigating the cause of the accidents on the trolley-car lines, a conductor testified that the men in the old days of horse-cars only made about five trips a day, whereas now they have to make nine and ten. The companies made out the time schedules on an unfair basis. If there were no stopping of cars from one end of the trip to another, it would not be necessary to run the cars probably faster than eight miles an hour—the speed which the law says they must not exceed—to keep up with the time schedule. But much time was lost, necessarily, by making stops to let passengers on and off, and consequently it was necessary to run the cars at ten miles and even eleven miles an hour to make it up. This increased speed was, in the speaker's opinion, the chief cause of the accidents. The witness said that the strikers were willing to waive the question of an increase in their wages if the companies would increase the time for making the trips. He said the physical and mental strain to which motormen were subjected made it impossible for a man to last longer than a few years at the business. The commissioners adjourned to meet on January 29th.

The Edison Electric Illuminating company of New York reports as follows for the year ended December 31st: Station earnings, $1,369,066; operating expenses, $550,426; net earnings, $818,630; earnings, other sources, $32,944; income from investments, $62,325; total, $913,909; less general and legal expenses and taxes, $124,443; net earnings, $789,466. The company also received from royalities accruing previous to 1894 $46,000; interest on bonds, $207,266; dividends, $476,196; total, $683,462. Arthur Curtis James and George F. Gregory were elected directors in the places of J. Hood Wright and Mr. Johnson.

Application has been made to Justice Gaynor, in the Supreme Court, Brooklyn, for the appointment of a temporary receiver for the Lewis & Fowler Manufacturing company. The application was made on behalf of all the trustees of the company, and the reason assigned was financial losses following a general depression of business. This company manufactured street railroad cars and appurtenances and was capitalized for $300,000. The liabilities, it is said, will exceed the assets by from $50,000 to $75,000. One of the largest stockholders in the concern is said to be Daniel F. Lewis, president of the Brooklyn City Railroad company. J. W. Fowler, formerly a large stockholder, recently disposed of his interest to F. A. Barnaby. Until recently the stock of the company was considered good security, with prompt payment of dividends, and a stock quotation of 160. Beside the valuable patents owned by the company it had favorable contracts with the Brooklyn City railroad. The stockholders recently met and voted to issue $200,000 in bonds, but it was impossible to market them. The shops of the company are in Sandford street, where more than 500 men have been employed.

The management of the Kings County "L" road of Brooklyn is considering the introduction of electrical power. The Kings County and Fulton "L" companies are to be merged, probably within a few weeks. The Fulton's charter was secured in 1888, when the road extended into the town of New Lots. Since the annexation and since the Fulton company has completed its structure, there is no need of keeping up two boards of directors. The capital stock of the Fulton company is $1,500,000, and that of the Kings County $1,650,000. After the transfer of stock is certified with the secretary of state, and the Fulton's stock has been cancelled, the Kings County road will have a capital of $3,150,000. Both roads are in a bad way financially. They have cost nearly $9,000,000, including the expenses of litigation. There are first and second mortgage bonds aggregating $5,500,000. The interest on the latter has never been paid; that on the former was paid from the earnings until the trolley was introduced. Since then it has been paid from the pockets of the syndicate which holds the stock. The money for the connection with the new bridge terminal, which will cost about $80,000, is to be paid in the same way. The directors do not expect to make the road pay until they introduce electricity and elevators. This is the only way they can compete with the surface electric lines, unless the authorities succeed in making the latter run more slowly. The Kings County stockholders own the Rockaway and Brighton Beach roads. The electric system will be extended to these. If the courts permit the connection of the Kings County and Brighton Beach tracks the company will run electric cars through to the beach from the bridge, with probably a five-cent fare. With electric cars they intend to run smaller trains, but more frequently.

W. F. O.

## St. Louis, Mo.

St. Louis, January 18.—The St. Louis Electric club's third annual banquet at the Mercantile Club building was attended by about fifty members and invited guests. The club enters the third year of its existence in a very prosperous condition.

The Union Depot Railroad company is using the three-wire system of distribution on its down-town line with a view of ultimately adopting it generally throughout the system.

The American Electric Manufacturing company is doing a fine business. With the opening of the season last fall an unusually large stock of lamps, which had been manufactured during the summer, was completely sold out in a few weeks. Additional manufacturing facilities have been added to the factory to keep up with the demand.

The Columbia Incandescent Lamp company has just finished an extension to its buildings, 40 by 40 feet with three stories, and 40 by 25 feet, one story. Two hundred horse power in boilers, engines and alternating current generators is now being installed, which, when completed, will give an output of about 10,000 lamps per day. A new lamp, said to have high efficiency and long life, is now being put upon the market. A branch office has been established in New York.

R. J. H.

# PERSONAL.

Daniel Hemingray of the Hemingray Glass company, Covington, Ky., was in Chicago last week.

John R. Markle, general western agent of the Electric Storage Battery company, was recently married to Mrs. Phœbe A. Donaldson of Chicago. His friends are extending hearty congratulations.

Henry W. Frye of the editorial staff of the *Electrical World* passed through Chicago recently on his way to New Mexico, where he seeks restored health after a recent illness. Mr. Frye is well known and well liked in the electrical fraternity, and only good wishes follow him in his temporary retirement.

# NEW INCORPORATIONS.

Newman Canning & Electric Light company, Newman, Ill.; capital stock, $14,000; to can vegetables and operate an electric light plant; B. Thomas, Newman, Ill.

# ELECTRIC LIGHTING.

The Young Men's Business League of Orlando, Fla., has put itself on record as favoring an electric light plant for the town.

The machinery committee of the Atlanta Exposition has decided to engage at once an electrical and mechanical engineer and to send a representative North to buy equipment for the proposed electric light plant. The electric lights and operative exhibits will require 3,000 to 5,000 horse power. J. H. Allen is chairman of the committee.

A deal has been consummated between the Edison Electric Light company and the Citizens' Electric Light, Heat & Power company, by which the former secures exclusive control of the lighting of Lancaster, Pa., having some time ago bought out the Lancaster Gaslight company. The sum paid by the Edison company for the Citizens' plant is $182,807. Among the projects held by the Edison people is the formation of a company to introduce an improved general system of steam heating for houses, using gas for fuel. The new company promises a material reduction in the cost of electric light and gas.

# ELECTRIC RAILWAYS.

There is a movement on foot to build an electric railroad fifteen miles from Portland, Me., along the Elizabeth shore. Several capitalists will petition the next Legislature for a charter, the petitioners being F. Coleman Boyd of New Haven; J. S. Winslow, S. R. Small, J. H. Boyd and A. R. Boyd, all of Portland. It is proposed to have the road ready for use by summer.

The Foreign Electric Traction company of Washington, D. C., has been incorporated to buy and sell patents for foreign inventions of electric railway, lights and other appliances. The capital stock is $1,000,000. The officers are: William M. Stewart, president; Eppa Hunton and Philip B. Thompson, Jr., vice-presidents; Gordon G. Atlee, treasurer; Charles J. Kappler, secretary, all of Washington.

At a meeting of stockholders of the Rochester, N. Y., Electric Railway company last week the following named gentlemen were elected directors: H. Sellers McKee, Pittsburg; Benjamin Graham, New York; Horace Magee, Philadelphia; T. DeWitt Cuyler, Philadelphia; John N. Beckley, Hon. Frederick Cook, Marsenus H. Briggs, Arthur Luetchford, William C. Barry, Chauncey C. Woodworth, Hon. Charles S. Baker, Charles F. Pond and Patrick Cox of Rochester.

The line of electric railway which is in process of construction between Adamstown, Lancaster county, Pa., and Mohns-

ville, Berks county, being an extension of the Reading & Southwestern company's road, is nearing completion, and in celebration of the event the citizens are preparing to hold a jubilee on Washington's birthday. The notable feature of the affair will be an oration by ex-Governor James A. Beaver, whose great-great-grandfather, William Addams, was the founder of Adamstown.

The Gettysburg, Pa., electric railway has been sold to J. Luttrell Murphy of Chicago and Walter B. Kendall and John A. Connelly of Philadelphia. The price paid is equivalent to $250,000. The purchasers bind themselves to complete the road to the Maryland line, there to connect with the Maryland system of trolley roads. They are to obtain possession of the franchise on March 1, 1895, and in the meantime the present company will endeavor to settle the condemnation proceedings of the government, which are now in process in the District Court at Philadelphia.

The Westmoreland & Allegheny Traction company, composed of Pittsburg and Greensburg gentlemen, has applied for a charter and will commence to build an electric railway from Greensburg, Pa., to Wilmerding at an early day. The company has already secured the franchises for the right of way through Penn and Manor and will endeavor to get the others as soon as possible. The road will begin at Greensburg, passing through Jeannette, Penn, Manor and Irwin to Wilmerding, at which point it will connect with the Second avenue traction lines. The company will push the road to completion as rapidly as possible.

In New Orleans recently the motorman of a St. Charles street trolley car was frightened almost out of his wits about midnight when crossing Lafayette street, a square from the city hall and in the very heart of the city, at seeing a snake eighteen feet long, directly in front of him. The next minute the car had struck the snake, cut it in two and thrown half of it on the platform beside the frightened motorman. An examination showed it to be an anaconda of the largest size. What a serpent 18 feet long was doing in the business section of the city seemed incomprehensible at first, but an investigation showed that the snake had escaped from Wombwell's menagerie during a storm and had wandered some distance through the principal streets unobserved. It is said to have been one of the longest of its kind in America.

## TELEPHONE.

Lafayette, Ind., is now embraced in the long-distance telephone system, the line extending from Peru and taking in Logansport on the way.

A new telephone exchange of 200 instruments is being constructed in Newark, Ohio, by the Western Telephone Construction company of Chicago.

In the federal court at Springfield, Ill., the Western Electric company of Chicago, has instituted three suits against the Citizens' Mutual Telephone company of Decatur for violation of patent rights on apparatus used by the new telephone exchange, recently established at Decatur. This is the same company that is placing in new telephone exchanges in Central Illinois in opposition to the Bell system. An unsuccessful attempt has been made to establish an independent company in Springfield.

The Western Electric company has filed a bill for an injunction in the United States Circuit Court against the Harrison International Telephone company to restrain the new company from infringing certain patents claimed by the complainant. The devices which it is alleged are being infringed are the call-box switch, the magneto call box and the automatic crank switch, all alleged to be covered by the patents of Watson, Gray and Scribner. General Manager Hanford of the Harrison company, discussing the suit, said that the validity of the devices used by his company and the error of the position of the American Bell company were shown by the fact that the United States Circuit Court of Arkansas three years ago heard evidence in a similar case and sustained the Harrison company.

Encouraged by the recent decison rendered by Judge Carpenter at Boston, in the Berliner case, the officers of the Missouri & Illinois Panelectric company are making efforts to reorganize that corporation. A meeting was called for this purpose by Dr. K. Morgner, president of the St. Louis company, and a few directors and stockholders responded by assembling in the rooms of the Real Estate Exchange. No business was transacted further than to appoint a committee to examine into the state of affairs, which committee will report at a future meeting, to be called by the president. L. M. Chipley, who was one of the organizers of the St. Louis branch of the Panelectric system, said recently that while he regarded the instruments of that company as possessing real merit, the stock is so greatly divided into small holdings that it may be difficult to secure an effective reorganization. Many local capitalists and business men are stockholders, but no one, so far as he knows, were holders of blocks large enough to make them take an active interest in the affairs of the company.

## MISCELLANEOUS.

It is related that when a locomotive equipped with a powerful electric headlight appeared for the first time in Pekin, Ill., much commotion was created. One lady residing near the junction rushed from her house screaming "Fire!" when the locomotive reached that point.

A Washington dispatch states that a New York syndicate is back of the scheme to utilize the power of the Great Falls of the Potomac river. The plan proposed is to build a dam below the present dam owned by the government. From the former a canal 2,000 feet long is to be built to lead to pits 82 feet deep in which will be operated turbine water-wheels. These will furnish power for operating dynamos, which will supply a current to Washington and Baltimore. Frank W. Hawley, of Pittsford, N. Y., vice-president of the Cataract General Electric company, which controls the great power plant at Niagara Falls, N. Y., is reported as interested in the Potomac project.

It has been discovered that 3,500 pounds of trolley wire belonging to the Manchester electric line has been stolen by Italians at East Hartford, Conn. This wire was stored under the stock house of the Woodland mills, and was worth over $400. The wire was cut into pieces and sold to a junk dealer of Hartford, who in turn sold it to manufacturers. Nearly 1,000 pounds of copper wire has also been stolen from the Western Union company during the last two months.

## TRADE NEWS.

The Washington Electric company, 207 South Canal street, Chicago, reports a large and increasing business in Washington annunciators and general electrical specialties.

The Capital Electrical Engineering company has been organized at Lansing, Mich., to do general construction work and deal in electrical supplies. A specialty will be made of isolated lighting plants for mills and factories throughout the state.

The R. D. Nuttall company of Allegheny City, whose improved trolley and general railway supplies are becoming more and more popular in the electric railway business, is so busy now that the company has been obliged to start its shops working double turn.

The New York office of the Electric Storage Battery company has been located in the Manhattan Life Insurance building, 66 Broadway. The change was made to meet the rapid increase of business. Charles Blizard, sales agent for the company, will be in charge.

The Garlock Packing company of Palmyra, N. Y., has recently established a New England branch with offices and salesrooms at No. 12 Pearl street, Boston, Mass. John D. Lane, for many years traveling salesman of the company, has been appointed general manager of the New England branch.

Frantzer & Bennett, electrical contractors, Room 704, 84 La Salle street, Chicago, desire bids by Februry 10th for two 35 kilowatt compound wound multipolar 115 or 125 volt incandescent dynamos, to be installed in Chicago; also bids for a high grade, slow speed Corliss engine at 90 pounds initial pressure and developing 60 indicated horse power, and for an engine developing 80 indicated horse power.

Foree Bain, so well known, especially in the South and West, has opened an office as electrical engineer in Suite No. 1657, 1658 and 1659 Monadnock building, Chicago, and extends a cordial invitation to all his friends to call on him. He is making a specialty of designing machinery in which electricity is applied to new uses to hasten and cheapen the process of manufacture in the industrial arts. He also devotes considerable time and is meeting with success as an expert in patent causes. He announces that he is not connected with any manufacturing company. Mr. Bain's experience, together with his large personal following, should insure him immediate success in his new venture.

Commenting on the electrical fire loss of the country, the Simplex Electrical company, in a recent circular, says: "We do not know of any agency tending toward a high class of construction so important as the grade of wire. From the many different causes, in the statistics referred to [in the WESTERN ELECTRICIAN] of electrical fires the large majority can be traced directly to poor insulation. Simplex is reliable; use it and you will have no cause to worry; insist on its use and it will be a step toward a higher class of construction." The Chicago office of this company is in charge of H. R. Hixson, 1137 Monadnock block.

The Perkins Electric Switch company of Hartford, Conn., can justly be proud of its new factory at 83 Woodbine street. It was built after numerous visits had been made to the leading industrial plants of New England, with the view of having every detail complete. President Perkins of the company drew the sketch for the new building, which is three stories in height and 150 by 40 feet, with an L 35 feet by 50 feet, giving about 25,000 square feet of available floor space. The building is admirably adapted for the business of the company, being well lighted throughout and provided with every facility for conducting the manufacture of the company's specialties. There is also connected with the factory considerable vacant ground upon which it is intended soon to erect additional buildings. The company is now placing new machinery to meet the demands of the growing business. In the selection of J. J. Gates as general manager, the Perkins Electric Switch company was very fortunate. His wide acquaintence and knowledge of the trade eminently fit him for the position, and the company's name, through his energetic efforts, will be impressed upon the electrical trade as the high standard of its goods have merited.

## BUSINESS.

The Onondaga Dynamo company of Syracuse, N. Y., has just shipped an 82 kilowatt generator to the Westminster Coal company of Wilkesbarre, Pa.

The Joseph Dixon Crucible company of Jersey City, N. J., has just issued a third revised edition of its pamphlet on "Graphite as a Lubricant." Much valuable information on the many uses of graphite in the engine room is given.

The Perkins Electric Switch Manufacturing company has issued a special illustrated price-list of Gibbs switches, including the three-wire switch, said to be the only switch of this kind made. The Chicago office of this company is at 1536 Monadnock block.

G. W. Conover, representing the Perkins Electric Switch Manufacturing company, extends an invitation to his electrical friends to call at his office, 1536 Monadnock block, and see a pair of ornamental Waterhouse arc lamps just received from the factory.

Friends of L. M. Millard, the popular traveling representative of the Electric Appliance company, Chicago, will regret to hear that he is now sick in the Presbyterian Hospital, Chicago. Any of Mr. Millard's friends who happen to be in Chicago will be welcome visitors at his bedside.

The demand for Packard transformers continues brisk, and the Electric Appliance company states that where it has installed the original equipment of transformers it is always sure of the orders for renewals and has yet to know of the first case where the "Packard" has been displaced.

The Empire China Works, Green street, Brooklyn, report a large increase in their business of late, especially in the demand for insulators for street railway use. This company furnished everything in this line used by the Brooklyn City Railway company, and it is now delivering orders for the same insulators on several other lines. The company's facilities for the rapid manufacture of all kinds of specialties in hard porcelain for electrical purposes insure prompt delivery of all orders taken.

General Agent F. W. Horne of the National Electric company of Eau Claire, Wis., is jubilant over the success of his company. Mr. Horn states that the National company paid a 10 per cent. dividend about January 1st, with a handsome surplus in the treasury and not a dollar of indebtedness outstanding. Such a record as this is remarkable, and speaks well not only for Mr. Horne's qualifications as a business man and as a salesman, but likewise for Mr. Ide's skillful management of the factory so as to turn out high-class goods at a fair profit.

The pioneer electrical house of Julius Andrae, 225 West Water street, Milwaukee, which was established in 1860, changed hands on the first day of January, 1895. A stock company was then formed, with the following named officers: Julius Andrae, president; Herman Andrae, vice-president; Henry P. Andrae, treasurer; and F. T. Andrae, secretary. The company was incorporated with a capital of $50,000. The Andrae company will continue to carry on the electrical supply and construction business with increased facilities. Among the specialties handled by this company, which have found a large and ready sale, is the new Andrae incandescent lamp, which can be furnished of any voltage and for any socket. Okonite wire and cable is another specialty, and a large amount of business has been done during the last season in private line telephones.

Stanley Green, western manager of the Fuel Economizer company of Matteawan, N. Y., has recently secured a fine order from Russell B. Harrison, president of the Terre Haute Street Railroad company and of the Lake Cities, Mich., Street Railroad company, in the shape of a Green fuel economizer of 800 horse power for the first mentioned road. This contract completes an order of 1,000 horse power for this one road. Mr. Harrison has also a Green economizer in the Lake Cities plant, which was likewise sold to him by Stanley Green. Through the energetic efforts of Mr. Green his fuel economizer has obtained a remarkably strong foothold in the Western and Middle States, as well as in Canada. The good record of service of these economizers is making a rapid increase of sales for the makers, and Mr. Green is naturally proud of continued success. It may also be mentioned in connection with the taking of the Terre Haute order that Mr. Harrison sells the exhaust steam from his engines. This steam would otherwise have had to be used to heat his feed water to 212°.

Misunderstandings have been occasioned between the manufacturers and users of stranded copper cables in regard to the weight and circular millage of such conductors. It would appear, according to the reported statements of several concerns which make this material, that stranded cables weigh less than solid bars with equivalent circular mils. This is manifestly an error. John A. Roebling's Sons company has adopted another principle in the construction of stranded conductors. Its method is to divide the required circular millage of the finished cable by the number of wires which it proposes to use; the quotient is the area in circular mils of each wire perpendicular to its axis. When the wires are twisted into a strand the addition to the weight of cable due to stranding is from 2 to 4 per cent. over that of a solid copper bar of equal cross-section, varying with the size of cable and pitch of wires. The circular millage of the strand in the plane perpendicular to its axis is not considered, because there is more or less resistance between individual wires, and only the sum of the carrying capacities of each of the wires taken separately is computed to be the capacity of the completed cable.

The new firm of the Ferris Electrical & Manufacturing company has been organized, with its headquarters established at Cedar Rapids, Ia., to take care of the local construction and electrical interests of that enterprising city. The firm will be composed of Thomas Ferris, formerly connected with the engineering department of the General Electric company, being one of the original "Edison men" for years, and at present traveling for the General Electric company in the West, and Robert Ferris, for seven years a practical electrical worker, and who has held important positions with the Ansonia Electric company, the General Electric company, and up to within a recent date has been one of the most successful traveling men in the employ of the Central Electric company. In the long ago days he was in the railway department of the Thomson-Houston Electric company at Lynn. It is the intention of the firm to carry on a general construction business, handle supplies of all kinds, making a specialty of fixtures. They will also manufacture a line of specialties, such as designs for window displays, and other novelties that are from time to time demanded. They will also have a repair department of considerable proportions. Altogether, they will be in a position to install electrical plants complete, both railway and lighting, and supply everything necessary for the running of the same. The members of the firm are young men of high standing in electrical circles, and their plan of organization is such as to merit the patronage of every one in search of excellent work.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

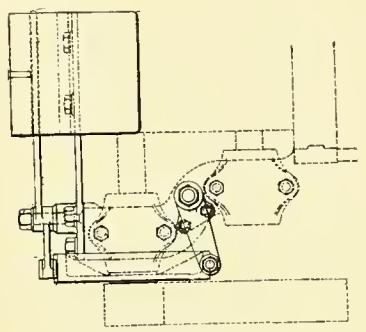
*Issued January 15, 1895.*

532,441. System of Power Transmission. Charles S. Bradley, Avon, N. Y. Application filed September 12, 1893.

This system for transmitting power includes a generator provided with a normally charged field magnet and an armature wound with two or more circuits longitudinally displaced, means for producing a relative reciprocatory movement, and thereby developing polyphase currents in the armature, a line circuit connected to the armature, and a reciprocatory motor provided with a polyphase winding connected to the line circuit.

532,448. Conduit Railway Trolley. William T. Dulany, Jr, New York, N. Y. Application filed March 30, 1894.

An underground trolley standard having two plate conductors separated by insulating material and inclosed in insulating material, front and rear bars, side plates and wearing plates secured to the bars and inclosing the insulated plate conductors, each conductor consisting of two plates united end to end by a fuse cut-off.



NO. 532,475.

532,449. Conduit Electric Railway. William T. Dulany, Jr., New York, N. Y. Application filed August 16, 1894.

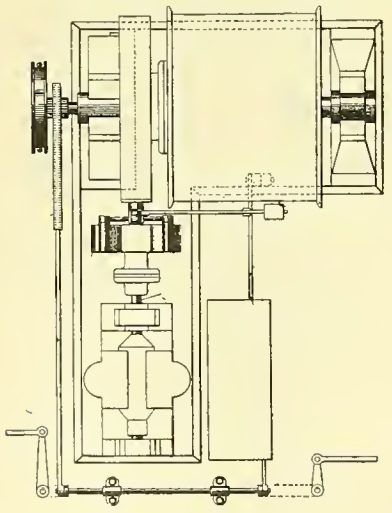
This invention comprises an underground trolley standard having two conductors, with insulating material separating and inclosing them, front and rear bars, side plates and wearing plates secured to the bars, and a head block secured to the upper end of the standard, each conductor consisting of three plates, one plate being at the end of the other two, but apart from each other, and a fuse cut-off uniting the plates on a lower level than the wearing plate, and a fuse cut-off connected with the upper end of each top conductor plate.

532,468. Carbon Filament and Method of Manufacturing Same. Arthur D. Little, Boston, Mass. Application filed June 18, 1894.

This method of making filaments for incandescent lamps consists in heating cellulose with an organic acid to a high temperature, forming filaments of the product thus obtained, and subsequently carbonizing them.

532,475. Brake for Electric Motors. William H. Morgan, Alliance, O. Application filed March 19, 1894.

The arrangement illustrated includes an electric motor, a brake wheel and a bracket projecting from the field of the motor, a pivoted lever, a friction device connected to the short arm of the lever, and an armature carried by the long arm of the lever. the armature being adapted to rest under and in close proximity to the bracket or projection attached to the field of the motor and to be attracted thereto when the field is energized to effect a release of the brake.



NO. 532,514.

532,477. Trolley Catcher. Martin V. B. Nichols and James A. Fraser, Port Arthur, Can. Application filed May 26, 1894.

The last claim reads as follows: The combination with the trolley arm, the bracket on the car top, the pole pivotally connected with the trolley arm, and the guide or box held on the dashboard, of the weight held to slide vertically on the box, having a handle member, the spring detent, adapted to engage the said handle, the bell crank lever, the taut cord connection connected therewith, the slack cord connection secured to the weight, said cord connection having a snap hook or detachable connection with the lower end of the pole.

532,514. Electric Elevator and Motor Controller. Robert Wilson, Louisville, Ky. Application filed June 23, 1894.

In this device for controlling electric motors, as shown in the cut, there are a rheostat in the motor circuit, a solenoid having its core connected with and operating the arm of the rheostat, the solenoid being wound in three main sections, two of which are at the ends and the third between the other two, the end sections being sub-divided into sub-sections, a commutator whose segments are connected with the several sections and sub-sections on the solenoid, and two switch arms adapted to travel over the commutator and switch the current into any number of the sections at one end of the solenoid and out of a corresponding number of the sections at the other end, whereby the center of magnetism in the solenoid will be changed.

532,531. Electric Arc Lamp. Arthur Chester and John J. Rathbone, London, Eng. Application filed March 26, 1894.

For this invention is claimed the combination in an electric arc lamp, with a stop, of a roller pivoted and rocking armature, spring, low and high resistance coils, terminal contact, contact plate electrically connected to the coils and to the main circuit, the stop combining the functions of a brake for controlling the feeding of the carbons together under the control of the high resistance coil, and a pawl for causing the roller to rotate in the opposite direction to move the carbons asunder, the terminal contact and contact plate serving to automatically switch the lamp out or into circuit under the combined action of the coils.

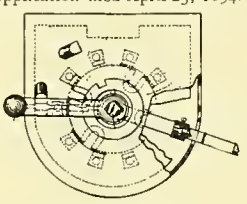
532,538. Controller for Electric Cars. Harry P. Davis, Pittsburg, Pa. Application filed April 14, 1894.

In a controller for electric cars, as shown in the cut, there are a reversing switch and its lever within the casing, a slot in the casing having an enlargement at one point, a socket in the end of the switch lever, and a handle having a web portion wider than the narrow portion of the slot, the end of the handle being adapted to enter the socket when the web portion lies at right angles to the direction of the slot.

532,549. Alternating Current Motor. Ludwig Gutmann, Pittsburg, Pa. Application filed August 27, 1890.

The method of reducing self-induction in an armature as described consists in producing two alternating fields of the same phase, rotating an armature coil, one part under the influence of one field and another part under the influence of the other field, so that the one part will cut a maximum number of lines of force while the other part is cutting a minimum. The cut illustrates a machine for which is claimed among other features the combination with a field magnet system adapted to produce two magnetic fields of the same phase, of an armature coil adapted to be rotated under the influence of both of the fields, the magnetic fields being disposed relatively to the coil, so that the coil cuts a maximum number of lines of force in the one field while cutting a minimum number in the other.

532,559. Galvanometer. Adrian H. Hoyt, Penacook, N. H. Application filed April 25, 1894.



NO. 532,538.

An electrical indicating device comprising a solenoid, a normally neutral or non-polarized armature or needle pivoted midway between its polar extremities on an axis parallel to its own plane and perpendicular to the axis of the solenoid and within the solenoid a constantly increasing force opposing the movement of the needle, a pointer carried by the needle and co-operating with a suitably graduated scale, and a normally neutral magnetic core or pole piece adapted to be polarized by a current flowing through the solenoid and having one of its polar extremities in inductive proximity to the needle or armature.

532,560. Galvanometer. Adrian H. Hoyt, Penacook, N. H. Application filed April 25, 1894.

The last claim follows: In an electrical indicating device, the combination with a solenoid and movable armature in inductive proximity thereto, of a rheostat in circuit with said solenoid and a pointer connected with said rheostat movable over a scale calibrated in terms of current periodicity.

532,561. Galvanometer. Adrian H. Hoyt, Penacook, N. H. Application filed April 25, 1894.

This device comprises a coil, an armature or needle consisting of a disk of soft iron pivotally supported on an axis parallel to its own plane and perpendicular to that of the coil, the armature extending across the mouth of the coil and having one of its extremities projecting into the mouth of the coil, a force opposed to the movement of the armature, means for adjusting effect of the force to balance the force exerted by the current upon the armature at a predetermined position, and an indicator co-operating with the adjusting means.

532,576. Closed Conduit Electric Railway. George W. McClintock, Wollaston, and Daniel J. McLane, Quincy, Mass. Application filed July 2, 1894.

An exposed sectional conductor rail with insulation between its sections, and each section provided with depending contact pieces, a feeder having branches for connection with the pendent contact pieces of the conductor rail respectively, bracket supporting insulation in which the branches of the feeder are inserted with their ends exposed at one side, a trolley rail composed of depressible spring supported sections corresponding with the sections of the conductor rail, and switch levers pivoted between the conductor rail and trolley rail, and movable in vertical planes at right angles to the latter's plane of movement, the levers extending under the trolley rail on one side of their pivots and carrying contact plates at their opposite ends arranged to move along the supports of the feeder branches and connect the latter with the pendent contacts of the conductor rail when the trolley rail is depressed.

532,588. Contact Device for Electrical Appliances. Friedrich W. Schindler-Jenny, Kennelbach, Austria-Hungary. Application filed February 19, 1894.

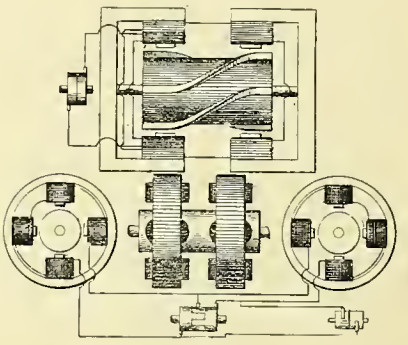
A contact device for electrical appliances, comprising a contact block or member provided with a leading-in wire or conductor having branches leading to two separate contact points and a leading-out wire having a contact point between said leading-in contact points combined with the three other contact points and their conductors, the middle one forming a common pole to all of the last mentioned conductors, whereby by adjustment of the contact points one or more of the leading-in contact points may be connected in circuit with one or more of the conductors and the leading-out contact point for the purpose of regulating the units of heat as specified.

532,590. Closed Conduit Electric Railway. John Schnepf, New York, N. Y. Application filed September 19, 1893.

The combination is claimed of a slotted conduit, and adjacent thereto an insulated conduit containing a continuous, flexible, movable main conductor, metallic plates which cover the latter conduit, and which are insulated from it and from each other, and which are also insulated from the surface of the street by superposed non-conducting material, and which project into the slotted conduit, a trolley which engages with the plates, and a magnet and a motor on the car, whereby the magnet may draw the main conductor into direct contact with the metallic plates.

532,593. Converter System for Electric Railways. Charles F. Scott, Pittsburg, Pa. Application filed July 31, 1893.

This invention, as shown in the cut, is for an alternating current feeding circuit, a working converter ted thereby, a choke coil in series with the primary thereof, and a normally open short-circuit around the choke coil, a bridge for closing the short-circuit, and electrical means for operating the bridge in series with one of the coils of the working converter, the choking coils being so proportioned as to be unsaturated when the secondary is open, and saturated when it is closed under normal conditions.



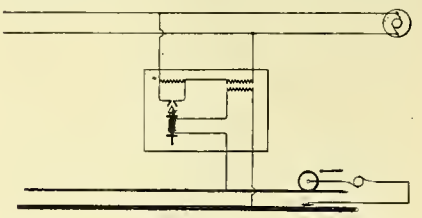
NO. 532,549.

532,605. Annunciator for Telephonic Circuits. Theodore Spencer, Cambridge, Mass. Application filed September 10, 1894.

The features of this invention are: A self-setting annunciator, comprising an electro-magnet connected directly in a telephone circuit, and having a magnetizing helix and also a winding shunting the entire magnetizing helix and constituting a path of low impedance to voice currents, a shutter or signal plate provided with a lever extension, and adapted when freed from control to fall by its own weight, and a lever of superior weight to that of the signal plate attached to the armature and normally resting upon the lever extension, and adapted when the armature is released from the attraction of the magnet to withdraw the signal plate and retain it in its retracted position,

532,633. Railway Block Signal. William Berrigan and William H. McClure, Elmira, N. Y. Application filed September 18, 1894.

In this system there is claimed the combination with the two semaphores of a block, of a track instrument opposite each semaphore to be actuated by the passing train or engine, a pitman connected to each semaphore, a lever pivoted to a fixed support and connected at one end to the pitman, a weight attached to the opposite end of the lever, a rock shaft having two arms connected respectively to the track instrument and to the lever, an electric circuit exclusively for the block between the semaphores, electro-magnets at the rear semaphore of the block, the armature provided with a hook, a catch on the pitman receiving the hook when the pitman is moved to set the semaphore to danger and the armature released from the magnet, an electric terminal carried on the pitman of the front semaphore of the block, and a terminal traversed by the aforesaid terminal to make and break the circuit during the movement of the pitman.



NO. 532,593.

532,662. Electric Switch. William P. Hancock, Everett, Mass. Application filed November 27, 1894.

The claim is for the combination of the pivoted U-shaped carrier provided with slots in its sides and with the oppositely extending horizontal pins, the pivoted blade within the carrier and provided with the oppositely projecting horizontal pins extending through the slots in the carrier, the external springs flanking the carrier and extending from the pins to the the pivoted blades and the stationary contacts engaged by the blades.

532,701. Mechanism for Forming Battery Plates. Charles J. Reed, Philadelphia, Pa. Application filed September 12, 1894.

A machine for forming a battery electrode or plate by rolling the same from a sheet or strip of lead, consisting of a pair of grooved rolls provided with corresponding depressions in each roll, and one or more pairs of cutting knives on each roll for severing the completed electrode from the material and forming stiffening ribs, in combination with means for cutting out a section of the material between adjoining pairs of plates, so as to form conducting lugs or ears.

532,742. Magnetic Separator. Henry Arden, Seattle, Wash. Application filed August 15, 1894.

One claim reads as follows: In a magnetic separator any number of electro-magnets, whose poles form a magnetic field within which a stream of black sand falls, having troughs within the line of fall of the sand in combination with the stream, conductors over which electricity passes to the magnets when the circuits are closed, and one or more commutators or switches actuated by power or hand for shifting the current from one magnet to another, or from one series of magnets to another.

# Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, FEBRUARY 2, 1895. No. 5


## Use of the Searchlight by the Japanese Army.

In the war between Japan and China the former nation has distinguished itself by the intelligence and aptitude it has shown in utilizing the most modern advances in military science. The Japanese have shown themselves to be a progressive and ambitious people, eager to avail themselves of the latest implements of warfare; and it is undoubtedly to this enlightened spirit that the complete success of their arms is due. Their armies are equipped with modern ordnance and handled in accordance with present-day theories of tactics as developed in Europe and America; their fleet comprises some of the best cruisers afloat; and in the use of electricity, as shown by the interesting illustration herewith presented, they are likewise up-to-date.

The picture is a reproduction of a water-color drawing made by a Japanese artist and sent to members of the Japanese colony in Chicago. It represents the Japanese forces employing an electric searchlight in the assault of the Chinese fortifications at the battle of Ping Yang, in Corea. The WESTERN ELECTRICIAN is credibly informed that the Japanese characters beneath the illustration, being interpreted, would read: "Representing the Japanese Army Using Searchlight in the Battle of Ping Yang." The portable projector is represented as being of material assistance to the Japanese artillerymen, who are shelling the enemy's fort, about half a mile distant across the river, with much enthusiasm and energy. Details as to the source of the current are lacking, and the man-operated mechanism at the left is also rather puzzling; but at any rate the artist clearly conveys the idea that the lamp sent forth a fine, solid beam that was of great assistance to the attacking party. The picture shows plainly the utility of the searchlight in actual warfare.

The battle of Ping Yang took place on September 15th last. The Japanese were completely successful in storming the city, and it is said that the Chinese loss was 1,500 killed, 3,000 wounded and 700 prisoners. The victors are reported to have secured $200,000 in gold and silver, large quantities of provisions and ammunition, thirty fine guns, several thousand Winchester rifles, thousands of flags, etc.

圖已用使氣電擊攻壤平

USE OF THE SEARCHLIGHT BY THE JAPANESE ARMY.

The lines of the Marion, O., Electric Street Railway company were put in operation on January 8th.

## Austin Water Power Electrical Plant.

Secretary Oliphant of the Austin, Tex., Board of Public Works, in his annual report, reviews at length the progress of the year on the great water power utilization plant of that city. He states that the contract for the electrical equipment (including, however, but a portion of the generating plant) was awarded to the Fort Wayne company for $113,500, of which $70,000 is being paid in cash in monthly installments as the work progresses. The remaining consideration to the company is the city's railroad to the dam, which is turned over at a valuation of $43,500.

The work of erecting the electric light poles and towers and stretching the wires was begun in the latter part of June and at the close of the year all of the 31 towers had been erected at such places as were designated by a joint committee from the Board of Public Works and the city council; 2,048 poles had been set, 2,200 pole stops, 5,000 cross arms, 10,250 pins, 10,000 glass insulators, 203 miles of wire, 186 arc lamps, 186 hoods and hanging boards; and 213 transformers, varying in size from 12 to 250 light capacity, had been put in place. The work has been under the constant supervision of Electrical Engineer Scovill and is pronounced first-class in every respect.

The following is the approximate amount of work yet to be done to finish the construction contract: Thirty poles are to be set, and one 500 light transformer; 15 junction boxes; 25 stubs; 100 pole steps; 14 arc lamps; 14 hoods and hanging boards, and five miles of wire. The quantity of wire that will be required to complete the entire system cannot be approximately estimated until the approximate number of light consumers can be ascertained. The wire that will be needed in addition to that contracted for is for secondary circuits.

The amount paid to the Fort Wayne Electric company under the contract of 1894 for construction was $59,671.64, and the amount paid on account of and charged to the same company for storage and freights under the contract of 1893 for machinery was $237.73.

## First Niagara Dynamo.

The first 5,000 horse power dynamo made by the Westinghouse Electric & Manufacturing company for the Cataract Construction company arrived in Niagara Falls on January 11th. The three turbines of 5,000 horse power capacity made by the I. P. Morris company of Philadelphia are all in position. The dynamo will be immediately set up and attached to one of these. Before the dynamo was shipped from the Westinghouse works it was set up and tested.

## Massachusetts Electric Lighting.

The annual report of the State Board of Gas and Electric Light Commissioners of Massachusetts shows that there are now 128 companies or individuals under the supervision of the board; 25 of these supply both gas and electric light, 46 supply only gas and 58 only electric light. Twelve towns are also supplying lights, two of which supply gas and electric light and the others have electric plants only. There have been no applications during the year by gas companies for leave to do electric lighting. Seven companies to do electric lighting have been incorporated during the year.

The following named towns have municipal plants in operation: Braintree, Danvers, Hingham, Hull, Marblehead, Middleboro, Needham, North Attleboro, Peabody, Reading, Wakefield and Wellesley. Of these Middleboro and Wakefield have the only plants for supplying both gas and electric light. The others manufacture only electric light.

The average price paid by the consumers for coal gas to the companies selling annually more than 30,000,000 feet each is $1.20 per thousand feet.

Aggregates from the balance sheets of the electric companies show the following facts: Assets, June 30, 1894, $15,028,578.97, as against $14,275,363.23 at the same time in 1893; liabilities, 1894, $14,217,580.37; surplus, $642,804.77. The aggregate receipts of the companies for 1894 were $3,649,457.12; expenses, $2,452,982.69; balance, $1,196,474.43.

## A Blow at the Bell Company.

A bill introduced in the Indiana Legislature by Mr. Thomas of Rush is attracting considerable attention. It presents the duties of telephone companies and compels each company to permit the use of its exchange, toll line or toll station to any other company owning and operating a telephone system. The bill provides for the charging of fair tolls between the rival companies.

In the division of moneys derived from charges for telephonic services, as provided in the act, each terminal ex

change or toll line station shall be entitled to one-third, and the company owning the lines shall be entitled to the other third. If there is more than one owner of said connecting line, the remaining third shall be pro-rated according to mileage.

The bill is aimed at the American Bell Telephone company.

Since the expiration of the recent patents on the receiver, smaller companies are being formed, but the Bell company refuses to coöperate with any of these companies, and no connection is allowed between them. This monopoly of exclusiveness is what the bill attacks. The bill will be fought by the Bell people.

## The St. Louis Electric Ambulance Car.

The especially designed electric ambulance car built by John Scullin, president of the Union Depot Railroad company, for the Health Department of St. Louis, was put into service January 1st. The car was constructed by the St. Louis Car company on especially designed plans made by Dr. Homan, city health commissioner. Fig. 1 is an exterior view of the car and Fig. 2 an interior view.

The description of the novel vehicle is as follows:

The total length of the car is 33 feet, including the platforms, the inside measurements being 24 feet long by seven feet two inches wide. The platforms are about one-half the width of the car and front the left half of the body, the car being double-ended, the steps leading to the entrance and not to the platform. The doors are located at the right-hand side of the ends of the car, the steps being four in number, placed obliquely and affording access from either front or side with equal ease. This arrangemeot has been adopted to facilitate the exit or entrance of litter-bearers. A telescoping brass hand-rail guards the outer side of the steps, and these are so arranged that they may be lifted when not in use, thus preventing access to the car. The entrances are five feet two inches in width, the doors moving on rollers placed at the top, and grooved below over a metal edge secured to sill, excluding coal and dust.

The car is lighted by seven windows on each side, 28 by 28 inches in size, stationary, the lower half frosted. There are two drop sashes in each door, and a number of ventilators or adjustable decklights above on the sides and ends.

The interior of the car is divided in the middle by a wooden partition five feet six inches high, placed four inches from the floor, with two doors swinging either way in the center, one compartment being for males, the other for females. The partition is so constructed that both parts may be swung back if desired and rest closely against the sides of the car. A drop desk is hinged to one side of the partition for the surgeon's use. Two hinged shelves are provided, attached to the sides of the car, on which to place dressings, instruments, etc.

To the right of each door on entering the car is a large locker for litters, blankets, towels and the like, while between the windows are eight small ones for papers, medicines, bandages, instruments, etc. Immediately back of the large lockers are two earth-closet conveniences.

Electric bells communicating with both platforms are placed near the middle of the car for the use of the surgeon. A lavatory is also located there, supplied with water by a pump from a tank under the floor, the metal work being silver-plated, as are the water coolers at each end of the car.

The interior is finely finished in cherry, there being no spaces for dirt to accumulate. The floor is of quartered oak, double, with asbestos filling to deaden sound. The ceiling is of bird's-eye maple in panels. All the trimmings are solid bronze, polished.

Lighting is secured by 10 incandescent lamps, 16 candle power each, four being placed in each compartment and one outside above each platform. The car is warmed by six electric heaters placed along the sides just above the baseboard and occupying but little space, being 30 by 7½ by 3 inches in size.

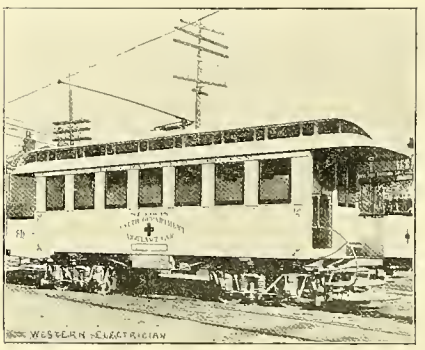


FIG. 1. ST. LOUIS ELECTRIC AMBULANCE CAR.

The body of the car is painted white, trimmed with gold and blue. The lettering on the sides reads, "St. Louis Health Department, Ambulance Car," and the last two words are repeated on each end. The Geneva cross is displayed on the sides and the ends to emphasize the humane purposes to which the vehicle is devoted.

The car is mounted on two pivotal trucks of special construction, having two sets of equalizing springs over the oil box in addition to the springs that carry the car body. This truck will greatly reduce the noise while crossing other tracks and make it an easy-riding car.

Under the center of the body of the car a space is enclosed in which to carry stretchers, splints and the like; and a water-tank and ice-box are also provided under the car. The distance from the body to the rails is three feet three inches. Drawbars are provided in case it becomes necessary to tow the ambulance by means of another car. The car is equipped with an electric brake beside the usual hand-brake, and arrangement is made for heating by electricity the water used in the lavatory.

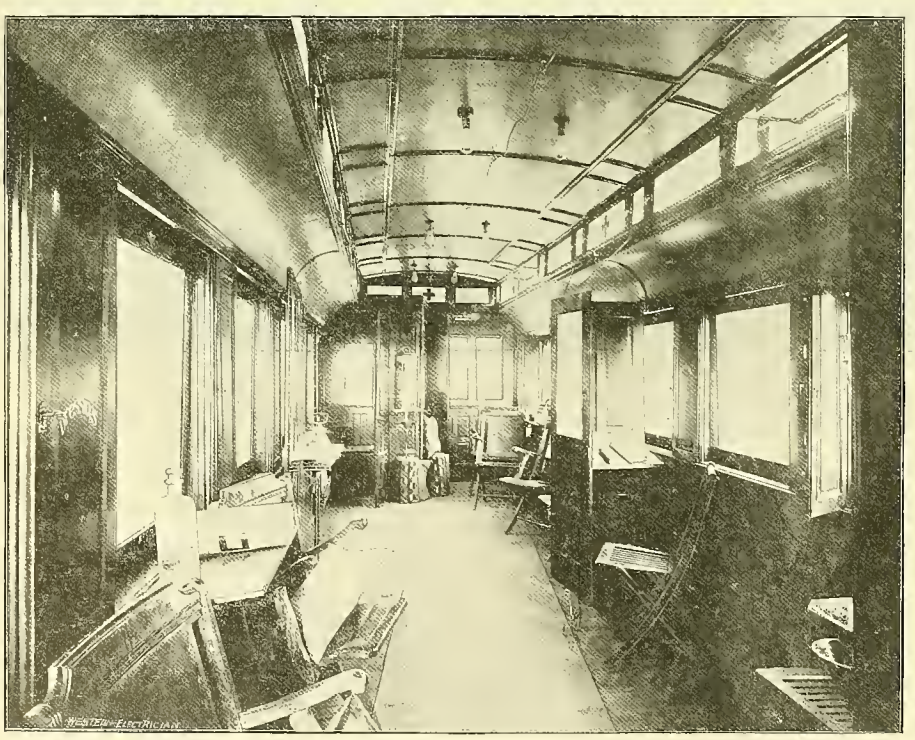


FIG. 2. ST. LOUIS ELECTRIC AMBULANCE CAR.

The furnishings consist of 18 plain folding chairs 12 having arms and six being without arms. All are provided with rubber fenders to prevent slipping. The car is in charge of a surgeon and an attendant from the Health Department and a motorman supplied by the Union Depot Railroad company, and will be run under orders of the surgeon. The car is run on a regular time card, which is published in order that police and public may know when the car is due at any given street.

The inauguration of the electric ambulance service was celebrated in an appropriate manner at the Union Station banquet room at 8 o'clock Thursday night, December 27th. Invitations were issued to the presidents and managers of all the street car lines, street car manufacturing companies city officials, the leading physicians and the electrical journals.

The following is an abstract of the remarks made by Dr. Homan, health commissioner:

Every step forward, be it great or small, must be counted in the life of a city in truly reckoning from time to time the progress it is making toward better things. And better things are those which show in themselves a real gain over the past whether in mind, heart, or soul, in science, intellect or work, in enlightened skill or humane achievement.

The step forward which we mark this evening is in the line of more considerate treatment and more humane handling of sick and wounded unfortunates; and, if the worth of the civilization of to-day shall be measured in this wise and by such a standard, who, knowing the truth, will dare deny that our shortcomings are many and opportunities for improvement correspondingly great? Nor does it avail to extenuate our delinquencies in this regard by pleading that others have done no better.

## Incandescent Lamp versus Welsbach Burner.[1]

By William Goltz.

The hitherto triumphant progress of incandescent electric lighting has of late encountered an obstacle which may prove a serious one in the future, if the promoters of this most perfect art of illumination do not use adequate means to remove it. The obstacle I refer to is the Welsbach incandescent gas burner, and it shall be the object of this paper to point out to station managers and contractors some of the defects of this uninvited guest, thus enabling them to show him the door at the earliest possible moment. Before doing so, I may say that the very limited space of time that has been accorded me for the preparation of these lines has prevented me from giving the matter as close a study as would have been necessary and desirable. I have also been unable to make any tests, and for the correctness of some of the data given I have had to rely on reports published in the gas papers and on statements made by the promoters of the Welsbach burners. The so-called incandescent gas burner was invented in Germany by Dr. C. A. von Welsbach. By the new discovery, it can hardly be denied, gas lighting has entered upon a new epoch. The main point of the invention is that immediately the gas is lighted the light-giving body or mantle is raised to a high degree of incandescence without forced pressure or alterations of existing fittings. The gas is supplied through a special form of atmospheric or Bunsen burner, which can easily be attached to fittings already in use. The flame thus produced is non-illuminant, and the combustion almost complete, with a consequent considerable diminution of the smoke and dirt which accompanies the use of gas in the ordinary way. Experiments with this burner have been made for seven years, but only during the last two years has the same been so improved that it has become quite a competitor for the incandescent lamp. Notwithstanding the inclination of some of our friends, among whom I may mention Foree Bain, who has discussed this matter in a recent issue of the Western Electrician, to treat this matter lightly by simply calling it a fad, I do not think that the expression dangerous is exaggerated, for there is no doubt that the Welsbach burner offers advantages which, to say the least, are and have been an inducement to many consumers to install this light. It not only does away with two of the principal objections to ordinary gas burners—insufficient light and flickering—but it also materially lessens the cost to the consumer. The latter point may be illustrated by the following data, which although procured from the enemy's camp, I think are nearly correct:

One Welsbach burner using about 3.2 cubic feet of gas per hour gives about 60 candle power, and is, therefore, the equivalent in candle power to about 3¾ 16 candle power lamps. Assuming the price of gas to be $1.00 per thousand feet, and of electric light .01 cent per ampere hour, we would obtain the following result: One Welsbach 60 candle power light, consuming 3.2 feet per hour, costs 3-10 cent, and 3¾ 16 candle power lamps, consuming 1⅞ amperes per hour, cost .01⅞ cents. Now, it is evident that although the figures relating to the Welsbach burner are only obtainable under the most favorable conditions, that is, with a gas of high thermal power and a new mantle of the very best material, the difference is sufficiently large to induce many people to install this wonderful illuminant without going to the trouble of considering any other points, and the effect these figures have already had can be seen by the fact that an alarmingly large number of these burners have already been introduced throughout this country. In many cities you will see in stores, show-windows, small hotels, and, in fact, wherever running expenses are an important item, combination fixtures where the incandescent lamps are out of commission and where the gas outlets, which had long been out of use, have been fitted with Welsbach burners. The people who so readily installed these lights at the rate of $2.50 apiece would perhaps not have done so had they taken into consi-

1. Read before the third annual convention of the Northwestern Electrical association, Milwaukee, January 16, 1895.

deration that the monthly gas bill is not the only item of expense connected with this light. Mantles are apt to give out frequently, renewals costing 50 cents, and the glass chimneys are subject to breakage, while mica chimneys, although unbreakable, become smoked and must be thrown away. Almost in every instance the breakage of a chimney means the breakage of a mantle also, and the economy of the Welsbach is, therefore, not quite as striking as may appear to the casual observer. Fortunately for the incandescent lamp, it has never been price and quantity which resulted in its almost general adoption at a time when the cost of current was twice as high as it is to-day, and it is high time to bring to the remembrance of all who are interested the fact that something else than candle power alone should be considered when contemplating the installation of the most satisfactory and at the same time most economical light. One of the reasons why the Welsbach burner does not comply with the former condition is its color. The bare statement that a light is of so many candle power really conveys no accurate information at all. Artificial light is generally produced by raising some body to a high temperature. As soon as the temperature is sufficiently high, it parts with some of its energy in the form of radiation. At first, the radiations are not of a kind to which the eye is sensitive; they are of greater wave length than red light and may be called infra red. As the temperature increases, the infra red radiations increase, and presently there are added radiations which the eye perceives as red light; and, subsequently, while the red light increases, yellow, green, blue and violet rays are successively thrown off. The rays of the incandescent lamp, similar to those of the candle, are largely composed of red and yellow, while those thrown off by the Welsbach burner combine an abundancy of green and blue, and those of an arc lamp all of these colors, with violet added to them. In other words, while the temperature of the filament of an incandescent lamp, when burning at its rated voltage, is such as to generate as large a proportion as possible of such rays as are most pleasant for the human eye, that of the Welsbach, being considerably higher, will cause the production of rays containing a larger proportion of yellow and blue rays than is desirable for a majority of indoor purposes. I have heard numerous complaints from people who have used the light for some time, to the effect that it ruined their eyes, acknowledging that they made a mistake in putting it in. I note from *Electricity* of December 19, 1894, that it was tried in the show rooms of Dorflinger Bros., the leading American cut-glass makers, and would have ruined the business of the concern if it had been long continued. The purest and whitest of the product was made to look as green as the cheapest grade of window-glass, and the electric light was soon re-installed. In the issue of December 12th, of the same paper, we find the following statement, made by B. Altmann & Co., one of the leading dry goods concerns of New York: "Some time ago we allowed an agent of the Welsbach people to put on a few burners, but the light was of a yellowish glimmer, trying to the customers and unsuitable for a proper showing of colored fabrics, so we decided not to purchase the burners, which were removed. We do not know whether any gas was saved, as we made no tests."

The following opinions were given by Bowery merchants.

"The Six Little Tailors" said: "It is generally admitted that we have the handsomest tailoring establishment in the city, and at night it is brilliantly illuminated with electric lights. We were offered a lot of Welsbach lights free of charge, but declined the offer with thanks, as the effect of the light upon our goods would have been unsatisfactory. We want the best light going and we have it."

"The Original Harris Cohen" said: "We have no time for the Welsbach burner; it takes two men and a boy to monkey with it in a large store like ours. We tried it last year and gave it the g. b."

"Callahan, The Hatter" said: "We use hat-wing gas burners under globes and electric incandescent lamps in stalactites, using both systems of lighting every night. We do not use the Welsbach light because it throws hideous colors upon our goods and decorations."

Simpson, the pawnbroker, was short and to the point: "Welsbach burners don't go here—not on your life—electricity is good enough for me."

Wherever complaints about the ghastly glare have been made, the gas companies or the promoters of the Welsbach burners have tried to remedy matters by fitting the lamps with frosted or opal shades, for some of which even the shape of the incandescent bulb has been adopted. This was an improvement, but, of course, caused an enormous reduction in candle power, and also in the diffusive capacity of the light. I cannot understand why, in cases where such extreme brilliancy is required, incandescent arc lamps, which can be run for less money, should not be preferred. By using them, consumers who do not consider quality, but simply want the highest candle power for the least money, can avail themselves of all the advantages offered by the Welsbach, without the addition of heat, breakage, poisoned atmosphere, etc. To illustrate this, let us follow the methods used by the gas companies.

Two incandescent arc lamps in series on 110 volt circuit, giving 2,000 candle power each and using 10 amperes of current, costs 10 cents per hour. To obtain the same candle power, about 67 Welsbach lights would have to be installed, which would consume 214.4 feet of gas per hour and would cost 21.44 cents, or more than twice as much as the arc lamps. This simply goes to show how ridiculous such figuring is and what results can be obtained thereby. However, it seems, from the foregoing, that the Welsbach may, to some extent, be a competitor of the arc lamp, but, although giving more candle power for the money will not stand comparison with the incandescent lamp, whose mild rays and agreeable light nobody can possibly find fault with, if central station managers do their duty to the public. The old adage, "too much of a good thing," applies preëminently to the Welsbach burner as far as indoor lighting is concerned. What people want nowadays is plenty of light of the best quality, and the pear-shaped bulb fills the bill in a manner which cannot be improved. Of course, station managers should do all in their power to prevent their customers from finding fault with the quality of the light furnished. The almost general habit of leaving lamps on the circuits until the filaments give away ought to be discontinued, and the lamps ought to be exchanged as soon as the candle power drops below the normal. First-class apparatus, an intelligent distribution, plenty of copper and a sufficiently high pressure at the station will do away with all other causes of complaint. There is no reason why, with the present price of incandescent lamps, station managers should endeavor to save a few cents to prolong the life of the lamps by running them below their rated voltage; nor does it seem to be good business policy to charge 40 cents apiece for lamps where the consumers stand the cost of renewals. A little liberality in this respect would lessen the danger of any other illuminant receiving the preference, and would undoubtedly largely increase the list of customers.

Another claim advanced by the Welsbach people as an inducement is the cheapness of installation. Now, it is almost impossible to make any comparison in this respect, as the cost of installing electric lights is dependent upon different circumstances in each and every case. I may say, however, that to wire a store or office or a similar place for incandescent lamps, the wire to be concealed under molding or mounted upon insulators, and the lamps to be suspended by means of flexible cord, costs about one-half what it would cost to have existing gas fixtures fitted with Welsbach burners. It is a well-known fact, at least to the majority of those present here, that wiring of this description is usually done for about $1 a light, while the cost of installing Welsbach burners is at least $2.50 apiece. Where new electric fixtures are to be installed, it is only fair to compare the cost with that of new gas fixtures, and the result would be about the same. Add to this the extreme unsightliness of this burner, including glass chimneys, corrugated opal shades and holders and the impossibility of throwing the light in the direction it is usually most wanted, that is, downward, and you will have to acknowledge that cost, notwithstanding the points, are all in favor of the glow lamps. I have not dwelt upon another objection to the Welsbach, an objection of a very serious nature, as it involves sanitary principles, because being common to all gas burners and not special to the Welsbach, it does not properly belong under the head of this paper—I mean vitiation of the atmosphere. Although we all know that it is unhealthy to breathe the air of a room that is lighted by gas, it would be interesting to find out just to what extent the air in a room of a given size is vitiated by ordinary gas burners and by the Welsbach burners, and to what extent health is impaired thereby.

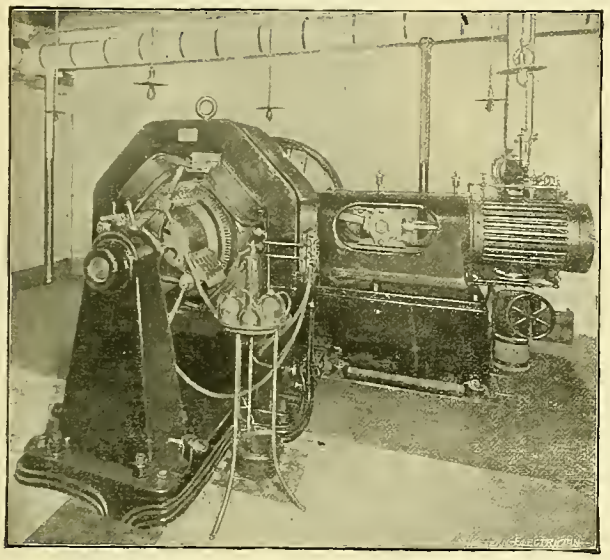
Whatever defects have been pointed out, the claims made by the gaslight people are sufficiently enticing to the casual observer so that we should warn our friends to be on their guard. Although I do not think that the Welsbach burner has come to stay, or that the present competition will be lasting, the members of the electrical fraternity ought to declare war against it without further delay. Much can be done during the next few months, while the advent of summer, when the surplus of heat furnished by these miniature gas stoves is not needed, will certainly relegate them to where they belong—the ash barrel.

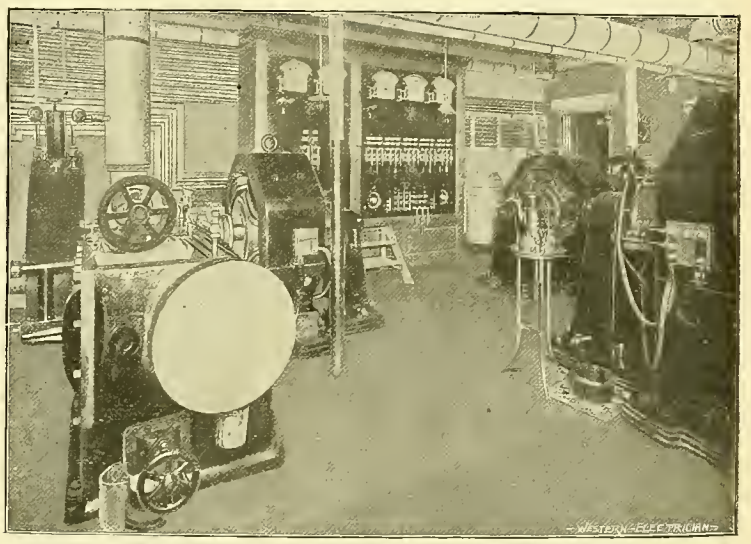
## Electrical Power in a Large Newspaper Establishment.

The *Philadelphia Inquirer* has a new building and a new mechanical equipment throughout. To electrical men the establishment is of particular interest, owing to the extensive use made of electricity for light and power.

The generating plant consists of two 40 kilowatt lighting dynamos and one 90 kilowatt, 220 volt power generator, made by the Eddy Electric Manufacturing company. Each machine is directly connected to a McEwen engine running at a speed of 300 revolutions per minute. The connection between engine and dynamo shaft is accomplished by means of a rigid flanged coupling securely fastened by bolts, no bearing being used between the armature of the dynamo and the engine box. An outboard bearing is provided, however, at the commutator end of the machine. It is supported by a pillow block which is made adjustable to the engine bearings by means of wedges. The bearing sleeve itself is of the spherical self-aligning type, and self-oiling from a reservoir in the box.

The armatures are of the iron-clad type, with conductors consisting of copper bars of rectangular section embedded in slots cut in the core. These bars are connected at the ends by copper strips, bent spirally and so arranged as to prevent any crossing of conductors. Insulation is accomplished by placing the copper bars in micanite tubes before introducing them into the slots, the slots and core being also thoroughly insulated by micanite. The whole armature and commutator is thoroughly ventilated by apertures and ducts for the free passage of the air. The field coils are wound on metal spools, the series and shunt coils occupying separate compartments. The machines are all highly finished and present an appearance in accord with the attractive engine room in which they are placed. Their behavior, too, is fully on a grade with their appearance, and they handle their full loads and often large overloads without the least sparking or undue heating. The whole combination of engines and dynamos makes so little noise and vibration as to be hardly noticeable in the adjoining rooms. In the accompanying illustration Fig. 1 shows a separate unit and Fig. 2 a general interior view of the engine and dynamo room.





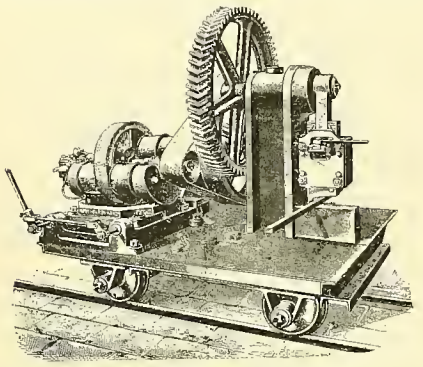
FIGS. 1 AND 2. ELECTRICAL POWER IN A LARGE NEWSPAPER ESTABLISHMENT.

The switchboard is composed of two panels of slate; one for the generators and feeders of the lighting system and the other for the power system. These panels contain Weston illuminated dial switchboard instruments, switches for dynamos and feeders, ground detector, fuses, etc. The wiring of the building is done on the three-wire convertible system, with switch so arranged on the switchboard that the load may be thrown on the regular three-wire system of the Edison Illuminating company or on either one or both of the lighting generators. When the system is operated from the lighting dynamos it becomes virtually a two-wire system at 110 volts. In like manner the panel for the power system has a double-throw switch so arranged as to permit of the motors throughout the building being thrown on the street circuit should the power dynamos be disabled by any cause.

The building is supplied with 1,200 incandescent lamps of 16 candle power each, and many of the fixtures are elab-

orate and artistic. On the occasion of the formal opening of the building on December 15th the entire edifice was brilliantly lighted, with many special designs, the whole making a striking display.

Motors are used for the varied power purposes of a newspaper establishment. Directly belted to each press is a slow speed Eddy motor. That on the largest press is a 40 horse power machine operated at 475 revolutions per minute, and on each of the smaller presses is a 25 horse power motor at 525 revolutions. These motors are of the multipolar, consequent pole type with steel frames and iron-clad armatures. Their construction is such as to insure, as far as possible, against danger from accident, either mechanical or electrical. The absolute dependence put on these motors for the mechanical production of a great newspaper proves the confidence which the proprietors feel in electrically utilized power.



ELECTRIC TRAVELING SHEARS.

Other motors are in use as follows: Typesetting machines, one 10 horse power; stereotyping room, one 10 horse power; plate lift, one 5 horse power; photographers' room, one 2 horse power; pneumatic tube system, one 2 horse power; paper lift, one ½ horse power. The plate lift is a high-speed elevator used for conveying plates from the stereotyping department to the press room. The newspaper lift carries papers from the basement to the first floor and was devised by the Link Belt Engineering company of Philadelphia.

To Walter C. McIntire & Co. of Philadelphia, who represent the Eddy company in that city, belongs the credit for the design of the plant as a whole, and for its successful construction and installation. Every precaution has been taken to make the plant a model one and one in which every reliance can be placed. Two sources of power are available for driving the motors and furnishing light. The machinery and appliances are of the highest grade and most approved design; the wiring is of the most approved system and protected in every way. Altogether, the *Philadelphia Inquirer* has as perfect an electrical plant as modern engineering can suggest.

## A Home-made Traveling Crane.

The appropriations being nearly exhausted in the case of a small lighting plant, says *Machinery*, and a traveling crane being almost a necessity for handling the armatures, etc., of the generators, the engineer in charge sketched the plan shown herewith and had it made in the repair shop. The frame *A A* is simply to hold the I beam which forms the track in place, and one is supplied at as frequent intervals as strength demands. The upper edges of the I beam form the track, and the rollers are cast iron, governed as shown, and are held in the yoke *B* by the studs shown. These are fastened solidly in the yoke and form the shaft or axle for the rollers. A swivel crane hook *C* completes the equipment and makes a very handy addition to almost any shop or lighting plant. The cost is very little, and should not deter anyone from making it who has use for one.

## Electrically Protected Safe.

By the device for the protection of a safe represented in the accompanying illustration, the safe is inclosed by a metallic casing, which does not touch the safe and is insulated from it, the envelope having a door opposite the safe door. The envelope or casing rests on springs mounted on insulating blocks on the top of the safe, and depending from the envelope are top contact blocks, which strike the safe and close an electric circuit through an alarm when the springs are compressed. There is also an outer envelope which does not touch the inner one, but is in electrical circuit with the safe, this envelope resting on the floor, and also having a door opposite the safe door. A spring near this door acts as a circuit breaker when the door is opened, and in case either envelope is raised, it strikes either the safe or the other envelope, closing the circuit and sounding an alarm, a battery beneath the safe or in some other convenient place being connected by one pole with the safe and the outer envelope while its other pole connects with the bell. A closed circuit battery is also connected with contact lugs in the floor which connect with the outer envelope, a wire leading from the other pole of the battery to a circuit closer composed of an electro-magnet and a hinged armature, normally resting on the magnet, but raised by a spring when the circuit is broken. When the circuit through this battery is broken, the drop falls, as indicated in dotted lines, and strikes upon the free ends of wires forming branches of the open circuit wires, thus closing a circuit through the bell and sounding an alarm. This device has been patented by James W. Gilstrap of Spurgeon, Mo., and William D. Gilstrap of Racine, Mo., and the cut is from the *Scientific American*.

## Electric Traveling Shears.

The WESTERN ELECTRICIAN has already described several interesting applications of electrical power in iron-working establishments, but none more novel than the electrically operated traveling machine for cutting iron bars which is represented by the accompanying cut. This device is in use in the establishments of the grandsons of F. de Wendel at Hayange, Loraine (France) and is illustrated by *L'Industrie Electrique*.

This firm makes a specialty of bar iron, which is produced in such extreme lengths that its transportation to the shears, where it is to be cut into merchantable sizes, is a matter of difficulty and inconvenience. To surmount these obstacles is the object of the traveling shears.

The illustration shows the machine as constructed. It consists of a cutting knife as ordinarily made, but actuated by a Henrion motor, which receives the current from the trolley line connected to the center of distribution of the works. The power is transmitted to the cutting edge, which is connected to a crank as, shown, by the intervention of gearing.

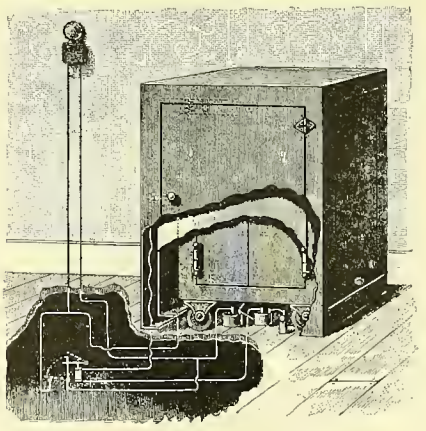
The motor consumes 75 amperes at a difference of potential of 110 volts and is operated at a speed of 800 revolutions per minute. The combined tool and motor are mounted upon a car, which runs about the mill upon rails, and is taken to any needed part of the works. The propelling power is furnished by the motor, which is thrown into gear with the car wheels by the lever shown at the left in the cut.

With this combination a large economy is already shown in the handling of the products of the establishment, and it is anticipated that far greater economic advantages will be shown in the future.

## Some Characteristics and Economies of Accumulators as Applied to Central Lighting and Power Stations.[1]

By JOHN R. MARKLE.

Accumulators embody characteristics which eminently fit them for fulfilling three prime functions in electric lighting and power distribution. They fulfill these three important functions more perfectly and at the same time with greater economy than any other apparatus. These three functions are: First, storage or holders of potential; second, equalization or controlling pressures; third, transforming or transmitting electromotive force and current. Any one, two or all three of these offices are fulfilled by accumulators at one and the same time as may be required. Under these three heads let us consider some of their characteristics and accompanying conditions which fit them for application to practice.

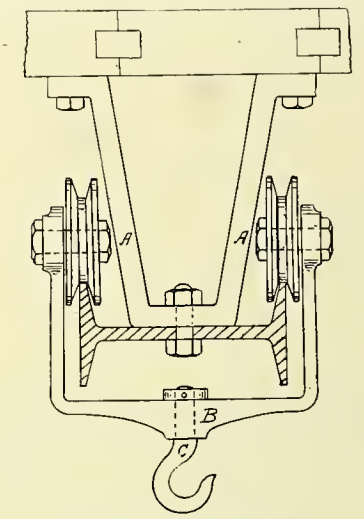


ELECTRICALLY PROTECTED SAFE.

*Storage.*—The most marked characteristic of accumulators is found in their more economical working at minimum or slow rates of charge and discharge. Opposite results follow the operation of steam boilers, engines and dynamos under light loads. It is here at once manifest that by telescoping or manipulating intelligently these two opposites there will be obtained the nearest perfect results: First, by obtaining a better time factor during which to generate and pass current over feeders to sub-distributing points, and thereby enabling reductions in their size and cost; second, a better load factor would at the same time be secured for the generating machinery; third, greater economy in consumption of current.

The area of space required for accommodation of batteries is less than for steam, air or water storage, until very high pressures are reached. A space of ten yards square will accommodate a battery having capacity of one thousand kilowatt hours. The cost of containers or holders of the active or working agent is less with accumulators than with steam, air or water, and depreciation and repairs thereon are less; the life is also longer.

With steam, air and water storage load diagrams show that the pressure or work line falls rapidly, whereas with accumulators the line at and near the two volts per element remains nearly horizontal for a period of about eight hours.




HOME-MADE TRAVELING CRANE.

*Equalizing or Controlling Pressures.*—Accumulators perform this, which is one of the most important requirements in the distribution of electrical currents, in manner most perfect. For steadiness and constancy no source of electricity or power can compare with a storage battery. Each element and series of elements making up a battery begins and ends with a negative terminal and thus differs in marked characteristics from all other forms of apparatus. An element or series of elements will transfer any excess of current (amperes) contained to others of lower electromotive force and thus automatically equalize the total electromotive force. Short-circuits and grounds are promptly blown by accumulation from their quickly responding store of accumulated energy. In fulfilling this function they maintain the electromotive force on the distribution line and so prevent excessive rushes of current from generators to motors and lamps, causing excessive sparking and cutting at commutators or other contacts with ultimate burning out of armatures of generators and motors and destruction of lamps. Absence of close equalizing of pressure precludes the employment of high economy lamps, due to frequent high pressure strains on the lamp filaments.

In continuous current distribution no form of dead equalizers, or what are known as machine or "live" equalizers, has enabled the use of incandescent lamps of better efficiency than 3-1 watts per candle. Alternating current transformer equalizing, so generally in use, does not make as good showing, in that 3.6 to 4 watts per candle is the requirement in this practice everywhere. With accumulator equalizing, lamps consuming but 2.5 watts per candle can be employed, showing an economy in use of current over dead equalizers of about 20 per cent., and over dead metal transformers equalizing in general use of from 35 to 45 per cent.

*Transforming or Translating Electromotive Force and Current.*—It is preëminently the best practice to charge accumulators in series and discharge them in multiple, and thus, under conditions of their best handling, it is found they fulfill the functions of ideal transformers. At the same time, they will also operate as equalizers and fulfill storage functions on but one drop or less of 10 to 25 per cent., owing to conditions under which operated. All other forms of transformers and equalizers pass current irregularities and armature impulses unrectified through to the secondary lines and into the lamps, thereby subjecting them to further damaging strains, shortening or destroying their life. Therefore, a tougher and less efficient lamp is required as a first condition to commercial lamp life. Accumulators do not thus pass to the secondary lines and lamps such primary irregularities and impulses. Attention is here specifically called to this valuable characteristic.

*Applied to Central Lighting and Power Stations.*—In order to determine what values a set of accumulators would produce for any given central station, the first cost of the accumulator should be set off against its achievements.

Where lamps of 4 watts per candle are employed, as against 3.1 watt lamps, a saving in current is shown at the lamp alone of about 20 per cent. Many stations show an aggregation of other losses between the generators and lamps, ranging from 30 to 50 per cent. If the latest and most efficient style of lamp is used, which battery regulation alone can enable at this time, namely, 2.5 watts per candle, so large a measure of saving appears as now to call serious attention of the ablest engineers to the problem of adapting all classes of current for battery use.

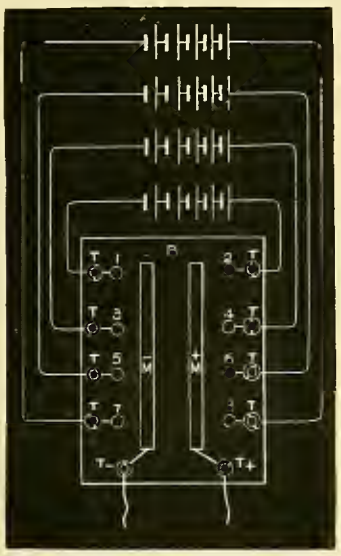
From statistics published in Switzerland for the year 1893, we find that there were 24 transmission of power installations; sixteen used continuous current, six three-phase, one

1. Abstract of a paper read before the Northwestern Electrical association, Milwaukee, January 16-18, 1895.

two-pbase and one one-phase current. There was an increase of 37 per cent. in the number of new accumulator stations, which numbered 40.

German statistics show that by far the greatest economy in fuel consumption and net earnings is shown by accumulating stations. At Altoona, with a station of but 468 kilowatt hours' capacity per day, the fuel cost is but 5.3 pounds per kilowatt hour of current delivered. One firm alone, Hagen & Co. of Germany, had installed prior to 1894 100 central stations and 3,000 isolated storage battery plants.

The drop or loss from a battery is often estimated singly, whereas it should be computed on the total electrical energy generated by the station, and the total values thus fairly arrived at. Average practice shows that where batteries are working at an efficiency of 75 per cent. the ratio of battery loss to total net output is from 10 to 14 per cent., and at 85



MERCURY SWITCH FOR LECTURE TABLE USE.

per cent. battery efficiency, 6 to 9 per cent. Average accumulator costs for depreciation and repairs show them to be about the same as on the steam plant.

In central station work it has long been demonstrated that one of the most helpful economies lies in the lamp. It was observed as early as the year 1888 that in stations using 4 watt lamps, and whose earnings were 3 to 5 per cent. on changing to 3.1 lamps, without other alternations or additions whatever, the net earnings were immediately increased to from 15 to 20 per cent.

The first cost of producing and installing accumulators is generally misjudged, for the following reasons. First, lack of knowledge of the many details of manufacture of a properly constructed element, and the necessary supplemental apparatus required for their working, such as instruments and their assembling, containers, racks, insulators, electrolyte, labor, freight and supervision; second, interest or increment on capital invested in factories and machinery and advanced for raw material; third, working capital necessary to bridge between time of sales and dates of collections; fourth, costs of selling the product, such as solicitors and agents' salaries; fifth, books, stationery, advertising, etc.; sixth, losses from bad debts; seventh, insurance and taxes; eighth, costs of administration over all these.

The railway power house offers at once the most favorable opportunities for accumulators. Here are found the most frequent and widest ranges of fluctuation of load, and the largest accumulative damages to fall upon expensive equipment. It is therefore highly essential to have the most helpful equalizing, economizing and reliable apparatus possible. It is instructive to note that about the first electric railway power house battery was installed at Zurich, Switzerland, where coal is high and local conditions such that usual average costs of operation of electric roads would preclude the possibility of showing prospective profits. The makers of an accumulator of established reliability guaranteed the costs of maintenance, whereby their costs became a known quantity, and the road was constructed and put into successful operation. Results last obtained in June, 1894, showed a saving of 2.2 pounds coal per horse power per hour. The cost of the accumulators will be earned in about four years from the saving of the coal alone. This saving is due to the facts that the engines are running continually at their best efficiency and the repairs are much less owing to the absence of load variation, shocks and burning out of generator and motor armatures.

A combined accumulator, steam and dynamo plant for railway power or other central station work is often regarded as a very expensive style of equipment. This is erroneous. An original plant of this description should cost but little (if any) more than a direct supply plant of good design. This is shown by the following estimates:

500 HORSE POWER, DIRECT SYSTEM.

| | |
|---|---|
| Cost of steam plant, $70 per H. P..... | $35,000.00 |
| Electric plant, 400 K. W., at $30 per K. W. | 12,000.00 |
| | $47,000.00 |

500 HORSE POWER, STORAGE SYSTEM.

| | |
|---|---|
| One-half above steam plant..... | $17,500.00 |
| One-half electric plant (200 K. W.)..... | 6,000.00 |
| 750 kilowatt hours accumulator capacity at $30 per kilowatt hour..... | 22,500.00 |
| | $46,000.00 |

What is of most vital import to the central stations are the load and time factors, for on these depend the commercial weal or woe of business. With these rest the size of the dividend. They are the arbiters of success or failure. The maximum and ideal load factors have not been obtained until all the machines in a station are running continuously at full load. Conversely, the maximum and ideal time factors have not been secured until the feeders of the system of distribution are passing continuously the same and the least number of watts that will fill the total demand. The system that fulfills these requirements best must of necessity embody storage in some form, and without which it is at once manifest no system is further in the race.

## A Mercury Switch for Lecture Table Use.[1]

By W. Perren Maycock.

Speaking more particularly with reference to science classes in magnetism and electricity, there are as yet comparatively few with facilities for obtaining current from a dynamo or from the street mains, or even from a secondary battery. In such, a primary battery has to be used; and partly on account of the trouble in setting up the cells, the number required, and ignorance or difficulty of combining them properly for a given effect, there are a good many experiments of great importance that are not shown to the class at all. Among these may be mentioned the magnetic figures of straight and coiled current-carrying conductors, a current-carrying conductor picking up iron filings, the sucking effect of a solenoid, the electric arc, attraction and repulsion of currents, the principle of the electro-motor, etc.

These and many other experiments in current electricity require currents of widely varying strength; and to get the proper current for any given experiment, the battery must be arranged as regards electromotive force and internal resistance to suit the conditions of the outside circuit and apparatus. For experiments on the electric arc, for instance, all the cells would have to be put in series; while for a good number of other experiments with apparatus having a very low resistance, and requiring a heavy current, the cells must be arranged in some parallel-series combination. In this connection it should be remembered that with a given number of cells, the greatest current is obtained when the cells are so arranged that the internal resistance of the battery is equal to the external resistance.

To facilitate the quick arrangement of cells in various series and parallel-series combinations, the writer has devised the simple and easily constructed form of mercury switch illustrated in the accompanying figure. Not only is much time saved by the use of this apparatus, but absolutely perfect connection is made between the separate batteries. *B* is a teak base 1 inch thick, 6 inches wide, and of a length proportional to the number of batteries it is intended to provide for. The switch illustrated will accommodate four separate batteries; in the present case of five cells each. The batteries may, of course, be composed of any convenient number of cells, but they must all be equal. The batteries are connected with the terminals, *T*, *T*, *T*, etc., as shown, and the latter have thick copper wires riveted to them, the ends of which dip into the mercury cups, *1*, *2*, *3*, etc. *T*+ and *T*— are the terminals to which the outside circuit is connected; these are connected by stout pieces of wire with the mercury troughs, *M*+ and *M*—.

Suppose all the cells are to be put in series, *1* and *M*—, *2* and *3*, *4* and *5*, *6* and *7*, *8* and *M*+ must be respectively connected by bent pieces of thick copper wire; this will give 20 cells in series. If 15 cells only are required, *1* and *M*—, *2* and *3*, *4* and *5*, *6* and *M*+ must be connected. Similarly, 10 or five cells in simple series may be used. Suppose the batteries are all to be thrown in parallel, *1*, *3*, *5* and *7* are connected by short wires with *M*—; and *2*, *4*, *6* and *8* with *M*+. This will give four parallel rows of five cells in series. If *1* and *M*—, *2* and *3*, *4* and *M*+, *5* and *M*—, *6* and *7*, *8* and *M*+ be connected, we shall have two parallel rows of 10 cells in series.

When cells are arranged in parallel, it is not well to leave them so connected for any length of time, even though each row be nominally equal in electromotive force. With the above switch, the cells may be thrown in and out of circuit immediately before and after an experiment, without the slightest trouble.

## Harrison Street Station of the Chicago Edison Company.

In the article on "Economy of Operation at the Harrison Street Station of the Chicago Edison Company," which appeared in the Western Electrician of January 19th, an error was made in placing the decimal point in stating the cost of current per kilowatt hour. It should be said that the average fuel cost of generating the current, by the use of oil under the boilers and direct-connected engines and dynamos, is .7 cent per kilowatt hour, while at full load the cost is reduced to .6 cent per kilowatt hour. It may be added that the maximum efficiency is reached when a unit (engine-dynamo) is about 10 per cent. overloaded, although before cutting in an extra dynamo the overload is permitted to reach 30 per cent. above the rated capacity. This is due mainly to the increased efficiency of the engine at full or overload as compared with half or three-quarters load. The probable cost of current, including operation and maintenance of station and distribution system, is 2 to 2½ cents per kilowatt hour. The use of the fuel oil and the new station equipment saves the company, as stated, $60,000 per year, as compared with the operating expenses of the old Adams street station, at which coal was burned. The oil expense is equivalent to coal at $2.80 per ton. The maximum load of the station is about 25,000 amperes at 140 volts

1. From the London *Electrical Review*.

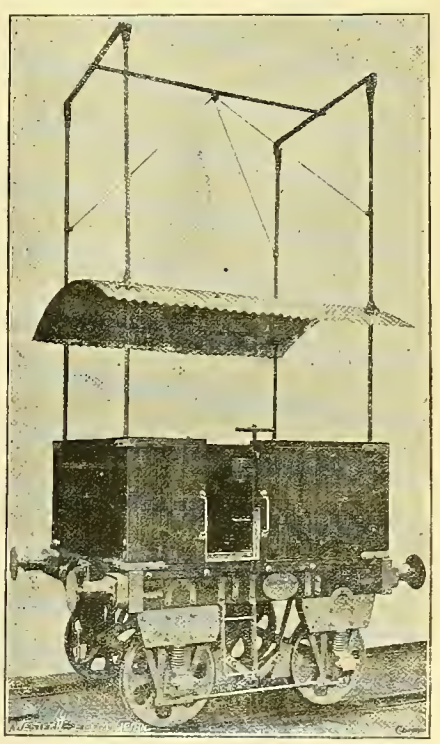
## Electric Switching Locomotive.

The January number of the *Railway World* of London contains a description and cut of an electric switching locomotive in use at the textile machinery works of Tweedales & Smalley, Castleton, which is herewith reproduced. It is explained that the interest of the arrangement described arises chiefly from the hint which it conveys of possibilities, for the locomotive is designed to draw a loaded wagon not exceeding twenty tons weight at a speed of about two miles an hour. It is used for shunting wagons on a siding connecting the boiler house and delivery stores of the textile machinery works with the main line. The electric generator, which is of the Manchester type, is designed for an output of 100 volts, 54 amperes, at 1,100 revolutions per minute, and is driven from the main shafting in the works. It is fitted with fast and loose pulleys, so that it can be stopped when not required. The construction is of the overhead type with return through the rails, which are bonded with copper strips and rivets.

The locomotive, which was designed and constructed by Mather & Platt, limited, of the Salford Iron Works, somewhat resembles a delivery wagon. It is fitted with coil spring buffers of the standard height and centers, axle boxes, and guides, and hand screw brake with wooden brake blocks bearing on the car wheels, which are 28 inches in diameter. The locomotive is roofed in with galvanized corrugated iron carried on wrought iron pillars. These continue through the roof and carry the collector bars.

The driving motor is also of the Manchester type and is mounted on a cast-iron bed-plate which slides on cast-iron brackets bolted to the framing of the car. The motor is fitted with a vulcanized fiber pinion with steel end plates of 21 teeth, which gears with a cut cast-iron wheel of 72 teeth on the gudgeon shaft, on which is keyed a chain pinion of seven teeth, driving a chain wheel of 22 teeth. The latter is split into two halves and is fitted to one axle of the locomotive. A sand box is provided and the car is fitted with a controlling switch, resistance box for starting and regulating the speed, and a reversing switch. The weight of the locomotive is a little over three tons.

The system of collectors on the locomotive lends itself particularly well to the requirements of this line, as there



ELECTRIC SWITCHING LOCOMOTIVE.

are many points, curves and crossings. The system consists of two wrought iron bars placed about six feet apart, one of which is always rubbing on the under surface of the overhead wire. This system is controlled by Mather & Platt and has lately been used on an extended scale on the Douglas and Laxey electric tramway.

As the locomotive is only required for two or three hours each day at odd times, it will be at once seen that a very great saving is effected by using an electric locomotive in place of steam, as the generator is simply started whenever it is required. As an ordinary laborer looks after the entire plant, including an overhead electric traveling crane, supplied by Mather & Platt, to lift three tons, and worked from the same generator as the locomotive, the cost for attendance is also small.

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THE staid railroad commissioners of New Hampshire, in considering the extension of electric railways throughout the country, make this announcement: "No conservative prophet is safe in front of an electric motor." Now, what does this mean? Is it a joke? It reminds us of our respected contemporary, the London *Electrician*, which bubbles over with waggery that it endeavors to conceal beneath a mask of severe and scientific precision.

ACCORDING to a Chicago daily paper the Metropolitan "L" road of this city is pronounced vastly superior to the elevated electric road of Liverpool by Edward Bentham Rae, who is described as "a heavy stockholder and director" of the Liverpool company. Mr. Rae is examining the methods of rapid transit employed in large cities in this country and is quoted as saying: "I had heard so much of the Metropolitan road that I decided to stop off on my trip across the continent and compare its plant with ours. I am bound to say I am more than pleased that I did so, for this 280-foot power house, with its mammoth machinery, takes the starch out of our Liverpool layout. I congratulate Chicago on having the most perfect electric elevated railway in the world. Your have not only been fortunate in having an opportunity to profit by the experience of others in the handling of the new motive power, but have had the enterprise and money to give effect to the chances offered to endow Chicago with a system of rapid transit which must be an object lesson to the whole globe." Mr. Rae says the operation of the Liverpool road and the returns thus far are satisfactory to the company and the public. He believes that electricity will eventually supersede steam on elevated roads.

MANY delays, much adverse criticism and numerous disappointments have not lessened Prof. Forbes' enthusiasm over the Niagara project, judging from his letter in the London *Times* reprinted elsewhere. In this article Prof. Forbes refers to his communication in the same journal three years ago in which he outlined his plans and recounted "the dreams of the engineer." In the present letter "the narrative is continued," and it would appear that the engineer is still dreaming, or at least that he is assuming as successful accomplishment plans that have not passed the experimental stage and about which there is still some doubt in the minds of competent and unbiased engineers. While there is a general disposition to aid and encourage the enterprise, it might be well for the friends and promoters of the project to await the results of the present experiments before indulging further in visionary schemes.

SENATOR HALE last week introduced a bill in the United States Senate providing for an appropriation of $500,000 for a complete survey of a cable route connecting this country with the Hawaiian Islands. This action will meet with the unqualified approval of a large majority of the people of this country, who are not in sympathy with the proposed plan to turn over one of the Hawaiian Islands to the British government for the purpose of enabling it to control the Pacific cable. As was pointed out in these columns, the English government will now be compelled to make a landing on Fanning Island or some other point. This will materially change the route of the proposed cable, and it is possible that the English government will not care to undertake the project if a landing on the Hawaiian group is not to be secured. It would certainly be of great advantage to this country to have a line established connecting Washington and Honolulu.

ORGANIZED labor has again received a serious set-back in the failure of the Brooklyn trolley strike. This movement gave greater promise of success at the start than any controversy of the kind in many years; it was well organized, ably conducted, and there were many commendable features in the men's side of the case. But like former movements it became impossible to restrain the men after they had been out a few days. Violent measures were adopted by individual strikers and sympathizers, and public opinion would not countenance acts of lawlessness. This is the secret of the collapse of the movement. It is to be hoped that the companies will adopt a liberal policy in their dealings with their employes. The chief point which the companies maintained was their right to administer the affairs of the roads and conduct their business according to their own ideas and regardless of the wishes of the labor leaders. They have succeeded in this. But this victory will not avail unless they modify their policy in many ways. There is no corporation in the country conducting a similar business and appealing directly to the public for privileges and patronage that is as unpopular with the masses upon whom it depends for support as are the several Brooklyn street railway companies. The late strike should be of value to them, if in no other way than by showing them in what light they stand with the people.

THERE is a good deal of interest manifested in the warfare which is being waged between the steam and electric roads of Connecticut. The New York, New Haven & Hartford company has suffered greatly during the last two years by reason of the competition of the electric roads and now it is engaged in retaliating upon the newcomer. In carrying out this policy the Consolidated company has invoked the aid of the courts and the Legislature—the latter as usual acting as a willing servant of the great monopoly. Owing to the activity of the electric traction companies that have been engaged in establishing a network of lines throughout the state, the steam company found it necessary to secure injunctions to restrain the electric companies from making further inroads upon its business until its lawyers could prepare the bills for the Legislature to enact by which it was hoped to shut out further competition. On January 16th a bill was introduced in the House providing that after its passage "no steam railroad in the state shall be crossed on grade by any electric, cable or horse railroad, nor shall any steam railroad cross any cable, electric or horse railway at grade." The rules were suspended by a vote of 180 to 12, and the bill was passed by a *viva voce* vote and ordered transmitted to the Senate. In the Senate the bill was referred to the committee on railroads. The aim of the bill was to prevent the Bridgeport Traction company from laying its tracks across the New York and New Haven road at the Fairfield avenue crossing, near the Bridgeport railroad station. Both houses adjourned to Tuesday, January 22d. On that day the Senate passed the bill. The traction companies have not exhausted their means, however, and the warfare will be continued. The Consolidated found that it had a wide-awake opponent, for it has already been caught in its own trap. At South Norwalk the tramway company refused to permit the steam road to cross its tracks to connect with the Standard Oil company's works at Wilson Point. Injunctions were served on the contractors, but the company took up the work and attempted to force a crossing. The tramway company tore up the tracks as soon as they were put down and at last report was in possession of the field. The Consolidated finds itself in the position of a man shut out of his own house. It has secured the passage of a bill by the Legislature, by the terms of which it is prohibited from crossing the tracks of an electric company. Little sympathy will be expressed for the monopolists and less will be felt.

THE future of electric traction never looked brighter than at present. The trend of events is such that it is likely that in a few years there will not be an elevated railroad in the country operated with steam locomotives, while the surface street railways will be exclusively cable and electric, with the former confined strictly to the conditions of long, straight hauls, with heavy traffic, in localities where the overhead electric construction is not permitted. Suburban and rural electric railways are also multiplying at an astonishing rate, and no one can assume to name the limit of this development. Three or even two years ago conservative electrical men admitted that for heavy, long-distance traffic the electric railway could never hope to compete successfully with its long-established steam rival. But to-day who will dare to assert that the electric railway is not, in sober truth, the railway of the future for all purposes? The advance of electric traction has been so rapid and astounding that he would be a rash prophet who should take it upon himself to set the metes and bounds.

Signs of the steady and continuous progress of the electric railway are visible on every side, and particularly, just at this time, in the great American centers of population. From New York comes the welcome news that Russell Sage has at last publicly committed himself to the statement that electric motors must soon supersede steam locomotives on the extensive elevated railway system of the Manhattan company. Mr. Sage is certain that the change will be made, and he adds that in time the company will provide elevators at the stations to lift passengers from the street level. It is very probable that these elevators, also, will be operated by electric motors supplied with current from the track feeders. There is little doubt that the example of the Manhattan company will be followed—possibly preceded—by the elevated railway companies of Brooklyn, whose position on this subject was detailed last week in the New York correspondence of this journal.

In Philadelphia, Brooklyn and Chicago the transformation of practically all the old horse-car lines into modern electric street railways, within the last two years, is well known.

Chicago also presents a field of activity in elevated electric railway construction. The new Metropolitan—the first permanent all-elevated electric railway in the United States—will be in daily operation in a few weeks. The "Alley 'L'" company is only awaiting the results on the former line to avail itself of the economy of electrically transmitted power. On this point the language of President Hopkins in his recent annual report is of especial interest. He says:

Considerable attention has been given by your board of directors to the question of equipping the railroad of your company electrically. Careful estimates of the cost of a proper power plant and necessary equipments on the line have been obtained, together with estimates on the cost of the operation of the railroad when fully equipped. In view of the fact, however, that the abandonment of the steam locomotives entails a large direct loss, and the cost of equipping electrically would involve a present outlay of a large amount of money, and in view of the further fact that the amount of saving by operatig electrically has not, in the opinion of your directors, been entirely solved, it has been deemed prudent to defer the incurring of the large expense of changing the character of the motive power of your railroad until the experience of the Metropolitan West Side Elevated Railroad company could be ascertained. That company has equipped its railroad electrically and is about to commence the operation of the same. Its experience will be the best guide that could be furnished for the future action of your board of directors in reference to this question.

The Lake Street "L" and the Northwestern, of Chicago, will also be electrically operated. Turning to the surface roads of the same city, we find that in addition to the equipment of previous horse-car lines for electrical power, as noted above, the City Council has just granted to the North and West Side companies valuable franchises which will enable them to transform the existing cable routes into electric lines. This is a very radical step, and although advantage may not be taken of the privilege, for some time at least, the passage of these ordinances shows the truly wonderful progress that has been made in this direction. Truly, the future of electric traction wears a most flattering aspect.

## Interior Wiring Patent Litigation.

In the United States Circuit Court of Appeals, on January 22d, Judges Lacombe, Wallace and Shipman affirmed the decision of Judge Coxe in the case of the Interior Conduit & Insulation company against the Eureka Electric company. The suit was brought for an infringement of the Johnson and Greenfield patents for conduit wiring, and was defended by the New York Insulated Wire company. Judge Coxe rendered his decision last spring, dismissing the complaint. As the appellate court has confirmed this judgment, Judge Coxe's reasons for holding the defendant blameless of infringement are of importance. The concluding portion of Judge Coxe's opinion is as follows:

I have examined the patent with care to discover what new idea it has contributed to the art and am compelled to think that the art of electric lighting would have lost nothing tangible if the statements of the patent had never been made public. I cannot resist the conclusion that many of the marvelous attributes ascribed to the patent are afterthoughts which find their orgin largely in ardent and ingenious expert imagination. It may be doubted whether the patentees themselves were conscious, when they put the old wires in the old pipes, that they had made a discovery which cured all the defects of the past and was to lay a heavy tribute upon all electrical wiring in the future. What they did do seems most simple to the ordinary layman. Both were accomplished electricians. Mr. Greenfield had had large experience in wiring buildings. In 1883 he had wired the Mills building by drawing insulated wires through zinc tubes. Mr. Johnson had a cottage at Greenwich which he wished to have wired. He consulted Mr. Greenfield on the subject, and the latter describes what occurred at the supreme moment when the invention had its birth. "Mr. Johnson asked me if I couldn't wire that cottage in a way so that the wires could be got at and repaired, if necessary, without tearing up any of the building, and I told him yes, I thought that I could put in a system of tubing which could be used for race-ways, if properly constructed, making a continuous channel, and he said, 'Greenfield, go ahead and do it,' which I did." Most assuredly he did it! What else could he do? He had done substantially the same thing before in the Mills building and he utilized his knowledge to suit the changed condition precisely as any other skilled electrician would have done after he was told what was wanted. The attempt to magnify this apparently simple exploit into an invention of surpassing excellence can be accomplished only by the substitution of theories based upon the imagination for facts based upon the evidence.

If the construction, broad enough to cover the defendant's structures, is placed upon the claims, they must be held invalid. If limited to a complete system of pipes extending continuously through the building, "from supply to consumption," as shown in Fig. 1 of the patent, the claims may be upheld. But the defendant does not employ such a system, and, in no event, is the third claim infringed for the reason that the defendant does not use a pair of wires twisted together.

## Another Case of Temporary Blindness from Electric Shock.

The *Cincinnati Post* of recent date says that John Sweeney, the engineer at the Main street electric railway power house at St. Bernard, lost his eyesight while at work on one of the generators. He was engaged in sandpapering one of the machines when, in some manner, he grounded it, and there was a flash of fire that lighted up the whole engine-room. Sweeney fell back as though shot, and when he made an effort to get away he discovered that he could not see. He was totally blind, and had to grope his way from the machine. The man thought his eyes had been blown out, so strong was the stroke. He called for assistance and a physician was sent for. For two hours the man's sight was a total loss, and it was feared that the injury would become permanent, but with the aid of soothing lotions and being kept in the dark his sight was restored. The flash was so hot that his left hand was badly burned, three fingers being nearly roasted to a crisp. After he was able to move about his injured hand was dressed and he was taken to his home.

## Prof. Forbes on "Niagara of To-day."

The London *Times* publishes a letter from Prof. George Forbes, dated at Niagara Falls, December 10th, in which he says:

Nearly three years ago you published a letter from this place in which I gave some account of how the dreams of the engineer were in the act of being realized, and without injury to the natural beauties of the spot. Three years have passed, my work is ended, and it seems natural to continue the narrative and tell what these three years have brought forth. I am perched on the top of a small Eiffel tower, lately erected, and, casting my eyes up the river, over the housetops and beyond the town, I see a new world created. There is a wide canal leading water into that gigantic power house where three turbines are set up to drive three dynamos of 5,000 horse power each. There is the bridge to carry cables across to the transformer house. Inside the power house the water is carried down pipes 7½ feet diameter into the turbines, and then it passes through a 7,000 foot tunnel under the town, emerging below the falls, and capable of developing 100,000 horse power. Far as the eye can reach extend the company's lands, with here and there a huge factory either now using the water power, or waiting for the electric supply. One of them uses 3,300 horse power, another 300, a third one 1,500, and that unfinished mill requires 1,000. You can see, far away, the model village for workingmen, and improved sewage works with drainage, pumps for water supply, electric light, and well-paved streets. There, again, is the dock where ships from all parts of the great lakes can unload, and there a huge expanse of reclaimed land; while the whole is swept by the company's railway, seven miles long, connecting every factory with the great trunk lines. The power is transmitted by electricity, and the first work is to produce aluminum with 1,500 horse power. New types of machines have been devised for this work, as also for every other purpose. All criticism as to cost of electric works has been swept away by the results achieved, and the efficiency of each type of machine is greater than has been attained before. All the machinery for the first working has been made and tested in the shops, and the last parts are now being set up. The plans for carrying the power to Buffalo, 18 miles distant, are complete. In a month or two factories will be in full operation; in a year Buffalo will be supplied; in two years the same company will be working the Canadian side of the falls, and in ten years (shall we say?) the whole of the 100,000 horse power which can be supplied by the existing hydraulic works will be giving power to smokeless manufacturing towns. The period of planning the transmission scheme, of designing the greatest dynamos in the world, and of construction of the first plant now closes. The financial period commences with the new year. The earning of dividends and the ordering of duplicate machinery is the future work of the company. In conclusion, it is difficult for me to say who were the boldest, the capitalists who embarked on the scheme before any plans were matured, or the manufacturers who moved their factories to this field before a single result had been achieved. The action of both was typically American, but their confidence was not misplaced. Their success is now assured.

## Hints Upon Daily Work About a Dynamo Plant.[1]

By Pliny Norcross.

It is ten years since I became interested in the business of furnishing electric light to some of my townsmen. Thus far I have used only water power. I know nothing of steam engines or boilers. I am, however, watching with considerable interest the later kinds of gas and gasoline engines.

At the risk of pounding straw already threshed, I wish to present a few facts which seem quite essential to success. A dry, solid foundation for dynamos to rest upon is of the utmost importance. We should seek by every possible means to deliver the current to the lamps with the least possible hindrance. A damp floor steals the current, and a trembling or unsteady dynamo tends to an unsteady current and hot boxes and armatures.

Heat in and about a generator, however occasioned, lessens its efficiency.

Not long ago I visited a very large and very expensive lighting plant in a western city. The second floor, upon which the dynamos rested was placed upon heavy iron girders, but the great weight of the dynamos and the great speed at which they were run made such a severe vibration that I could hardly keep my hat on while standing near the dynamos. The waste in coal and burned-out parts must have been enormous. Most of the smaller plants, if defective in this regard, can be materially helped by the outlay of a small amount of money. In large plants such defects in the original plan cannot now be eliminated without very serious outlay.

I would also call attention to the negligence or carelessness in finishing up generators. If the main shaft is not exactly round, and if it does not rest in boxes or bearings which are perfectly fitted to it, and absolutely level; if the babbitting is not of the very best quality and properly put in; if the armature is not accurately balanced, heat is generated, and the efficiency of the generator seriously reduced.

I well remember that one of my tasks when a boy was to turn a grindstone for sharpening scythes. I soon learned to detect the slightest variation in the balancing of the stone. How much more plainly would such a defect be observed in an armature weighing from 1,200 pounds to several tons, and where the speed is from 600 to 1,800 revolutions a minute. So with a shaft not properly turned and fitted, revolving in a poorly fitted box from 10 to 24 hours a day without cessation, carrying a load from 10 to 150 or more horse power.

Years ago we thought a dynamo was simply a machine for generating an electrical current, but observation has led me to believe that good workmanship in the parts of a dynamo which are common to all heavy machines, built for rapid, severe, constant use, is fully as essential as the electrical features.

Take a slow-speed dynamo, which has a heavy, substantial broad base; large, accurately turned shafts; long, heavy boxes, babbitted with the very best material; let the pulley be a little too wide, instead of a little too narrow; then put in a wider belt than you really think you need; have the boxes beautifully fitted and self-oiling; then furnish the finest lubricant which money can buy, and you have in such a machine, so equipped, laid the sure foundation for good work with the least possible outlay of power, so far as the dynamo is concerned; and just think of the peace of mind and serene comfort you will have. In this way you have eliminated a large per cent. of the trouble which seems incident to the business.

A few years ago I was troubled with a pulley which was used as a belt tightener. I tried various kinds of oil, grease and graphite, all to no purpose. One day an old machinist called my attention to the W. B. Miller grease, made or sold at No. 21 River street, Chicago. I tried a 25 pound can, for which I paid 15 cents a pound, and the trouble disappeared as if by magic. Graphite is good in case of trouble, and perhaps all of the time, but it is the better way not to have trouble.

As regards dynamo oil, we have the same difficulty as with cigars. A good brand is put on the market; the goods are kept up to the high grade for a while, then the consumer finds fault because the price is so high, and then the maker, anxious to hold his trade, cuts the price, but also cuts the quality of the leaf or the price of making, or he becomes careless in assorting the material. So with oil. I have found the dynamo oil made by A. W. Harris of Providence quite uniform and satisfactory. I have also had good satisfaction with the best brands of the Standard Oil company. Any oilmaker can make good oil for a dynamo. Quite often it is the fault of the consumer that he will not buy a good lubricant. He thinks the cheap grades will do well enough.

Nothing is too good or too nice to be used in the generation of electrical current. Poor oil is dear at any price, and good oil is cheap at any price. Anything and everything to keep a dynamo cool. You all know how hard it is to keep a dynamo cool on a hot summer's night. When an armature burns out it means delay, trouble and expense. Good oil is an important factor in the problem.

A blower is a great help and costs but very little. A current of cool air directed upon the heated parts may prevent disaster. The later style of generators are made with reference to their being taken apart and cleaned.

Almost, if not quite, the only thing which can be said against the Thomson-Houston arc dynamos is that it is difficult to take them apart.

Another source of constant trouble and waste of energy is the slipping of belts. Apply a speed indicator to the driving shaft, and then to the dynamo shaft, and you will find in all high speed machines a *loss*, especially if the driver pulley is a small iron pulley. A slip is a sudden stop and start. It would not be noticed in a sawmill or turning lathe, but is bad anywhere, and especially on a dynamo. It directly affects the light and tends to heat a machine.

There are several causes: Oftentimes the belt is too short; oftentimes it is too narrow; sometimes the belt is overloaded; again, the pulley on the dynamo is so small that the belt cannot get sufficient contact with its surface; again, excessive speed will alone induce it; also greasy belts are bad.

One means of relief is the use of a wider belt. In this way we can have a looser belt and more sag, and thus more contact on the smaller pulley and less tension. Again and again I have noticed belts strained to their utmost capacity. A few dollars expended in changing the small pulley belt for a wider one would eliminate the trouble.

Keep the belt pliable by the sparing use of some good belt dressing, made by any good beltmaker. As to pulleys, I prefer iron for the heavy, large drivers, but I like wood or fiber for the small driven pulley. If you have iron, they can be improved by putting leather or canvas or, perhaps, paper on the outside, but it must be carefully done by an expert or it will come off and make serious trouble.

The day of the high speed dynamo is passed. If you ever buy another, get a slower speed machine. Of course, a direct connected is better, but to many of us that means a great outlay. We can't change our whole outfit every year or two, but when we do make changes, let it be on the line of improvement.

Another thing which I think helps producer and consumer is a uniformity of dynamos and lamps in a plant. I call to mind several large plants in which there where hardly two dynamos of the same make, and there were several kinds of lamps in use. I doubt the wisdom of such an equipment; $100 spent in looking at different plants and ascertaining by actual observation the kind of machine which is best adapted to your use is a good investment.

Get all the the information you can from the secretary and superintendent, but be sure to call on the man who cares for the engine and dynamo. Don't rely wholly upon the men who make and sell the machines, although I think they can be relied upon to hint at the defects of other kinds than their own. The test of long actual use is, after all, the best thing.

Having secured a good dynamo, see that it is properly put up as before suggested, and when you add to your plant get the same kind, unless you are very sure that you made a mistake in your first purchase.

In this way your customers all get the same service. If there is trouble in lamp or dynamos, you look to one company. The seller cannot evade the responsibility by putting it upon the other machine or lamp. He must be your friend and silent partner and he must help you.

In placing wall controllers, I would suggest that it is well to have them so set up that they cannot tremble. If your building is of wooden frame, I would place a post through the floor and well into the ground, so that it will not be affected by the vibration of the building. Then fasten to the upper end of the post a plank crosswise, like a guideboard, and on this plank secure the wall controller and you will be surprised at the improvement.

As to carbons, I have used several kinds, but have had better success with the National than with any other make, but I am open to conviction and conversion.

I like the plain carbon better than the coated, for the reason that the copper coating melts into little globules, and flies off to the globes and breaks them. I think the plain carbon gives a better light. I prefer a carbon with a blunt round end or even a flat end. By this plan the carbons are not so likely to slip by each other during the time between setting them and lighting. Our customers desire longer hours. One way of effecting this result is the use of a larger carbon. The Turner Brass Works of Chicago furnished me with new fixtures for my old T.-H. 7-16 carbon lamps, so that I can now by the use of ½ inch carbons, and without a great outlay, furnish 10 or 11 hours of light.

Bushings for arc dynamos in the Thomson-Houston machines are made of lignum vitæ well soaked in shellac. The surrounding heat oftentimes checks the bushings, and thus a short-circuit makes sudden trouble. I would suggest throwing out this kind of bushing and using in their stead a fiber bushing made at Wilmington, New Jersey, or a hard rubber bushing made at Akron, Ohio.

Wiring through trees is unpleasant work, and when the wire is once threaded through a tree the insulation is slowly rubbed off, and then current is wasted and the dynamos flash. A couple pieces of thin, narrow boards from 18 inches to two feet long, grooved so as to receive the wire, and then fastened together with the wire under the offending limb, is a good device for such trouble. Of course, it should be put on before the insulation is worn off. The

1 Read before the Northwestern Electrical association, Milwaukee, January 16, 1895

H. W. Johns company makes a good device for such trouble, only those which I have seen are too short.

I must add one word about wiring. I really believe that defective wiring, poorly made joints, cause an immense outlay of current. Let your whole line be looked over often and you will find that your coal bill has some other cause for its size than furnishing light to your customers.

As to prices, the laborer is worthy of his hire. The man who has been rash enough to invest his savings or credit at the bank in a good electric light and power plant is a public benefactor and should receive a fair interest on his investment and a fair return for his labor.

Ten years ago the gas companies of the world looked with some apprehension upon the new light. It was to them what the star in the east was to Herod, a signal of a coming overthrow. But these fears were, in a large respect, groundless. I am sure that more gas is used to-day than ever before. The price has been reduced. All sorts of devices have been adopted to enable the gas companies to keep their stock at or above par, and they have succeeded even beyond their own expectations.

Gas has several very strong points in its favor. It can be made of water and gasoline and a little coal, and when thus cheaply made it can be stored away in tight receivers until wanted. If we don't use it one day we can use it the next day or week.

Another fact in its favor is that it is always ready for use, except in very cold nights.

The electric light is, in my judgment, a more expensive light. I know there are those who deny this, but I think the most disastrous course ever pursued by the men who put in an electric light into a town in competition with gas, is to announce to the public that the new light is cheaper than gas. Better by far stand securely upon the simple truth that it is better light, but that it costs more to make it.

Another thing, electric light is not in ordinary cases quite as certain as gas. A storm may blow down your wire. An armature or lamp may burn out; a half-dozen unforeseen and unpreventable things may happen, and I think it is the better way to say so in advance to the customer.

Again, in all the smaller plants of the country the current must be used when it is made. We may be crowded to the very last atom of power for a very few hours in the day, and for a week or so in the year, and you must have power enough for that brief hour, even if you don't need it again for a year.

A customer says, I would like your light for Christmas exhibition and New Years trade, but I can get along with oil or gas the balance of the year.

He does not think that the large investment of wire, engines, buildings, dynamos, etc., must be carried for the whole year, summer as well as winter, and a price made on an average of the whole year.

Yet there is no ground for fear if we would be brave enough to test our lights upon its merits and not pretend that it is cheaper.

One New Years day not long since the man who practically owned the gas plant in the town where I live and I were having a little chat on light. He said that he had sold more gas the preceding year than in any previous year, despite the two electric light companies. A few days later I submitted his statement to the Standard Oil man of our town. "Is that so?" said he. "Well, I have had to buy another tank wagon and team to supply my customers." This increased use of gas and oil was mainly, if not wholly, due to the introduction of electric light in the town. Neither should it be forgotten that gas has been reduced in price from 50 to 100 per cent. in the last ten years.

Curiously enough, but nevertheless true, the electric lighting companies have suffered most in the competition. Of course nothing could seriously injure the great oil companies. As long as they could buy barrels to hold oil, they were safe enough. Gas companies could make and sell gas for 50 per cent. of the prices obtained in 1883, and still by the use of watered gas pay good dividends on watered stock. Electric companies started up all over the world, expecting in many instances, I think, to supersede all gas or oil rivals. The result has not justified this expectation.

A few gas companies may have gone down in the contest, but not nearly so many as of the electric light companies. Their road is strewn with the debris of disaster and failure. This result is largely due, I think, to an overweening confidence and zeal. Less hurry and more careful consideration of some of the important facts of the situation would have prevented much of the disaster. It has for years been one of the main arguments with sellers of electrical outfits and supplies that the manufacture of electric current for its many uses was a source of great profit.

Time has shown the folly of this statement. The electric light stands firmly upon one proposition, to-wit: it is a better light than oil or gas. It will never cover the entire field of illumination so long as oil or gas can be made at so much less price.

Step into any room lighted with oil or gas and you are at once made sensible of the fact by smell as well as sight. You may use the Welsbach lamp, which gives the ghastly pallor of death all about it; you may disinfect or cleanse it with lime or any other substance; you may put the price at 50 cents per 1,000 feet, but you cannot get rid of the unpleasant fact that wherever gas or oil are burning they devour the life-sustaining element of the atmosphere; they leave an odor which is not wholesome and almost irremovable.

Tom Moore, in one of his choicest effusions, alludes to the vase in which roses have been distilled, as follows:

> You may break, you may shatter the vase if you will,
> But the scent of the roses will hang round it still.

So with the strong, pungent, disagreeable, unhealthful combination of gaseous poison with the oxygen of our atmosphere. Its odor will hang around every object with which it comes in contact. Roses don't thrive in a room well lighted and scented with gas. Give your customers a little time, and take a little yourself, and this matter of supply and demand, of price, and profit or loss, will settle themselves just the same as every other great discovery has eventually filled its proper place in the economy of life.

## Interior Conduit and Interior Wiring.[1]

By Charles E. Burton.

I assume that the members of this association meet for the interchange of views relative to operative methods and for procuring such information as may be had; further, that you regard your business as one of permanency and that all that tends to the betterment thereof increases its permanency. The cautious manager expends careful thought in the purchase and operation of the most economical generating devices, both steam and electric. The expense of producing a watt is most carefully scrutinized, and if possible reduced; and when a month's record shows that this watt has been manufactured and delivered at the switchboard at a cost less than the preceding month, it is a matter for congratulation. This watt, which has probably caused so much watchfulness to economically create, is turned loose upon the wiring system to earn the cost of its generation and enough more to pay interest on the investment.

But right here in many instances the surveillance seems to cease. If this watt meets with resistance in the overhead lines or finds a short path to the ground, the loss falls on the station, but if this result occurs on the inside of a meter, that is another matter, and the loss falls upon the customer; and it is the failure to regard this effect as much more than a joke on the customer that tends to establish strained relations between the electric light company and its customers, with a possible like effect on the net earnings. It is generally conceded that a majority of the interior wiring found in most cities is of a character that reflects little credit on its author and less on the lighting company which allows it to menace property by putting current through it. People not identified with electrical interests readily profess a dense ignorance of electrical matters; they regard it as a science acquired only by long and exhaustive application, and hence they are not capable of determining whether the wiring on their premises is of a safe character or not, trusting to the judgment of the local lighting company; and when an electric company consents to use interior wiring which it knows to be of an inferior or unsafe character, it might be accused of playing a mild confidence game on its customers. The insurance companies writing fire risks upon structures of all kinds assert that inasmuch as they have assumed a liability by placing a line of insurance upon a building and its contents, they shall control, in a measure, the property covered, indicate the hazards that exist and insist upon their correction. They have learned by costly experience that electric light companies as a rule are exceedingly negligent in the inspection of the interior wiring to which they attach their supplying conductors, and hence rules have been issued by the underwriting associations, relating very minutely how all classes of wiring shall be installed, and there are also inspectors in most cities whose duties consist of a systematic and rigid examination of wiring in all structures upon which insurance now exists or is liable to be placed, and who have the power to insist upon the correction of existing evils or faults, or in the event of failure on the part of the assured to so correct them, to make a rate proportionate, in their estimation, to the hazard incurred. It is not to the credit of electric light companies or to the business of electric lighting, that the underwriters have been compelled to take the initiative steps toward the improvement of the electric business. In reality there should be no underwriting rules. If the standard of electric wiring has fallen so low as to require the rigid inspection and supervision that is now exercised by the underwriters, the electric companies themselve should be the ones to protect their own interests in the provision of proper rules and regulations against the introduction of poor labor and material; and as the business has assumed the dignity of a permanent profession, it is not right that the action of its members should cause the necessity of such close surveillance by those who claim to have been injured by a lack of ability to conduct its business on a safe basis. We would think very poorly of a physician whose lack of ability was so apparent as to require inspection of his prescriptions before we could consent to use them; and hence the conclusion can be inferred that if those supplying an electric current for use by the public, and knowing the damaging character of poorly installed interior conductors, had been more alert in the anticipation of results and more exacting as to the quality of work performed there would not have been the general distrust of the presence of electric current in a building, but there would have been an increased approval of that method of service. It is undoubtedly a fact that in many places electric lighting plants are instituted on a basis that precludes the possibility of the highest quality of work. The customers refuse to pay for it, and the prices charged for service are so low as to render the highest grade of work almost prohibitive. It does not, however, mean that poor wiring can be used. It is far better to have a high grade system of exposed wiring than a low grade system of concealed wiring. The ideal method of wiring, looking at it with a view of greatest security and insulation, is exposed, heavily insulated wire supported upon non-combustible insulators. This may do for factory and other places where exposed wires are not objectionable. Your customers, however, object to the presence of wires on their walls and ceilings, and naturally expect that the wire shall be placed in a manner that will be the least objectionable. But when it comes to concealing wires it would appear to be the practice in some places to perform a quality of labor and use material that would not be tolerated if the wiring were to be exposed. Concealed work, in view of the fact that it can not be inspected, or, pending trouble, seen, should in its varied natnre be of a character that would preclude the possibility of any existing danger. It has been customary in work of this kind to bore holes through the joists, pulling the wires through the holes and supporting them upon anything that proves to be convenient. The insulating or fire resisting qualities of these supports seem to have been a matter of little consideration. In a recent report of fires from electrical sources it was reported that 71 fires were caused by short-circuits in wiring, passing through or adjacent to wooden supports, and the present underwriting rules provide that all wires, whether concealed or exposed, when not run in interior conduit, must be supported wholly upon non-combustible insulators; this means that every hole through which the wire is passed must be previously bushed out with some insulating substance, such as metal sheathing bushings, glass or porcelain. This method naturally increases the cost over the old method of wiring, but at the same time increases the security of the system; it has many disadvantages, however, that render it quite objectionable. All concealed wiring should also be of a character that will secure the owner immunity from loss of current and protection from fire hazard. It should further be of a character that will enable its inspection at all times subsequent to its installation. Where interior conduit is not used, this latter effect is rarely attained, and this brings us to the use of interior conduit for all classes of interior wiring. It is claimed that by the use of this conduit the objectionable features formerly found in concealed wiring have been eliminated. It gives to a system of wiring mechanical protection, additional insulation, and above all the ability to withdraw and reinsert wires at any time without damage to the building or any of its decorations, should the insulation of the system become impaired. It is probably useless to describe with any minuteness the interior conduit system, as it is to be hoped that it has been sufficiently advertised and presented to most of you, so that its good qualities have been readily understood. The system consists virtually in equipping a building throughout with insulated pipes, thereby providing continuous insulated raceways or channels for the reception of the wiring. The complete system provides in addition to the conduit, various forms of junction, cut-out and outlet boxes; and all varied conditions of interior wiring have been met and provided for in this system. Interior conduit is now furnished in three forms—the plain conduit, brass armored and iron armored. The plain conduit, which was the original form, is manufactured by building up tubes of special paper, the paper being wound on a mandrel spirally and the different layers cemented together; after seasoning, the tubes are boiled in preparations that render them impervious to moisture and practically fireproof. Many millions of feet of this kind have been installed, but to meet the demands of greater mechanical strength the brass armored conduit was introduced, which is simply the plain conduit having a sheathing of brass drawn over it by special machinery. The necessities and exacting conditions of modern construction demanded something having more mechanical strength than the existing types of conduit, hence to meet these requirements was brought out the iron conduit, which is the plain conduit forced into an iron pipe in such manner as to secure a positive union of the conduit and the iron. This tube is built to fill all the requirements of flexibility and permanency desired by engineers, and is fast assuming a popularity that must be gratifying to manufacturers. Interior conduit requires no arguments to secure the approval of architects and engineers; its advantages were apparent, but to secure its use by owners was a difficult matter. Most radical improvements or departures from existing methods require the expenditure of a large amount of labor and argument to secure their adoption. It is within the recollection of many of us when underwriters' insulated wire was considered the ideal insulation, and the early manufacturers of rubber insulated wire were obliged to use many strong arguments to sell their product. Time has demonstrated the fact that the best insulation is none too good, hence we have the almost universal use of rubber covered wires for inside wiring. Double pointed tacks were formerly used as insulators, but not in the present generation. It was also considered good engineering to bury electric light conductors in or behind plastering, but it is not done in first-class buildings to-day; interior conduit is used. In hundreds of places it is considered perfectly safe to run wires in an indiscriminate manner with no regard to the liability incurred, but time will demonstrate the fact that had interior conduit been used a great many of the existing evils would have been eliminated. The point has been and will continue to be raised by many that the cost of installation prohibits the use of conduit. All improvements of any value cost money. Interior conduit costs money to purchase and install. But are not the advantages gained by its use a sufficient argument to secure its adoption? Relative to the cost of installing interior conduit it has been demonstrated in actual practice that it will require approximately an additional expenditure of 20 per cent. for plain conduit, 40 per cent. for brass conduit; these figures being based on the cost of installing interior conductors in the old method, that is, boring holes through the joist, and with no regard to ordinary safety precautions; that if the wiring system is installed in compliance with modern regulations, that is, the bushing of all holes with insulating material, and the wiring system being supported by wholly non-combustible insulators. Interior conduit can be used at a cost averaging not more than 10 per cent. for plain conduit and 20 per cent. for brass armored conduit in addition to the cost of the method last above noted. These figures, obtained from actual installation, are average figures, given by a number of contractors who have installed wiring by both methods. The installation of this conduit is very easily accomplished; in fact, no previous experience is actually necessary beyond a few initial instructions as to the proper methods of making joints and economical methods of using the conduit. In a fireproof building the conduit is attached directly to the walls and ceilings by means of special clips or other devices, and in the case of plain and brass armored conduit is fully covered by finished plastering. In a wooden structure it is customary to channel the joist and lay the conduit directly in these holes, or if plastering is furred out from the joist a convenient raceway will be found for the use of the conduit. It is customary in most specifications to provide that the wiring shall not be pulled into the conduit until the building is practically completed. This provision is made so as to secure to the owner the continuity of tubing which is especially desirable to enable the proper subsequent manipulation of the system. If the contractor fails to make proper joints it will be impossible to pull the wires through, hence this provision; the inference being that the contractor, to secure immunity from trouble in pulling in the wires, will be careful in the installation of the conduit. This also enables the owner at any time to withdraw these wires and re-insert them, should it become necessary. It also enables the owner to have his building piped for these conduits,

1. Read before the Northwestern Electrical association, Milwaukee, January 16, 1895.

and the electric conductors can be drawn in at such time as may be found convenient; or if the electric current is not present near his premises at the time of construction, he can pull in such conductors as may be found necessary when the current is to be secured. The use of junction boxes and branch circuit boxes enhances the flexibility of the system in that it provides covered receptacles for the cut-outs and also increases the accessibility of the system. The advent of iron armored conduit has created something of a change in the methods of wiring. Formerly it was deemed advisable by underwriting associations to require that separate tubes should be provided for each conductor. In the case of the iron armored conduit and the use of an alternating electromotive force, compliance with this rule would manifestly be virtually impossible, the iron in the conduit having a choking or inductive effect upon the electromotive force passing through it, whereas with the two conductors in one tube this action was absent. Hence, taking this into consideration, and also the fact that a much greater mechanical strength was obtained than with former conduit, a ruling was made by the Underwriters' International association permitting the use of two conductors in a single tube of iron armored conduit. This concession opens up a wide field for the use of iron conduit and its effects are already apparent. Practical installation has demonstrated the fact that a building can be piped with iron armored conduit and the conductors placed therein at an expense less than would be incurred if brass armored conduit were used, using the double tube system. This statement may seem at variance with first impressions, but it is nevertheless a fact. The iron conduit is placed in a building in a manner similar to the gas pipes, similar connections and unions being employed. There need be no fear of mechanical disturbance, as it is nail-proof, hammer-proof and wheelbarrow-proof; can be placed upon the floors or run in advance of construction, and the wires pulled in at the convenience of the electrical contractor. In view of the fact that interior conduit meets with approval of the underwriters as an ideal method of concealed permanently accessible construction, and meets the requirements of engineers as a permanent mechanical protection for interior wiring, we can but see for it a future of universal adoption. "Its law is progress; a point which yesterday was invincible is its goal to-day, and will be its starting point to-morrow."

## Annual Meeting of the Standard Underground Cable Company.

At the annual meeting of the Standard Underground Cable company at Pittsburg on January 22d, the old board of directors was elected as follows: George Westinghouse, Jr., Mark W. Watson, J. W. Dalzell, James H. Willock, John B. Jackson, George B. Hill, John Moorhead, Jr., Robert Pitcairn, Joseph W. Marsh. The company expects to make a number of improvements this year. According to the reports submitted, the unfilled orders on hand December 31st amounted to $58,000, in addition to which the company has since secured its third annual contract with the Philadelphia Traction company, under which it will furnish this year about $200,000 worth of cable. It has also an annual contract with the Indianapolis Light & Power company, under which it expects to furnish $25,000 worth of goods. The gross business for 1894 was $963,464.56, which is $101,551 in excess of the business for 1893. The net profit for the year is $130,929.82, out of which four quarterly dividends of 1½ per cent. each, or $60,000 in all, were paid. The surplus earnings December 31, 1894, stood at $531,736.56. During the year the company's claim against certain New York lighting companies was settled, $35,983 having been assumed and lifted by individual guarantors, and for the balance, $145,864, the company accepted the funding agreement or proposition offered by the U. E. L. & P. company and accepted by all the creditors, under which it received $145,864 of 5 per cent. first mortgage gold bonds, $29,173 of preferred stock, and $43,759 of common stock, being bonds at par, and a bonus of 20 per cent. in preferred and 30 per cent. in common stock. The cable company has no accommodation paper out except $29,000, which is the residue of its notes given at bank to lift paper of the New York lighting companies mentioned, which class of paper at the beginning of the year 1894 was $58,000, so that the company has paid off during the year $29,000.

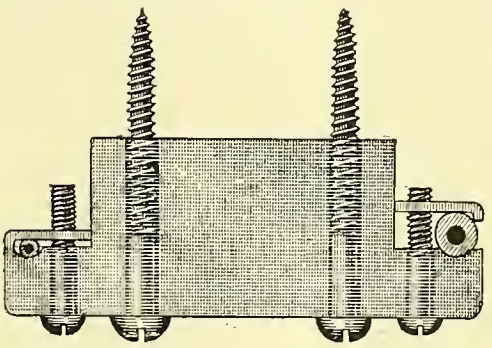
In order to relieve the crowded condition of the factory the directors of the cable company decided to erect a two-story and basement building on the lot 40 by 100 feet, purchased in 1893, adjacent to their property at Sixteenth and Pike streets, and this building is now ready for the roof, and will be ready for occupancy in a few weeks, with a railroad siding along its north end. This building will cost about $10,000. The directors have also in contemplation the erection of a four-story and basement building on the site of the present old two-story building, which was erected as a temporary expedient. To meet the company's increased business it is intended to erect a four-story and basement building. When this building is completed the company will have an extensive and conveniently arranged plant, with sufficient capacity to keep up with any demands that may be made upon it for many years.

## Stratton Improved Separator.

The accompanying cut shows a vertical section of an improved Stratton separator, manufactured by the Goubert Manufacturing company of New York. A test of this separator was recently made by Prof. R. C. Carpenter with very satisfactory results. In his report Prof. Carpenter says that for this test the steam pipe leading to the separator was surrounded for a portion of its length with a jacket which could be filled with water to any desired height, the purpose of the water jacket being to condense as great a per centage of the steam as possible. The discharge of steam from the separator was led to a surface condenser, where it was condensed and the amount carefully weighed. The drip of water discharged from the separator was led to a barrel standing on a pair of scales, and accurate weighings were made of the water taken out from the steam by the separator. A throttling calorimeter was placed in the steam pipe directly after the steam left the separator. Pressure gauges were placed on either side of the separator. Observations were taken and the results reduced by Messrs. Collins, Hubbard and Thomas of the class of '94, Sibley College, Cornell University. The following is the general summary of the results:

The steam supplied to the separator contained moisture, the percentage of which varied from a little over 5 to nearly 21; that discharged from the separator was in every case nearly dry, it containing in every instance less than 1 per cent. of moisture. The separator was worked up to its full capacity and there was no appreciable reduction of pressure. The summary of the results of different runs is given in the appended table. During these runs the water was kept at a constant height in the separator.

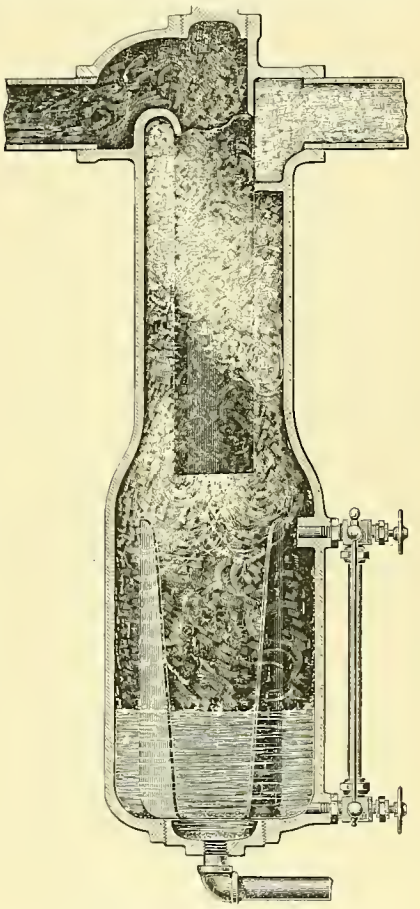
| No. of Run. | Pressure of Steam. | Moisture in Steam Supplied Separator. Per cent. | Moisture in Steam Leaving Separator. Per cent. | Quality of Steam Leaving eparator. Per cent. of Dry Steam. |
|---|---|---|---|---|
| 1 | 60 | 6 55 | 0.95 | 99.05 |
| 2 | 61 | 17 2 | 0 94 | 99.06 |
| 3 | 62 | 15.31 | 0.9 | 99.1 |
| 4 | 76 | 15.6 | 0 6 | 99.4 |
| 5 | 61 | 20 9 | 0.8 | 99.2 |



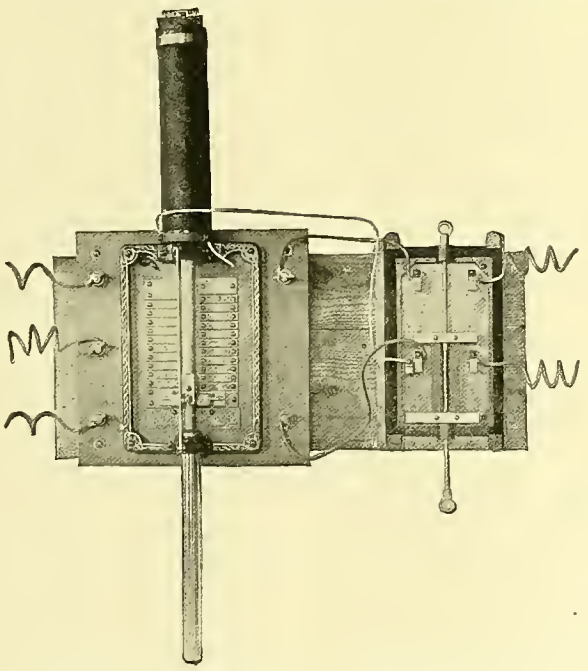
"SIMPLEST" CLEAT.

## "Simplest" Cleat.

The Electric Heat Alarm company of Boston has placed a new cleat on the market which it has called "Simplest" and for which great claims are made. The reasons enumerated by the company for calling this cleat "Simplest" are the following: Because it is in one piece; it anchors the wire; there is no breakage; it does not cut or bend the wire; it can be put up independent of the wire; it is practical for nearly all sizes of wire; it will bind two sizes of wire; and because of the perfect insulation of the wires. The cut clearly shows the features of construction. The company announces that it proposes to place at least one of these devices with every dealer in supplies in the country.



STRATTON IMPROVED SEPARATOR.



AUTOMATIC SWITCHING APPARATUS FOR ELECTRIC ELEVATORS.

## Automatic Switching Apparatus for Electric Elevators.

The device illustrated herewith is intended to be used in connection with ordinary freight elevators driven by an electric motor and started and stopped by an ordinary belt shifting arrangement, with the motor running continuously in one direction, whether the elevator is in operation or not.

Experience has shown that many freight elevators are in actual use only a small fraction of a working day and that the rest of the time the motor is running idly, consuming current and wearing out bearings and commutator, simply to be in readiness when needed.

The automatic motor starter and knife edge switch manufactured by the Automatic Switch company of Baltimore is designed to obviate the useless running of the motor by making it possible to start and stop the motor from any floor of the building by simply pulling a cord connected to the knife switch. The automatic motor starter, which is controlled entirely by the current, gradually cuts out the starting resistance when the current is turned on the motor

and immediately replaces it when the current is turned off. With this arrangement it is only necessary to run the motor when the elevator is needed, and when idle all wear and tear and current consumption is done away with. To show tha this saving is no small item, it is only necessary to call attention to the fact that one user of the apparatus saved on his regular meter bill for current nearly $200 in one year and another cut his current bill down from $35 per month to $7.50.

## Prohibiting Wire Tapping.

The recent exposure made in Chicago regarding the stealings made from the Associated Press by means of wire tapping has resulted in a movement to prevent thefts of news in the future by this means. A bill has been introduced in Congress by Senator Chandler of New Hampshire, which has been referred to the Committee on Interstate Commerce, providing that "any person who shall wrongfully tap or connect a wire with the telegraph or telephone wires of any person, company or association engaged in the transmission of news over telegraph or telephone wires between the states, for the purpose of wrongfully taking or making use of the news dispatches of such person, company or association, or its customers, shall be deemed guilty of a misdemeanor, and upon conviction shall be punished by a fine of not more than $2,000 or imprisonment not exceeding two years, or by both such fine and imprisonment."

## Death of Rudolph Eickemeyer.

Rudolph Eickemeyer of Yonkers, N. Y., died in Wormley's Hotel in Washington, D. C., on January 23d. Mr. Eickemeyer left Yonkers on January 12th to go South for his health, accompanied by his son Carl and his daughter-in-law. He stopped at Washington on business with the Patent Office, and while there he became ill. Mr. Eickemeyer has been a sufferer from asthma for a number of years, and it was that malady which caused his death. He was born in Bavaria, and came to this country in 1850. He took part in the revolution of 1848. He went to Yonkers in 1854 and established a tool-repairing factory. He became familiar with the hat trade, and set to work making machinery for the manufacturing of hats. His first invention was a machine for making leather hatbands, which is used throughout the world. A few years afterward he constructed the first sewing machine used to sew the leather into the hats. Other of his inventions used to-day in nearly all the large hat factories are hat-blocking machines and pouncers. Numerous other devices invented by Mr. Eickemeyer are now used all over the world. To the electrical fraternity he was best known as the inventor of the elevator motor bearing his name, which is largely in use. He also designed a dynamo for train-lighting service which has been used successfully.

## General Electric Company's Statement.

On January 22d the directors of the General Electric company adopted the following resolutions:

WHEREAS, Various printed statements (favorable and unfavorable) regarding this company and its business have heretofore appeared, most of them reading in a manner calculated to give the impression that they are issued either with the sanction of the company, from information furnished by its officers or directors, and

WHEREAS, In point of fact and almost without exception, such statements if made are unofficial, and while often having some foundation in fact are so inexact as to be to a great extent misleading; now, therefore, be it

*Resolved*, That the board of directors desire to caution the public against assuming that any casual statements, whether favorable or unfavorable, emanate from sources competent to furnish information respecting this company.

*Resolved* further, That this board now state for the information of stockholders that the company is entirely free from floating debt. Since the date of the last annual report the company has purchased $1,127,000 of its debenture bonds, using for this purpose the proceeds of various accounts and assets which have been liquidated since the date of the said report.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, January 26.—The great Brooklyn strike of motormen and conductors on the electric railway lines seems to be about over. The companies ran about 400 cars yesterday, as against 300 on Thursday. Nearly all the lines are now in full or partial operation again, but on some of them opened this week the traffic does not pay the wages of the motormen alone. The strikers appear to be beaten, although they say they are in just as good shape as they have been at any time, and that their prospects of bringing the companies to terms are excellent. Mayor Schieren said yesterday that he regarded the strike as practically broken, and General McLeer said that he apprehended no more serious violence. The New York soldiers are patiently awaiting orders to return home. Aside from the violence, the feature of the week has been Judge Gaynor's decision laying down the principle that the companies must run their cars or forfeit their charters, and that if it were necessary to give the proper service to the public the companies must pay their men the increased wages demanded.

At Albany Assemblyman Frida yof Brooklyn has a resolution before the House providing for an investigation of the differences between the railroad companies and their men. He will also introduce a bill which provides for the licensing of the motormen, and for a board of electrical commissioners in each of the cities of the first class in the state, which includes the cities of New York, Brooklyn and Buffalo. After the introduction of the bill Mr. Friday will introduce a resolution providing for the appointment by the governor of three commissioners, to serve at a salary of $1,200, who shall see to it that the provisions of the measure are carried out by the cities. The bill provides for the appointment by the mayor of three electrical examiners, who are to serve a term of two years, without compensation. They are empowered to employ an expert electrician for not more than thirty days in the year. His duty will be to conduct examinations of applicants at least once a month, and upon his favorable report the board will issue a license, which will be good in an adjoining county, except when this also contains a city of the first class. In that case, a new license must be secured from the Board of Electrical Examiners of that city. In case of a sudden emergency the board may employ three additional experts to conduct examinations. These are the qualifications which must be possessed by an applicant:

Section 3. Every applicant for the position of motorman, or for the position in a motor shop in a city of the first class, other than that of a skilled electrician, shall be a citizen of the United States, have resided within the state for a period of one year and the county in which he proposes to be employed for three months prior to the time of making such application, and have been licensed as provided by this act; but such restrictions as to citizenship and residence license shall not apply to any motorman or assistant in motor shops who has been steadily employed as such for a period of three months prior to the time when this act takes effect.

The penalty for the violation of the law by a railroad company is a fine of $100, or thirty days' imprisonment, or both.

Assemblyman Gerst of Buffalo has again taken upon himself the task of regulating telephone rates in New York state by statute. His bill provides that in cities of 1,000,000 or more inhabitants the charge for telephone service, with the use of all necessary batteries, instruments, etc., shall not exceed $78 a year; in cities of 500,000 inhabitants and less than 1,000,000 it shall not excee d$66 a year; in cities of 100,000 inhabitants and less than 500,000 not over $48; in cities of 20,000 inhabitants and not over 100,000 not over $36 a year; in cities of 8,000 inhabitants and not over 20,000 not over $30 a year, and in all smaller cities and places not over $27 a year. The Federal census of 1890 is to be the basis of population. It is further provided that at public and pay stations the charge for local conversations shall not exceed ten cents for the first five minutes and five cents for each five minutes or part thereof thereafter. No yearly or monthly subscriber shall be charged for the use of a telephone at a pay station when used by him or his employes to communicate with his own place of business or home. Arrangements are made to have the rates increased if it is shown that they do not pay the interest on the bonds of the company and a dividend of 10 per cent. on its stock.

Mayor Strong is on record as favoring rapid transit. He says: "I am going to see that the rapid transit which has been promised for such a long time is a reality. I am a member of the Rapid Transit Commission, ex-officio, and soon I will have something of interest to say on the subject I have been so busy so far that I have not had time to attend the meetings, but I will endeavor to do so in the future, and the people can rely on it that the work will be actually begun as soon as possible. Now, I am opposed to having the road built not as it should be because the $50,000,000 limit would have to be exceeded. I believe that as much money should be spent as is absolutely necessary to build the road as it should be constructed. I read that the commissioners are going to ask the Legislature to amend the statutes bearing on the rapid transit road, and I favor the proposition to amend them so as to permit enough money to be spent to make the road a success." The proposed amendments have not been made public, but it is understood that the commissioners are in favor of the limit of expenditure being increased and the time limit being extended.

In his annual report to the Legislature, State Engineer Adams says, referring to the employment of electrical power on the canals: "A trolley motor, running on its own tracks, attached to tow lines as now used, controlled by a line extended back to the helmsman, and requiring no space on the boats, seems to promise several advantages over the present method, at least with the great majority of boats, among which is the possibility of renting such power when it is needed, thus requiring no outlay for installation. Such trolley lines could be built on either side of the canal, or, preferably, as a double track (two rails) on the outside of the towpath and high enough above it so that animals could pass underneath the lines running to those motors when towing by present methods. Such a device would require little change in present methods, as the motors could be considered as 'electric horses.'"

It is announced that the traction companies of New Jersey have formed a combination for mutual protection. The combine was formed at a meeting held in Jersey City in the offices of the Consolidated Traction company. The organization is to be similiar to those already in existence in several of the other states. Its power, which will be great, will, it is said, be used to influence legislation, aid each company in case of strikes, prevent the building of competing roads and the exchange of experiences and knowledge gained in the operation of the roads. The constitution, which is concise, sets forth, among other things, as the object of the association the improvement of the car service, so as to give better accommodations to patrons, reducing the cost of operating, the encouragement of friendly relations between the roads and between the roads and the public, and the "protection of the large investment of capital in these important enterprises." David Young, the general manager of the Consolidated Traction company, is president of the association, G. S. Browning of Camden is vice president, and William B. Price of Elizabeth secretary and treasurer. All of the important railroad companies in the state were either represented at the meeting or sent word they would become members as soon as the association was formed.

Watson Whittlesey, the receiver of the Suburban Traction company, has obtained the permission of the court to equip the East Orange and Bloomfield line with the trolley system and to do away with the miserable horse car service. In order to equip the road, however, certain concessions are needful, among them being the use of wooden poles instead of iron ones in the outlying districts, the location of the new tracks where the track now lies, and a change in the franchise by which the "assigns" of the company shall possess the franchise. The amount of money at the disposal of the receiver is limited, and hence the necessity for these changes and allowances. Mr. Whittlesey expects to have the road equipped and running early in the spring.

W. F. O.

## Milwaukee, Wis.

MILWAUKEE, WIS., January 26—Business opposition to the Milwaukee Street Railway company, which now has a monopoly of the street car traffic of the city, has developed in an unexpected quarter. The Milwaukee & Wauwatosa Motor Railway company, which at present operates a dummy line between the western limits of the city and Wauwatosa and North Greenfield, has petitioned the common council for a franchise to build tracks from the city limits east to the lake shore. The proposed line runs from the corner of Wells and Thirty-fifth streets to Cedar street, east on Cedar street to Fourth street, south to Wells, east to Second, south to Clybourn, east on Clybourn and Huron to Cass and north to Wisconsin street, which would bring the line close to the Chicago & Northwestern Railway depot. The line would also run near the St. Paul railway depot and the Exposition building and the theaters. The company, in its petition, promises if a franchise be granted to it, it will build the line in the most modern style, equip the entire system—the present dummy line as well as the proposed line in the city—with electricity, and have the road in operation within six months. The company agrees to sell 25 tickets for $1, while the Milwaukee Street Railway company recently advanced the price of tickets to 5 cents, abolishing the sale of commutation tickets entirely.

James Petley, the president of the Milwaukee & Wauwatosa Motor Railway company, asserts that the capital of the company will be increased from $200,000 to $500,000 in case the Common Council grants a franchise to build a line into the city. Only the best and latest machinery will be used. If the conduit system is found practicable, the company will adopt it. The line will run straight to Wauwatosa, the state fair grounds and North Greenfield, and the company states that passengers will not have to change cars. Cars will be run to Wauwatosa every ten minutes and to North Greenfield every twenty minutes. During the state fair trips will be made every five minutes. One fare will be charged in the city and another fare in the suburban district; that is, a passenger will have to pay two fares for riding from one end of the line to the other end. A power house is to be built at Wells and Fifty-ninth streets in Wauwatosa. The company may have considerable trouble in getting a franchise. The difficulty, in fact, may prove insurmountable. In addition to the powerful counter influence of the Milwaukee Street Railway company, several of whose lines the proposed road parallels, the Wauwatosa company will have to meet the strong objection of the people living on Cedar street, many of whom have already signed a remonstrance against the granting of the franchise. The two

aldermen of the Sixteenth ward, which is very much interested in the matter, are divided on the question. Aldermam W. H. Starkweather introduced the Wauwatosa company's petition and declares that he will do everything in his power to help the company get the franchise. He says that the road is needed and that it will be a good thing for the city. Alderman Steveos is as pronounced in his opposition to the project. He gives four reasons—the street has but a 36-foot roadway; the people on the street have built fine houses in the warranted belief that no street cars would ever be allowed to run on the thoroughfare; they have only recently boulevarded the street at much expense, and it is the only street in that part of the city extending from the city limits to the river where one may drive without following street car tracks. The latter reason is not strictly correct. Prairie street has no car tracks, but it is two blocks farther north, which would make the route too circuitous.

An important change in the management of the Milwaukee Street Railway company has been decided upon. Heretofore Henry C. Payne, the vice-president of the company, has been the only resident member of the board of directors. In the future Milwaukee will be the home of three directors and of a majority of the executive committee. At the annual meeting of the company in Milwaukee this week Frank G. Bigelow, the president of the First National bank, and Charles F. Pfister, who sold the old Hinsey line to the company, were elected directors. The board is made up as follows: William Nelson Cromwell, the president, and Charles A. Spofford of New York, Messrs. Payne, Bigelow and Pfister of Milwaukee, and A. Marcus and Charles J. Whittemore of New York, or two other eastern bondholders in their places. The executive board will consist of Messrs. Payne, Bigelow and Pfister of Milwaukee and two of the eastern directors. The executive board will meet in Milwaukee hereafter instead of in New York. It is understood that the change is made for the purpose of giving the bondholders representation in the management of the road, to which they seem to be entitled by reason of their heavy interests and their waiving of interest for a period of two years or thereabouts, and for the further purpose of giving local color to the management of the great system. Ever since the company was organized by Villard, it has labored under the disadvantage of being considered an outside corporation. It has been subjected to dangers in the way of legislation that a home company would probably have escaped. The company has outstanding bonds to the amount of $10,000,000, and quite a large portion of these securities are held in Milwaukee.

President W. D. Mahon of the Amalgamated Association of Street Railway Employes of America and Canada was in the city a few days ago in the interest of the proposed bill to compel the street railway companies to equip all its cars with vestibules, front and rear, for the purpose of protecting the motormen from the blasts of winter. President Mahon said that the national organization had decided to urge a compulsory vestibule law in four states—Wisconsin, Michigan, Indiana and Colorado. M. G. Moore, the secretary of the national organization, who lives in Detroit, is attending to the proposed legislation in that state. President Mahon says that the outlook for the passage of the desired laws is good both in Indiana and Colorado. In Ohio and Minnesota the street railway companies took the question to the Supreme Court, and that tribunal decided in favor of the employes. The employes urge the vestibules in the cause of humanity. President Mahon alleges that during the last year the sick benefits paid to members of his association were at the rate of 80 per cent. The cause of this condition of affairs is ascribed to the exposed situation of the street railway men. While it is a matter of dollars and cents to the street railway companies, he urges that it is a matter of life to the motormen. Mr. Mahon went from here to Madison to urge the passage of the bill, which is similar to the law which is in force in Minnesota.

General Manager Wyman of the Milwaukee Street Railway company announces that the company will most certainly oppose the bill. In most cities where vestibuled cars have been tried, he states, they have been found impracticable and have been removed. Cars with vestibules are too heavy and cumbersome and are objectionable because the view of the motorman is obstructed by the window in the vestibule. Mr. Wyman declares that the partially vestibuled cars used on the Farwell avenue line are failures. Not a day passes, he reports, that one of these cars is not disabled and taken to the repair shops or breaks down on the line and causes delay. They will have to be done away with or else special extension trucks will have to be put under them, as their weight is too great to run them on the longest trucks now in use.

E. N. Herr, who for some time has been the general manager of the Gibbs Electric company of Milwaukee, has accepted the position of assistant superintendent of motive power on the Chicago & Northwestern railway. He was formerly connected with the locomotive works at Chicago. He will be stationed at Chicago.

In Oshkosh there has been filed a document which throws some light upon the interurban electric railway deal. It is the contract between James K. Tillotson and Stephen W. Dorsey and Jesse M. Thompson for the disposal of the Oshkosh city railway franchise and the right of way for the interurban road. These, under the agreement, were to be turned over to Dorsey and Thompson August 1, 1894, or as soon thereafter as possible. The persons purchasing the stock were to organize a company with a capital stock of $1,000,000 for the construction and operation of an electric railway in Oshkosh and an interurban line through Menasha, Neenah and Appleton to Kaukauna. For the franchise Dorsey and Thompson contracted to pay $20,000 within eight months, in four equal payments. In Neenah and Menasha Mr. Tillotson was to purchase the rights of the horse car companies for a sum not to exceed $15,000, which the other two men were to assume. Tillotson's friends claim that this agreement is void by reason of the non-fullfilment of the conditions on the part of Dorsey and Thompson. Tillotson is trying to form a company independent of Dorsey and Thompson, and has lately been to New York for that purpose. The people who have been opposing the project assert that the quarrel between the projectors means the death of the entire scheme. C.

## PERSONAL.

General Manager Herbert H. Brooks of the American Circular Loom company visited Chicago last week.

Godfrey G. Luthy of the Royal Electric company of Peoria is in Chicago. He reports that his company is doing a good business.

Hon. John C. Burke of the law firm of Marshall, Burke & Marshall has been elected to the presidency of the Bradbury-Stone Electric Storage company of Lowell, Mass.

Secretary Charles E. Brown of the Central Electric company, Chicago, is once more at his desk. Mr. Brown was detained at home for some months by an attack of malaria fever, but after his very serious and tedious illness he is now once more on the way to perfect health. While practically well he has still a slight trouble with his knee, which for a while longer will necessitate the use of a cane; he expects very shortly, however, to be entirely recovered.

## NEW INCORPORATIONS.

Rawson Electric company, Elyria, O.; capital stock, $50,000.

Tri-state Telephone & Telegraph company, Cincinnati, O.; capital stock, $250,000.

St. Louis County Telephone company, Clayton, Mo.; capital stock, $5,000; M. B. Greensfelder, Clayton, Mo.

Missouri Telephone Manufacturing company, St. Louis, Mo.; capital stock, $2,000; Russell Parker, St. Louis, Mo.

Danville Telephone company, Danville, Ill.; capital stock, $25,000; to operate a telephone exchange; Elliott E. Benedict, Danville, Ill.

E. S. Karoly Electrical Construction company, Chicago; capital stock, $12,000; to conduct a general electrical business; E. S. Karoly, Chicago.

## ELECTRIC LIGHTING.

It is reported that a $200,000 electric light plant will be built in Birmingham, Ala.

The city of Newnan, Ga., has opened negotiations for the purchase of the Newnan Light & Power company's electric light plant, which is valued at $17,000.

The Legislature of Michigan is considering the establishment of an electric plant to light the capitol. It now costs $5,000 per year for lights and $2,000 for water. The plant would cost $60,000.

At the annual meeting of the Electric Light & Power company of Redlands, Cal., it was decided to issue bonds in the sum of $100,000. Half of this amount will be used to take up the old issue and the remainder will be used to make additions to the equipment.

The Green Bay, Wis., Gas & Electric Light company, has been reorganized. J. H. Ebeling, heretofore vice-president, has been elected president in place of Carroll Collins; F. Hurlbut was chosen for vice-president and H. B. Baker reëlected secretary and treasurer. Thomas G. Littlehales of Chicago will succeed Mr. Collins as manager and superintendent of the plant.

The contest between the Western Electric company of Chicago and the Westinghouse company of Pittsburg to secure the contract for electric light extension in Allegheny City has been settled. The fight has been waged for eight months. When the proposals were opened it was found the Chicago company's bid was $32,417, while that of the Westinghouse company was $1,600 higher. Some of the councilmen wanted to favor the Westinghouse company because it is a local concern, and awarded the contract to it in violation of law. Mayor Kennedy vetoed the ordinance. The select branch of the council then awarded the contract to the Western Electric company, and the matter was sent to the common branch. After a hard fight the common council ratified the action of the select branch. The vote was 23 in favor of the Western Electric company to 16 against.

## ELECTRIC RAILWAYS.

The car station of the Brightwood Railway company at Brightwood Park, a suburb of Washington, D. C., about two and one-half miles outside the city limits, was destroyed by fire on January 24th. Fourteen electric cars were burned. The power house and boiler room were saved. The total loss is estimated at $30,000, partly covered by insurance.

Attorney Grinnell of the Chicago City Railway company has deposited $10,000 with City Comptroller Jones for that company. This is the first of a series of ten annual payments in accordance with the requirements of the ordinance passed by the council July 16, 1894, which gives the company the right and authority to change the motive power on many of its South Side lines from horse to electric power.

The proposed line between Sedalia and Brown Springs, Mo., will be built in the spring by the Sedalia & Brown Springs Railway company, which will issue $80,000 in bonds, secured by a mortgage on the power plant and system of the Sedalia Railway & Power company, which is said to be valued at $400,000. The bonds are issued at 6 per cent. The Brown Springs line is to be operated by the Sedalia company.

The three horse railroads which connect Herkimer, N. Y., with Frankfort have been purchased by a syndicate of capitalists. The roads will be consolidated, and after June 1st will be operated by electrical power. The present plans provide for a company with a capital stock of about $150,000. A full and modern equipment for the road will be purchased as soon as the promoters of the scheme get together and decide upon a set of officers to conduct the affairs of the company.

At a meeting of the committee on streets and alleys, West, of the Chicago city council Monday, a substitute was offered for the ordinance for the West Chicago Street Railroad company, covering Van Buren, Twenty-first, Loomis, Park, Lincoln and other streets on the West Side. It provided that in addition to the privileges named the company is granted permission to connect the track at the intersection of State street with Lake with the track of the North Chicago company, and that the company is also granted permission to equip and operate its line on State street from Lake to Randolph street with electricity, thus putting a trolley road for one block on State street and making the first down-town trolley line. The ordinance was recommended for passage with only three dissenting votes.

## MISCELLANEOUS.

James B. Waller, assignee of the Ansonia Electric company, announces that in compliance with an order of the County Court of Chicago, there will be sold in the court room of that court on February 5th at 10 A. M., to the highest and best bidder, for cash, certificate number 173 for one thousand shares of the capital stock of the Sunbeam Incandescent Lamp company.

In the course of a review of technical development in the applications of electricity during 1894, the *Elektrotechnische Zeitschrift* states that the use of accumulators in central stations in Germany has greatly progressed. On the other hand, alternating current stations have also been extended; and the four principles—moderate periodicity, large units, slower speed and direct coupling—have fairly throughout been introduced in German works. It is said that the rotary current system bids fair to be adopted in new stations in preference to the ordinary alternating system.

Considerable damage was done electric wires at Cleveland in the severe storm of last week. A press dispatch dated January 26th says: A blast of wind from the south tore across Cleveland last night descending with terrific force at Case and Payne avenues and Superior street. On these thoroughfares a total of several miles of telegraph poles was blown over, cutting off nearly all telephone communication in the city and blockading the Superior street and Payne avenue lines. A pole fell on a grip car, the gripman narrowly escaping death. The Cleveland and Pittsburg railroad at Payne avenue was covered with poles and wires and all trains were stopped for the night.

## TRADE NEWS.

M. E. Baird has returned East from an extended trip through the South, West and portions of Canada. He reports a bright business outlook for the interests of the Eddy Electric company in the sections he has visited.

R. V. Scudder has been appointed agent for the Eddy Electric Manufacturing company, with headquarters at St. Louis, Mo., for the Southwestern states. Mr. Scudder is well known to the trade, and he will bring to his present position considerable experience in general electrical work.

The superintendent of the Chicago General Railway company writes as follows to the Sperry Electric Railway company: "Your electric brake which is attached to our new cars, with new style Sperry controller, is creating a furore in the electric railway world in Chicago. There isn't a day but what I have men connected with the electric railways here to examine your brake."

The Storey Motor & Tool company, manufacturer of the Storey motor and dynamo, whose headquarters have heretofore been located in New York city, announces that hereafter its main office will be at the factory in Philadelphia, corner of York street and Sedgeley avenue. A New York office will, however, be maintained at 120 Liberty street, with N. M. Garland in charge.

## BUSINESS.

The D & D Electric Manufacturing company of Minneapolis, manufacturer of constant potential motors, incandescent dynamos and power generators, has issued a handsomely lithographed hanger, mounted on canvas, which serves as a

very effective reminder of the company's goods. The design is rich and artistic and reflects credit on all concerned in its production.

The Electric Heat Alarm company of 145 High street, Boston, has issued an attractive catalogue bound in flexible cloth covers. This volume is entitled "Descriptive Catalogue No. 4," and describes automatic fire alarms, automatic journal bearing alarms, hotel call and fire alarm systems, automatic alarms for grain elevators, coal bunkers, warehouses, etc., with full directions for installation.

The Abendroth & Root Manufacturing company, 28 Cliff street, New York, sole makers of the Root improved water-tube boilers and Root's spiral riveted pipe, finds business good, and announces that the outlook for the ensuing year is excellent. There has been a lively demand for the boiler from the South and West, for service in electric lighting and electric street railway plants. This is a class of work for which the Root boiler is especially well adapted, and for which it is deservedly popular.

The Bates Machine company of Joliet, Ill., has published a handsome pamphlet descriptive of the Bates-Corliss engines. The distinctive features of the engine are described in detail. The company says: "The Bates-Corliss engine embraces in its construction all that is superior in the original Corliss type, together with many new and important features, which give increased efficiency with a lesser degree of complication. As regards simplicity of construction it is without an equal in the entire list of Corliss engines. In economy of fuel and ease of operation it ranks with the highest, and its governing qualities have never been surpassed. From the foundry to the erecting room the best skill is used in its manufacture, and it leaves the erecting room ready for immediate and continuous duty at its final resting place."

The Electric Appliance company, Chicago, reports itself very well pleased with the recent convention of the Northwestern Electrical association held in Milwaukee, and claims to have received some substantial returns in the way of orders and meeting new trade, which gives promise of future business. The Electric Appliance company feels very much like refuting the statement, which is so often made, that convention meetings are monopolized by the supply men, at least so far as it refers to the Northwestern meetings, as it certainly has not held true of any of the meetings at which it has been represented.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued January 22, 1895.*

532,745. Automatic Disengaging Device for Atmospheric Brakes. Joseph Ackermann, Eitorf, Germany. Application filed June 16, 1894.

In a device for automatically setting the brakes of cars the principal features are a liquid receptacle, a beam balance, floats suspended therefrom and depending into the receptacle, contact pieces in proximity to the beam ends, and electrical connections extending from said beam and contact pieces, and means controlled by the electric circuit for controlling the brakes.

532,760. Incandescent Lamp. Mark H. Branin, Lynn, Mass. Application filed April 10, 1893.

The method of sealing in the lead wires of an incandescent electric lamp consists in forming a filament support with a flanged end, sealing the wires into the unflanged end, sealing the flange to the lamp base and drawing the filament support toward the base of the lamp, thus bringing the seal between the filament support and the neck of the bulb upon the outside of the neck, and forming an anchorage for the bulb in the lamp collar.

532,769. Call Generator Connection. Frank B. Cook, Chicago, Ill. Application filed November 27, 1894.

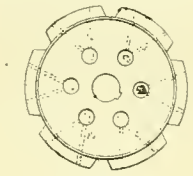
In signal sending apparatus the combination is described of a main or power generator normally connected with a circuit, a normally quiescent auxiliary generator, and means actuated by the operation of the auxiliary generator for automatically disconnecting the main generator from its circuit and for connecting itself in place.

532,782. Magnetic Brush Holder. John C. Henry, Westfield, N. J. Application filed December 11, 1894.

This invention consists in the method of effecting contact between the two parts of a current collecting device, which consists in causing the pressure of the contact to vary according to the variations of the transmitted current.

532,789. Electric Fan Motor. Joseph L. Ketcher, New York, N. Y. Application filed April 26, 1894.

The last claim reads as follows: In a combination with an electro-motor having a pivotal stem, an invertible support therefor, and an anti-friction coupling or connection between the stem and the support, whereby the motor is adapted to be supported from below or suspended from above at will, and to rotate freely about its stem in both positions.



NO. 532,795.

532,790. Electrical Display Apparatus. Joseph L. Ketcher, New York, N. Y. Application filed April 26, 1894.

A source of electric energy, a series of translating devices for utilizing the current so supplied, a switch adapted to direct the current to and divert it from the translating devices in series of succession, a motor for actuating the switch, and a locking device for holding the motor out of action, adapted to be moved or released by the introduction of a coin.

532,795. Armature for Dynamo-electric Machines or Motors. Hermann Lemp, Lynn, Mass. Application filed March 29, 1890.

In a dynamo or motor a laminated armature is constructed from sheet iron disks or plates, as shown in the cut, provided with ventilating holes or perforations merging or connecting with slots extending out to the periphery, the plates being assembled with the holes and slots of adjoining plates, registering with one another and forming free passages independent of the armature windings.

532,796. Electrical Conductor. Edward D. Lewis, Savona, N. Y. Application filed June 16, 1894.

An electrical conductor oblong in cross-section and having side extensions, a flexible strip of insulating material folded closely around three sides of the conductor, and having edge portions extending in parallel relation beyond the fourth side, and clips constructed to spring over the lateral enlargements of the conductor and retain the insulating strip in place.

532,798. Electrically Operated Clutch. Thomas H. Macdonald, Bridgeport, Conn. Application filed April 28, 1894.

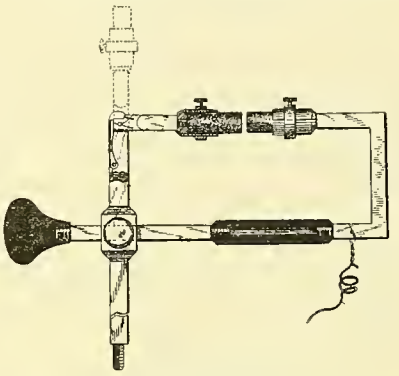
Claim 1 reads as follows: In a mechanism of the character described the shaft, pulley and driving clutch, and means for automatically uncoupling the same, a locking device holding the clutch normally in engagement by means of a closed electric circuit, one of the wires of the circuit being in proximity to the pulley, as described, whereby a foreign object caught and carried by the pulley may break the wire and circuit, and cause the uncoupling of the clutch.

532,812. Trolley Wheel. Benjamin O. Paine, Millbury, Mass. Application filed June 11, 1894.

In a trolley for electric cars the downwardly offset axle bar is journaled at its ends and arranged to swing or oscillate in the bearing fork in combination with the bearing fork and a trolley wheel, mounted to rotate about a bearing on the axle bar, the axis of the trolley wheel being lower than the axis of the axle bar bearings.

532,814. Electric Safety Device. Charles T. Penton, Christopher C. Gartland and Patrick J. Casserly, Buffalo, N. Y. Application filed February 2, 1894.

The accompanying cut shows a device for equalizing the overflow of electromotive force in a dynamo or motor, consisting of an upright rod connected with the frame of the motor, a U-shaped conductor, one arm of which is adjustably connected with but insulated from the rod, and the other arm of which carries a carbon point, electric connections between this conductor and the field windings, a horizontal arm pivoted to the upper end of the rod, and carrying a carbon point adapted when the rod is lowered to stand opposite the point carried by the U-shaped conductor, and a spring on the rod bearing on the arm adjacent to its pivot to hold it either raised or lowered.



NO. 532,814.

532,820. Machine for Assembling Laminæ of Armatures. John Riddell, Schenectady, N. Y. Application filed October 19, 1894.

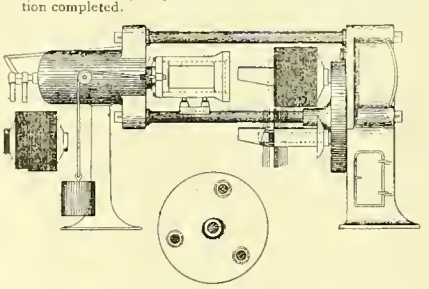
In a machine of the class illustrated there are a suitable frame, rods holding the parts of the frame together, a platen revolving upon one of such rods, studs carried by the platen, spindles revolving upon the studs, each spindle having a screw threaded portion at one end, a ram adapted to compress the laminæ when placed in position on the spindle, the ram having an opening in the head, and a nut registering with the screw threaded end of the spindle and holding the laminæ in position.

532,821. Machine for Winding Armature Coils. John Riddell, Schenectady, N. Y. Application filed October 19, 1894.

In a machine of the class described these features are claimed: a frame, a cam carried by a gear wheel rotating in the frame, a rack reciprocated by the cam, a form-carrying plate, and gearing between the rack and the form-carrying plate, the cam being composed of a series of shorter and longer portions alternating in position and at a greater or less distance from the center of the wheel carrying it, the shorter portions being adapted to draw the rack toward the center of the wheel, and the longer portions being adapted to move it away from the center.

532,826. Galvanic Battery. Charles B. Schoenmehl, Waterbury, Conn. Application filed November 14, 1893.

In a battery is claimed the combination with an insulated cover, of a peripheral annular recess within the cover, a series of openings extending through the under side of the cover into the annular recess, a series of bores extending into the top from the recess and registering with the beforementioned openings, carbon sticks arranged within the openings with their ends extended through the beforementioned recess and into the bores, and metal within the recess and surrounding the ends of the carbons, whereby they are retained and their metallic connection completed.



NO. 532,820.

532,838. Electric Welding Apparatus. Elihu Thomson, Lynn, Mass. Application filed August 18, 1889.

In the apparatus illustrated there are a source of constant average current and a series of pairs of terminals for holding the piece or pieces of metal to be operated upon, suitably placed in a circuit with one another between the terminals of the source, in combination with independent current, varying or graduating shunting switches, one for each pair of terminals, each adapted to be thrown from one extreme position to the other without interrupting the circuit through the piece or pieces which it directly controls, whereby the control of the intervals and extent of heating for any piece or pieces may be obtained without affecting the heating of other pieces.

532,839. Electric Meter. Elihu Thomson, Swampscott, Mass. Application filed August 10, 1894.

The last claim is as follows: As a means for varying the action of an electric meter, operating by electrolysis to accord with variations of temperatures or barometric pressure, a hermetically sealed chamber and a weight adapted to oppose each other, whereby variations of pressure may cause a difference in the balance between the two, and thus vary the times of action of the meter registering device.

532,861. Regulator for Dynamo-electric Machines. Louis Bell, Boston, Mass. Application filed December 18, 1893.

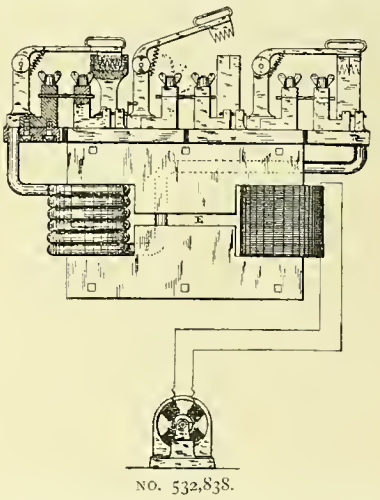
The first claim is for the method of regulating a dynamo-electric machine provided with a separate source of current exciting its field magnets, which consists in varying the speed of the separate exciter inversely to the variations of speed of the armature in the dynamo-electric machine.

532,868. Electrical Annunciator. John S. Bull, New York, N. Y. Application filed April 23, 1894.

In an electrical indicating apparatus the combination is claimed of a trolley, a series of contacts with which the trolley makes a traveling connection, a series of indicators respectively electrically connected with the contacts, an electric switch carried by the trolley, circuits controlled by the switch and indicators in the circuits, the switch being automatically thrown when the direction of movement of the vehicle is changed.

532,905. Trolley Breaker. William B. Potter, Schenectady, N. Y. Application filed August 4, 1894.

A central bar of insulating material forming a runway for the trolley, side bars of magnetic material, metallic end pieces connecting the bars together but insulated therefrom, an iron yoke connecting the outer magnetic bars together, coils upon the yoke connected at one end to the metallic end pieces of the trolley breaker, and at the other end to the auxiliary terminals



NO. 532,838.

upon the insulating bars, whereby upon the passage of the trolley the current passes around the coil and energizes the yoke and the side bars to form a magnetic field adapted to blow out the arc following the trolley.

532,909. Electric Stove. Charles E. Roehl, St. Joseph, Mo. Application filed January 4, 1894.

The claim reads: In an electric stove or heater the combination of a transformer or other electrical inductorium whose secondary coil is normally open, a series of high resistance rods in positive electrical connection with one side of a convolution of the secondary coil, said rods being grouped into sections or gangs, those of each section being connected to a common block of conducting material, and a contact spring and adjusting screw therefor, whereby said block may be thrown into and out of electrical connection with the other side of said convolution of the secondary coil.

532,979. Telephone Transmitter. William A. Mason, Sumter, S. C. Application filed October 26, 1894.

One or more loosely leaning or gravitating carbon bars or pencils having at their free ends an opening entirely through them are employed in combination with a carbon electrode passing through the openings in the gravitating bars and serving the double function of making a vibrating electrical contact, and holding in place the gravitating bars.

533,015. Telephone Switching Apparatus and Circuit. Joseph J. O'Connell, Chicago, Ill. Application filed May 1, 1894.

In a trunking system between two switchboards a trunk circuit extends between each station, provided with switching and looping apparatus at the receiving and trunking terminals thereof, and a signal at the receiving board operated by a source of electricity at the trunking board to indicate that the called sub-station line has been connected to the trunk circuit. Switching devices are provided at the receiving board, whereby the circuit of the signal is closed and the signal itself set or displayed by the connection of the looping apparatus to the trunk terminal at the receiving board, and switching apparatus is also provided at the trunking board, whereby the circuit of the signal is opened and the signal reset when the looping apparatus at the trunking board is connected to the called line.

Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, FEBRUARY 9, 1895. No. 6.

## Electrically Operated Rolling Lift Bridge.

In construction and operation the new bridge that spans the South Branch of the Chicago river at Van Buren street is of exceptional interest to engineers. It is a folding bridge, or, more correctly, a rolling lift bridge, and is wholly dependent on electric power for operation, being equipped with 200 horse power in motors. The rolling lift bridge is a drawbridge consisting fo two halves, which are rolled back and tilted up on either shore abutment when it is necessary to open the draw for a passing vessel. This is accomplished by a train of gearing actuated by four electric motors, two on each side, the machinery for each half being in duplicate. This bridge has been under construction for nearly a year. A brief preliminary article, with a sectional drawing, was published in the WESTERN ELECTRICIAN of August 4, 1894. It is now practically completed, having been thrown open to traffic this week, and the present description refers to the completed construction. Fig. 1 gives a photographic reproduction of the operating mechanism under the west approach; Fig. 2 is an accurate sketch of the general appearance of the structure, reproduced from the *Chicago Tribune;* Fig. 3 presents a sectional drawing of the motors, gearing and controller house of one side, while Fig. 4 is a plan of the machinery photographed for Fig. 1. In considering these illustrations it should be explained that the photograph for Fig. 1 was taken when the temporary wiring was in place, the finished job presenting a cleaner and more workmanlike appearance. A few minor changes have also been made in the progress of the work since the drawings, Figs. 3 and 4, were made, but merely in details that do not affect the general arrangement as represented.

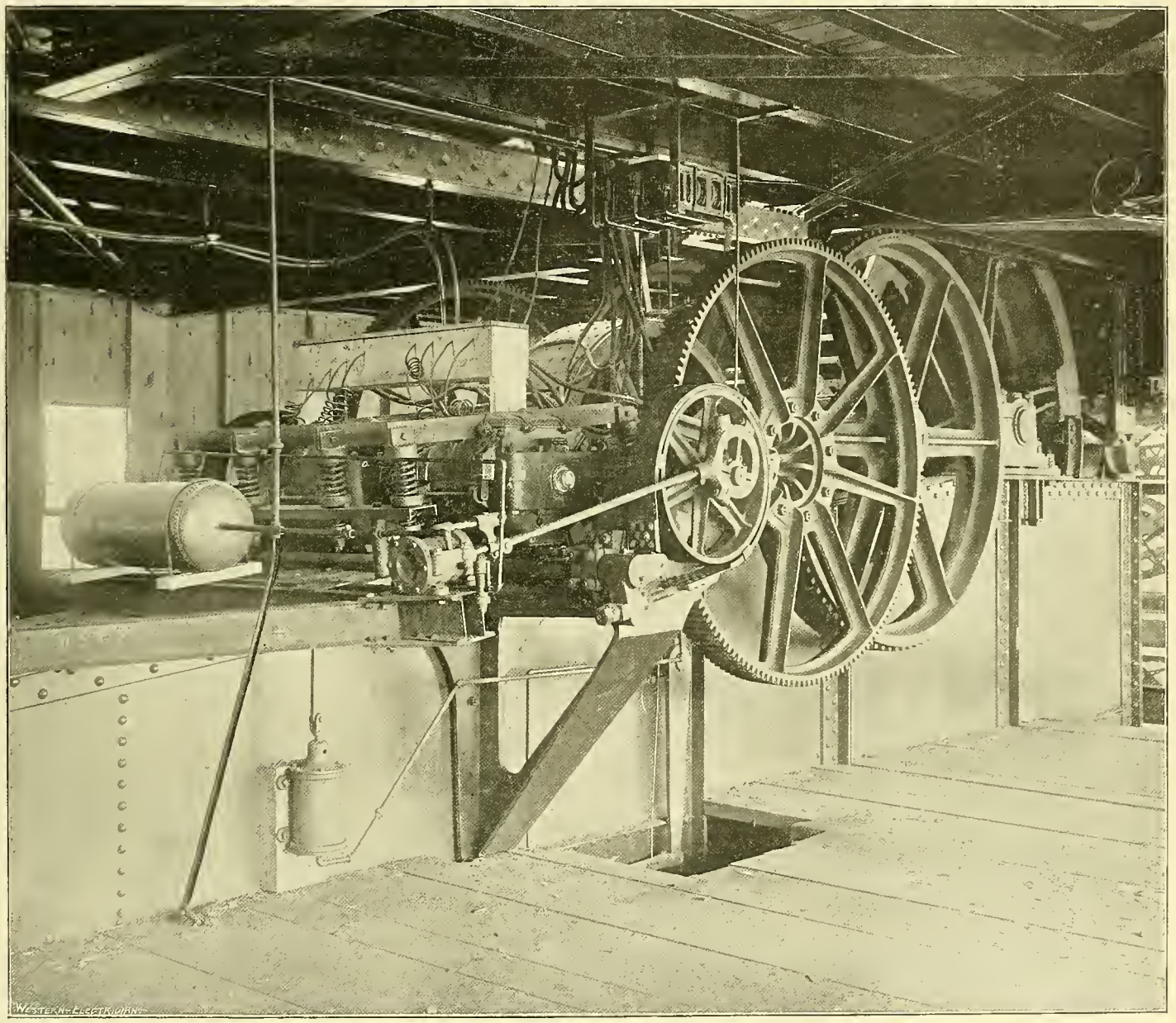



FIG. 1. ELECTRICALLY OPERATED ROLLING LIFT BRIDGE.—VIEW OF MACHINERY UNDER WEST APPROACH.

Before beginning a description of the bridge, the conditions to be fulfilled at Van Buren street should be understood. The old bridge at this site, being a swing bridge, divided the river into two narrow channels, neither of which was in direct line with the channel above or below the bridge. A new swing bridge, even if of longer span, would not have materially improved these channels. Moreover, the Metropolitan West Side Elevated Railway company wished to cross the river at a point near this bridge, which would not have been possible if the old bridge were replaced with a swing bridge of longer span. However, a lift bridge moving in a vertical plane would permit the Metropolitan "L" company to cross the river as desired, and the bridge having no center pier, a straight channel could be maintained through this point.

As shown in Fig. 2, the bridge is closed ready for traffic. Opened for navigation the halves are erected nearly at right angles to the plane of the roadway. The west approach is longer than the east; the abutment and pier on the west being separated by 40 feet, while on the east they are combined in one piece of masonry. This space between the abutment and pier is bridged over with plate girders and forms a room for the machinery on the west side. On the east side of the river space for the machinery was provided by building a room in the abutment. In each room are placed the motors, air pumps, air reservoirs and other machinery necessary to operate one-half of the bridge, and each half is operated independently of the other.

The foundation for each part of the substructure is formed of piling, driven with about three feet centers. The piles used are about 50 feet long, driven nearly to the water and sawed off 17 feet below the water line.

In building the masonry for the west abutment, the west pier and the west portion of the east abutment, open

caissons were used. The bottom of the caissons consisted of four courses of 12 by 12 pine, the side walls being a single course of the same material. Each caisson was built at the dock and filled with concrete until it sank almost to the level of the piling. It was then floated into position and the concrete continued up to within two feet of the water line. The pier was then faced up with Bedford masonry to the coping, the concrete backing for each course being put in before the following course of masonry was added. The coping is of large blocks of Bedford stone.

In each pier were formed three pockets, each to receive one of the tail girders of the movable portion of the bridge when revolved into the vertical position. To remove the seepage from these pockets an electric pump was placed in a sump, one on each side of the river. Directly upon the masonry of each pier were placed three very heavy castings, each of which forms the bearing for one segmental girder.

When the bridge is raised the floor of the movable part of the roadways passes back and beneath that on the approach, making it necessary to bring the latter to a very thin edge to form a connection when the bridge is closed. This connection was made for the full width of the roadways. The movement at the sidewalks is the reverse of the above; that is, the moving sidewalk passes above the fixed part as the bridge is raised.

From the machinery, Figs. 3 and 4, runs an operating strut joined to the center truss by a pin connection. Within this strut is a rack which engages with the rack wheel. When the bridge is closed the latch beneath the tail girder and the pin latch at the center of the span are both in position, and the bridge is locked ready for traffic. The first movement of the strut backward is to revolve the cam crank, which operates on a series of levers and shafts, withdrawing the pin latches. At the same time a small wheel strikes the cam of the rack wheel, and the first movement of this latter wheel operating through the small wheel and the connecting levers is to withdraw the latch from the tail girders. These two duties performed, the bridge is free to move, and the succeeding motion of the operating strut begins to move the bridge. In closing, these movements are simply reversed, and the bridge is again locked.

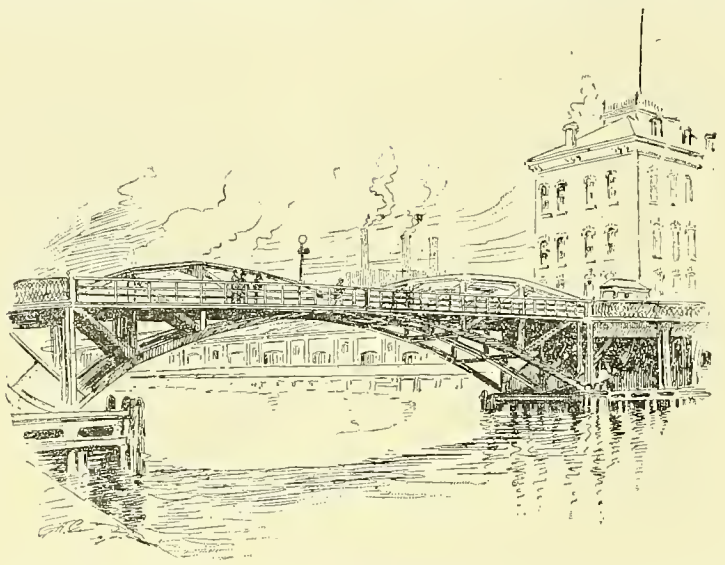


FIG. 2. ELECTRICALLY OPERATED ROLLING LIFT BRIDGE.—GENERAL APPEARANCE OF BRIDGE WHEN CLOSED.

As previously stated, the lock at the center is only to prevent lateral movement. The arm to the center acts as a cantilever; the tail girder, being the anchor, is held down by heavy anchor rods reaching to the bottom of the masonry. In raising the bridge, the power from the operating strut is carried from the center truss to the two outside trusses by heavy vertical bracing. Within the tail girders and between them, beneath the roadway floor, are placed the weights for counter-balancing the bridge. These weights are sufficient to prevent the bridge from coming to a horizontal position when freely lowered by the brakes. The bridge when so lowered comes to rest a little above the horizontal; the current is then applied, and the motors force the bridge down to a level.

The machinery and motors are shown in Figs. 1, 3 and 4. There are two 50 horse power ironclad Westinghouse motors on each side of the river, hung on the same shaft, and wired to operate in unison or separately. Current at 500 volts for these motors is brought from the Market street station of the Chicago Edison company by underground cables leading up to the west side of the bridge, where they enter a junction box. From this box two cables go to the operator's house, Fig. 3, and there connect with the controlling system for that side, and two submarine cables, or rather three—for it was deemed wise to lay one reserve cable for emergencies—cross the river in a trench five feet below the bed of the stream, and are brought up to a similar house on the east side. Westinghouse controllers, of the street car type, are used.

On each end of the motor shaft, Fig. 4, is an automatic brake wheel. The brakes on these wheels are actuated by compressed air, the compressors being operated by an eccentric on the end of the motor shaft. If at any time during the motion of the bridge the current is cut off, these brakes are automatically applied. In addition to these brakes there is an emergency brake on the center of the first shaft, back of the motor shaft, which may be set at any time by opening an air valve leading from the air reservoir to this brake cylinder. This brake is intended to be used only in case of an accident.

The bridge gates at the right-hand roadway at each end of the bridge and the signal at the center of the span are also operated by compressed air on a system devised by George P. Nichols. The center signal, Fig. 2, in general appearance is similar to an ordinary railroad switch stand, with target and lantern, except in height, the top of the lantern being 18 feet above the roadway. It is placed on top of the extreme end of the center truss, its purpose being to convey signals to vessels, the red target by day and the red light by night signifying that the bridge is down, and no target at day and a green light at night signaling "Go ahead." Motion is given to the spindle by a diaphragm acted on by the compressed air. The light in the lantern is furnished by two 16 candle power incandescent lamps. There are four lamps or two sets in the lantern, on two distinct circuits, connected with a double-throw switch in the operator's house, so that if a filament in one of the lamps is broken another can be instantly thrown in. As the lamps in the signal are on the same circuit as those in the house, the operator is instantly notified of a breakage. This system makes the use of electric light safe for signaling purposes.

A ten-inch electric gong attached to the signal stand takes the place of the old form of bell used on swing bridges for announcing to drivers and pedestrians that a draw is about to be made.

On top of the center girder on each approach is located the operator's house, Fig. 3, or "conning tower," as aptly termed by a marine engineer. From these points of vantage the entire operation of the bridge is controlled. In front of the operator is the controller; to his right the signal valve, the alarm bell switch, the emergency brake valve and gate valves, and on the left is the main switch and fuse block, all within easy reach of the operator. Above the controller is a switch and rheostat for operating the electric pumps in the pockets in the masonry, as above referred to. This outfit consists of a centrifugal pump set in a sump hole below the bottom surface of the pocket. On a platform above is a one horse power electric motor, which drives this pump by means of bevel gears attached to the long vertical shaft from the pump. In the point of the operator's house, in front of the bridge tender's position, is the automatic controller by means of which the current is cut off and the air brakes set when the bridge reaches its extreme position when open, or at a predetermined point when being closed. This prevents the bridge from running away and guards against accident through carelessness of the operators. In order that the two operators may be able to communicate with each other—for when both sides of the bridge are up they are as isolated as if miles apart—a telephone with bell is placed in each house to the operator's right, connection being made by a lead-covered cable laid in the bottom of the river.

The air for use on both sides of the river is compressed on the west side, that to be used on the east side being piped across beneath the river and stored in a reservoir. It may be remarked that the gear wheels are all of cast steel, excepting the spokes and hub of the rack wheel, which are of cast iron, as are also the journal boxes. The river channel left clear by the lifting of the bridge is 109 feet wide.

The two operator houses are identical in equipment, save that the signal and gong are operated from the west side only. Of course the electrical and pneumatic control of both sides of the bridge could have been centered in one point instead of two, but it was thought advisable to have a man on each side of the bridge and two sets of controlling apparatus. The little houses are to be heated by electric heaters.

The bridge was designed and patented by William Scherzer, who died before the drawings for it were entirely completed. It may safely be said that had he lived to carry out the work he had so well begun, many improvements would have been added to the bridge.

The substructure was built by the FitzSimons & Connell company of Chicago. The east pier and abutment, which came between two seven-story buildings, and the excavation for which was considerably below the foundations of these buildings, were especially difficult of construction. This work was all done very successfully and with credit to the contractors.

The contract for the superstructure was originally let to A. Gottlieb & Co., but Mr. Gottlieb's death very soon afterward made it necessary to re-let this work, and it was given to Charles L. Strobel of Chicago. Mr. Strobel had the work manufactured by the Elmira Bridge company of Elmira, N. Y., which sub-let the machinery contract to the Scaife Foundry & Machine company of Pittsburg.

The electrical equipment, including the brakes, air compressors, gates, signals, etc., was furnished by G. P. Nichols & Bro. of Chicago.

The bridge was constructed under the supervision of Samuel G. Artingstall, city engineer, Warren R. Roberts, city bridge engineer, having direct charge of the work.

The total cost of the bridge, including the approaches, the electric equipment and cables to the power house, was $169,700.

## National Electric Light Association.

In order to accommodate members who wish to display electrical specialties in connection with the convention of the National Electric Light association, the management of the Hollenden House, Cleveland, which is the headquarters of the organization, has decided to devote the basement of the building to exhibition purposes. The place is well adapted for this scheme, and entrance to it can be gained from the street as well as through the hotel. It will of course be much more convenient than any other place, and it is believed there will be ample room for all who wish to make displays.

It is announced that a paper has bee nprepared on "A New Method of Measuring Illumination," by E. J. Houston and A. E. Kennelly. "Underwriters' Rules vs. National Electric Light Association Rules" is another topic of discussion, and there will also be a "Practical Demonstration of Protecting Lines from Lightning," by A. J. Wurtz and others. The arrangements thus far made ensure an attractive programme.

It is also announced that arrangements have been completed with the New York Central & Hudson River Railroad company for a special train of Wagner vestibuled parlor, dining-room and buffet cars, leaving the Grand Central depot, Forty-second street, New York, at 9:30 A. M. Monday, February 18th, and running as second section of the fast mail, on the following schedule: Leaving New York 9:30 A. M., leaving Albany 1 P. M., leaving Utica 3:17 P. M., leaving Syracuse 4:40 P. M., leaving Rochester 6:30 P. M., leaving Buffalo 7:25 P. M. (central time), leaving Erie 9:33 P. M. and arriving at Cleveland 11:35 P. M. Seats can now be secured on this train by applying in person or by letter to the office of the National Electric Light association.

A special rate has been granted (on certificate plan) of a fare and one-third from all points in the United States east of the Mississippi river, Peoria and Chicago, to Cleveland. To obtain this rate it is necessary in purchasing going tickets to ask the ticket agent for a certificate, which when properly endorsed at Cleveland will entitle the purchaser to a one-third fare returning.

That the best results may be obtained, it is very desirable that delegates should make their application for space on the New York special at the earliest possible moment.

The following named gentlemen have charge of transportation in their respective districts, to whom application can be made for all information: A. C. Shaw, 620 Atlantic avenue, Boston, Mass.; H. A. Cleverly, 1018 Chestnut street, Philadelphia, Pa.; E. H. Heinrichs, Westinghouse company, Pittsburg, Pa.; E. L. Powers, Monadnock building, Chicago, Ill.

## Prof. Rowland on Modern Theories of Electricity.[1]

By Prof. Oliver Lodge, F. R. S.

A popular exposition should not be judged by too high a standard of rigorous criticism, nor need it always be instructive to specialists in the department of which it treats; but when a man like Henry A. Rowland of Baltimore endeavors to expound modern theories in ordinary language to untechnically instructed readers the effort is always of interest and seldom fails to yield some modicum of instruction.

In the *Engineering Magazine* of New York for the current montht (January) there is an article by Prof. Rowland bearing the title "Modern Theories as to Electricity." He begins by saying that electricity no longer exists; and that nothing is more certain than that electricity is not a fluid; healso speaks of that unfortunate term "electric current," and says that "even the definition of elcctrical units, as adopted by all scientists, suggests a fluid theory."

For our part we should not like to have expressed ourselves quite so unreservedly as this. To say that electricity no longer exists, though of course it only means that it is the ether which is now claiming the lion's share of attention, is hardly a helpful statement, and we fail to see how the orthodox electrical units are clever enough to suggest a fluid or any other theory.

As a specimen of exposition, the following can hardly be considered extremely luminous:

"But the question now arises as to how the lines of electric force can be produced in the ether; or, in nther words, how bodies can be charged. In the first place, we know that eqnal quantities of plns and minus electricity are always produced. As an illustration, suppose it is required to charge two balls with electricity. Pass a conducting wire between them, with a galvanic battery in its circnit. The galvanic battery generates the lines of force; these crowd together around it and push each other sideways until their ends are pushed down the wire, and many of them are pushed out upon the balls."

But the following attempt to explain electrification by friction is rather better:

"We can consider, for instance, in chloride of silver that the atoms of silver are joined to the atoms of chlorine by lines of electrostatic force, which hold them to each other. If, by rubbing the chloride of silver, we could remove the chlorine on the rubber while leaving the silver, we could stretch them asunder, and so fill space with the lines of electrostatic force. According to this theory, then, each atom has a number of lines of force attached to it, and it is only by stretching the atoms apart that we can fill an appreciable space with them, and so cause electrostatic action at a distance. We come to the conclusion, then, that all electrification is originally produced by separating the atoms of bodies from one another . . . by friction . . . or some other manner."

He speaks of an electric current as the sliding of the ends of these electrostatic lines on matter, and on matter always, and he continues: "But as they cannot end in a vacuum they cannot pass through it. Thus we conclude that a vacuum is a perfect non-conductor of electricity."

Here the phrase "pass through it" must be interpreted "*move* through it," or it will mislead a reader into thinking that a vacuum has no dielectric properties; and thus a novel discovery might be worked up by the newspapers, quite as good as the memorable and much puffed "discovery" of Prof. Dewar, that radiant heat was stopped by a vacuum.

Leaving these more or less verbal criticisms, we arrive at a bold and uncompromising statement, several times repeated, regarding the earth's magnetism:

"To account for the earth's magnetism, we must suppose the ether to have such properties that the rotation of ordinary matter in it produces magnetism."

And, again:

"The ether must also account for the earth's magnetism. If we assume that magnetic lines of force are simply vortex filaments in the ether, we have only to suppose that the ether is carried around by the rotation of the earth, and we have the explanation needed. The magnetism of the earth would then be simply a whirlpool in the ether."

Now these statements are full of more than doubtful hypotheses. First, that magnetism is certainly dne to rotation of something, which, although Thomsonian and Maxwellian, has never been proved; next, that rotating ether is the necessary and sufficient whirling material, whereas all that is known is that rotating electrification is sufficient; and, lastly, that the spinning of matter on its axis magnetizes it, against which may be adduced a crowd of specially-directed experiments, all of them having had a negative result.

Certain arithmetical calculations as to the strain required in the ether, in order to explain known electric and magnetic forces, may be of interest:

"First—It must be able to explain electrostatic attraction. These electrostatic forces are mostly rather feeble as we ordinarily see them. Air breaks down and a spark passes when the tension on the ether amounts to abont $\frac{1}{100}$ pound to the square inch. It is the air, however, that causes the breakdown. Take the air entirely away, and we then know no limit to this force. In a snitable liquid it may amount to 500 times that in air or 5 pounds to one square inch, and become a very strong force indeed. In a perfect vacuum the limit is unknown; but it cannot be less than in a liquid, and may thns possibly amount to hundreds, if not thousands, of ponnds to the square inch.

"Second—It must explain magnetic action. These actions are apparently stronger than electrostatic actions, but in reality they are not necessarily so. A tension on the ether of only a few hundred pounds on the square inch will account for all magnetic attraction that we know of, although we are able to fix no limit to the force the ether will sustain. No signs have ever been discovered of the ether breaking down."

It might be added that to explain gravitation—after a Maxwellian fashion—the stress that must be borne by the ether amounts to hundreds of thousands of atmospheres, in the neighborhood of very large lumps of matter such as the sun.

The most instructive statement here is the emphatic perception that it is the air which causes disruptive discharge. It is the residues of air which are responsible for the breakdown of condensers, as Tesla found; and in absolute vacuum there can be little doubt that all modes of conveyance of electricity, whether conductive or disruptive, must cease. And this is best expressed, as Prof. Rowland himself has done in an above quoted paragraph, by saying that the very phrase electric charge ceases to be applicable to vacuum; *charge* is absolutely limited to the surface of material atoms, and accordingly where they are absent there cannot possibly be any conveyance of electric charges, such as is involved in a current of any kind.

Another useful remark concerns the velocity of ethereal rotation in a magnetic field, supposing always, as Prof. Rowland evidently does, that such rotation is a certain physical fact. He points out that the speed of rotation can be estimated from the known valne of the Verdet constant; in other words, hy the amount of the Faraday rotation of the plane of polarization of light in magnetized transparent substances. He says:

"The velocity of rotation is immense, the plane of polarization rotating in some cases 300,000,000 times per second."

It is a perception of facts of this kind which has deterred the writer, and doubtless other experimenters, from a serious attempt to rotate the plane of polarization by rotating a transparent substance.

With respect to an explanation of gravitation, he shows how far away we still are from any approach to it. One of the difficulties connected with this subject is the necessity for infinite speed of transmission. Nothing less than a practically infinite speed suffices to account for astronomical facts.

The natural conclusion is that the ether must be incompressible and must transmit this action by some sort of thrnst or tension; and certain facts suggest that the ether really is incompressible, or else is insusceptible itself to gravitational forces; viz., the fact that "light passes in a straight line through space even when near one of the larger planets, unless the latter possesses an atmosphere. This could hardly happen unless the ether was entirely incompressible or else possessed no weight."

Lastly, Prof. Rowland deals with the ether as a conveyer of energy. He does not consider it in its function of a great storehouse or reservoir of energy on which the whole activity of the material universe depends, but he points out that it is remarkably competent to convey, and convey rapidly, much more energy than any known form of matter is.

"The amount of energy which can be transmitted by the ether in this manner is enormons, far exceeding that which can be carried by anything composed of ordinary matter. Thus, take the case of sunlight; on the earth's surface illuminated by strong sunlight a horse power of energy falls on every seven sqnare feet. At the surface of the sun the ethereal waves carry energy outward at the rate of nearly 8,000 horse power per sqnare foot.

"Again, an electric wire as large as a knitting needle, surrounded with a tube half an inch in diameter, in which a perfect vacnum has been made, to prevent the escape of electricity, may convey to a distance 1,000 horse power; indeed, even 10,000 or more horse power, there being apparently no limit to the amount the ether can carry.

"Compare this with the steam engine, where only a few hundred horse power requires an enormous and clumsy steam pipe. Or, again, the amount carried by a steel shaft, which, at ordinary rate of speed, would require to be about a foot in diameter to transmit 10,000 horse power."

He concludes by emphasizing once more his belief that magnetism is due to ethereal rotation, and says definitely that "a magnetic line of force is a vortex filament in the ether." The alternative view, championed by Dr. Larmor, that magnetism may be due to flow, and electric current to spin, has evidently not yet impressed him as possessing any force or validity. It may be assumed as probable that he has strong reasons for this orthodox Maxwellian belief, and it would be interesting to know them.

He considers magnetism more simple and easy to comprehend than electrostatics; which, again, must be considered as a thoroughly Maxwellian position; and it is interesting to see how the great foreign philosophers of the world are all slowly coming to recognize the magnitude of this great teacher. Prof. Rowland, indeed, has long recognized it, and it is hard to speak of members of the Anglo-Saxon race as foreigners; but their aloofness from insular prejudice and the bonds of the mother country render their adhesion to the English, instead of to one of the many forms of continental theory, of special interest.

The domain of electrostatics is evidently regarded by Rowland, as it is also by Poincaré, as the least edifying and satisfactory parts of the present theoretical treatment of the subject, regarded from an ethereal point of view, and almost the concluding words of the article now under notice are the following:

"Electrostatic action is more difficult to explain, and we have hardly got further than the vague idea that it is due to some sort of elastic yielding in the ether.

"Light and radiation in general are explained when we understand clearly magnetic and electrostatic actions as the two are linked together with certainty by Maxwell's theory."

1. From the *Electrician*, London.

## Chicago Edison Company.

The directors of the Chicago Edison company have decided to convert the old Adams street station into a building devoted to the company's offices and also providing room for a salesroom for the sale of electrical supplies, in which the company proposes to engage. The general offices will be removed from the Rookery as soon as suitable quarters can be provided. The successful operation of the new Harrison street station renders it unnecessary to retain any space in the Adams street building for operating purposes, save such as is necessary for a substation for distribution.

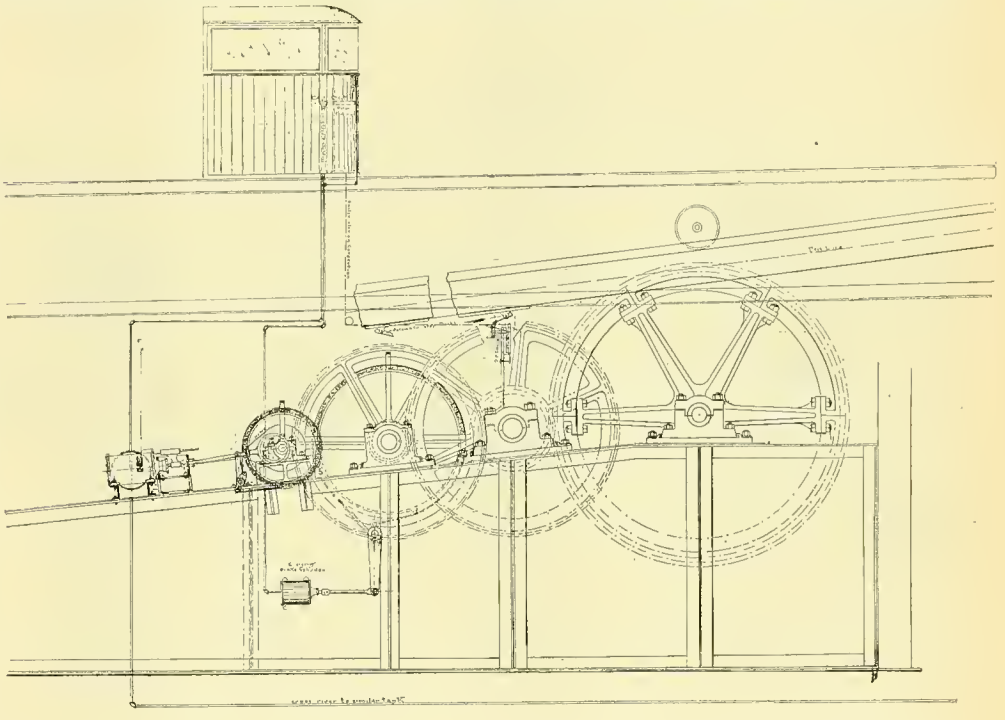


FIG. 3. ELECTRICALLY OPERATED ROLLING LIFT BRIDGE.—SIDE SECTION OF OPERATING MECHANISM.

## Heavy Shipments of Electric Railway Machinery.

Chicago is receiving heavy shipments of generator and motor machinery for its rapidly extending electric railways from eastern manufacturers. From the General Electric company came one consignment of 24 carloads of street railway motors last week. Each car contained 16 motors. These were for Mr. Yerkes' West Side company. The big 1,500 kilowatt generator for the Metropolitan company, also from Schenectady, has arrived here. Seven freight cars were required to transport it. The disposition and weight of the parts are interesting. The seven cars were loaded as follows:

| | |
|---|---|
| Commutator and 12 poles | 46,000 pounds. |
| Lower frame | 30,850 " |
| Upper frame | 22,550 " |
| Resistances, controllers, etc | 19,650 " |
| Twelve magnet coils | 19,350 " |
| Pedestals and sundries | 5,100 " |
| Yoke ring | 4,500 " |
| Total | 148,000 " |

## Electric Railways in New Hampshire.

At the request of the New Hampshire Legislature the Railroad Commission of that state has just made a special report on the electric railways of the state. The report contains much of value and interest and goes into the financial side of the question at considerable length. This information is given:

New Hampshire has now five street railways, of which three, the Manchester, Nashua and Laconia, are operated by horse power, and the other two, the Concord and Dover, by electricity. Arrangements are being made to convert the Manchester and Nashua roads into electrics.

The two electrics are interurban and both parallel steam roads, the Dover between that city and Somersworth, and the Concord between the central wards of that city and Penacook.

All these roads have passed from the ownership of the many people who furnished their original capital into the control of financiers. The stock of the Manchester road is, with the exception of six shares, owned by one man. Another man holds a controlling interest in the stock of the Dover, and the Nashua has just been sold to a foreign syndicate. The Concord and Laconia are now in the hands of a few recent purchasers.

The Manchester road has 10.17 miles of track. Its capital stock is but $25,000; it has no funded debt, and its unfunded liabilities are but $60,585. It carried last year 1,585,832 passengers, earned $81,627.15, of which $4,721.29 was net income, and paid its four stockholders 7 per cent. dividends.

The Nashua road has 10.5 miles of track. Its capital stock is $20,000 and its debt $161,650. It carried last year 560,901 passengers and earned $29,994.89, which was $4,147.35 less than its operating expenses. Its deficit for the year, including interest, was more than $12,000.

The Concord road is eleven miles long. Its capital stock is $100,000, of which one-half is preferred, and its funded debt is $100,000. Its earnings last year were $43,787.51, its operating expenses $32,980.85 and its interest account $5,057.95. It paid 6 per cent. dividends on the preferred stock and carried $2,746.61 to surplus.

The Dover road is 6.5 miles long. It is capitalized at $150,000 and has a funded debt of $100,000. Some months ago it passed into the hands of a receiver. Its stock is worthless and its bonds of doubtful value.

The Laconia road is 3.4 miles long. It is capitalized at $50,000 and has an unfunded debt of $4,400 above its surplus. It carried last year 206,473 passengers and earned net $2,418. Its stockholders received 5 per cent. dividends.

These five roads meet the requirements of the five largest cities in the state and of another smaller one. They occupy nearly all the territory in the state which can be made to furnish profitable business to purely local roads, and whatever remains is covered by charters already granted but not yet used.

New charters are therefore likely to be asked for only with a view to the construction of interurban or through lines connecting two or more cities or towns, and future construction will in all probability be mostly by foreign capitalists. Further development of street railways by our own citizens, with their own money, for the purpose of securing to themselves and their neighbors needed facilities is not to be confidently looked for.

Commenting on the progress of electric traction, the commissioners say:

The electric road has come to stay and be extended and perfected. The advantages it offers, rapid transit, cheap and delightful journeying, railway communications for communities to which they cannot be afforded by any other method, will command for it public approval, and capitalists, to whom it offers an unlimited field for investment and speculation, will construct it wherever there is business to warrant.

The prediction that within the next decade it will supersede the steam road for passengers, mails, expresses and light freights may be extravagant, but it is by no means as much so as a foretelling of what has actually been accomplished since would have been regarded a decade ago.

No conservative prophet is safe in front of an electric motor. In many of the states street railways have been restricted by their charters or the general laws to a passenger business, but there are at present about sixty roads which are a freight service, forty of them operating special cars for that purpose, more than sixty which carry mails and thirty-five which do an express business, and the tendency everywhere is toward the removal of statutory limitations of the business which this class of carriers may do, and capitalists who operate in this field base their plans upon a free competition with the steam roads in all lines of railway transportation. Legislation upon the subject should therefore be predicated upon the same theory, and legislators in this state should have in mind not merely the street road which has supplanted the omnibus, but the electric through line which aims to rival in power and importance, in variety and volume of business, the great systems along which are planted our towns and cities.

In accordance with this view the commission closes its report by recommending a general law to cover the whole subject of granting franchises to electric railway companies. It says:

We would therefore recommend the passage of a general law broad enough to make it unnecessary and unwise for the Legislature to grant a special charter in any case. We do not deem it expedient for us to attempt to draft such law in detail but in our judgment it should—

(1) Authorize the organization of street railroad corporations by some simple and easy method, and the construction of such roads wherever and whenever they are needed by whoever will furnish the necessary means.

(2) Provide an impartial and competent tribunal to determine the question whether the public good demands the construction of a proposed road and to fix the compensation, if any, for the use of the highways.

(3) Confer upon the towns and cities through which a road runs the authority to locate it, prescribe the character of its construction, and, in cases where it is confined to one town or city, the method of its operation.

(4) So far as it is practicable, to exclude such roads from the traveled highways in country districts and secure to the public directly or indirectly compensation for the property and privileges which are granted them.

(5) Protect grade crossings.

(6) Declare that failure to operate a street road shall be a forfeiture of its franchise; and

(7) Prohibit fictitious capitalization, the sale of securities for less than their par value, and the contraction of debts in excess of the amount of capital stock actually paid in.

## Maryland Telephone Commission.

Governor Brown of Maryland has appointed James L. McLane, James A. Gary and Charles Goldsborough as a commission to investigate the accounts and operation of the Chesapeake and Potomac Telephone company and to report the result of the examination to the next meeting of the General Assembly.

The commission, which is to serve without pay, was appointed under authority of chapter 207 of the acts of 1894. Its duty under the act is to ascertain the amount expended by the telephone company in acquiring rights of way and other easements in Maryland, and also the cost of constructing the plant, equipment and works now owned by the company and used in the telephone business in that state. The commission is to ascertain the actual cost of furnishing telephone service in Baltimore and in other sections of the state where the telephone is used. This cost is to include what is known as the ordinary or grounded service and the metallic circuit service.

The commission has power to procure any information which will aid it in forming a correct judgment of what would be a fair and sufficient rate to charge subscribers for the telephone service. The books, papers and all accounts of the company are to be open to the inspection of the commission at all times.

The act authorizes the employment of an expert accountant, who will aid the commission in making its investigation. This expert is to be paid by the telephone company, which is also compelled to pay the actual expenses of the commission in carrying on its work.

The passage of this act was the result of a prolonged struggle between the telephone company and its Baltimore subscribers before the General Assembly. The subscribers claimed that the price charged for the telephone service was exorbitant and that the company could still make a fair profit and charge a less rate. This the company denied and offered to open its books for the inspection of any authorized commission to prove its statements. It was this suggestion which led to the passage of the law which was agreed to by both the subscribers and the company.

Governor Brown says he put off the appointment of the commission until the telephone company could have ample time to test the efficiency of its long-distance or metallic circuit service. This, he thinks, has now been demonstrated. The commission will have a year in which to do its work and prepare the report.

## Electric Lighting for Carriages.

In a recent report to the State Department, C. W. Chancellor, the United States consul at Havre, France, makes some pertinent remarks concerning the lighting of carriages by electricity. He says:

Gas lighting, which was common in London as early as 1810, was not introduced into Paris until 1819, and more than twenty years elapsed before its use as an illuminant became general in France. On the other hand, when we turn to the subject of electric lighting, it must be admitted that France has taken a foremost rank among European nations in adopting the electric light.

In Paris electrically illuminated private carriages have, for the last five years, been extensively patronized by the wealthier classes, but only recently has this process of lighting been applied to private carriages in London and Berlin. The Prince of Wales was the first to adopt it in London, and now we learn that the German Emperor has brought the resources of his active mind to bear on the subject of lighting carriages, and, as a consequence, the court carriages in Berlin now have electric lighting not only by outside lanterns, but also in the interior, supplied with current from a series of accumulators carried in the vehicles. All over the harness are placed small colored lights, which glow like fireflies when the carriage is in motion.

There seems to be no valid reason why all public conveyances, cabs, omnibuses, tram-cars, etc., as well as private carriages should not be illuminated by electricity. It would certainly largely enhance not only the comfort but the safety of locomotion in the thoroughfares of large cities. Indeed, it has been found that in a carriage supplied with a properly arranged electric light the most formidable of outdoor foes, the dense fogs of European cities, might almost be defied, while the brilliant, searching electric light would enable passengers to amuse themselves by reading books and newspapers. It is, moreover, obvious that the adoption, on an extended scale, of electricity as an illuminating agent in private and public vehicles would serve a double purpose—first, one of a distinctly practical usefulness; next, that of increasing the brightness and cheerfulness of the streets, which would materially aid in the beautifying of a city. Again, it has been ascertained that the more the omnibus and tram-car companies make their vehicles attractive, the greater will be their traffic.

In private carriages the electric light is placed inside in the center of the roof, and the twin lights, for there are two, contained in flat vial-shaped vacuum glasses, are shielded by a circular glass plate rather larger than the "bull's-eye" of an ordinary searchlight, but neither convex nor concave. At the back of the lamp there is a dome or bell-shaped enamelled reflector. The horseshoe carbon filaments, which become incandescent, are very diminutive, and the current is conveyed to them by platinum wires. In order to economize space, the flat vacuum glasses are not hung vertically in the bell protector, but lie horizontally, and a little glass stilt is added to support them. In this way the roof of a brougham is filled with a light diffuser which will not interfere with a person's head when entering the vehicle. Each of these lamps gives a light equal to seven candles.

In the first attempt to light carriages in this manner the moving of the carriage was apt to jar the lamps, often causing a breakdown, and steel springs were not found sufficient to prevent this. The plan now adopted is to suspend the complete lamp in a sheet of rubber, which is attached to the interior of the carriage, neutralizing the vibration. It is only necessary to press a button in order to switch the current on, and by a second push it is turned off again.

A sufficient supply of electricity required for the lamp is stored in an accumulator. One accumulator, weighing two pounds, is provided for each lamp. Should the two outside

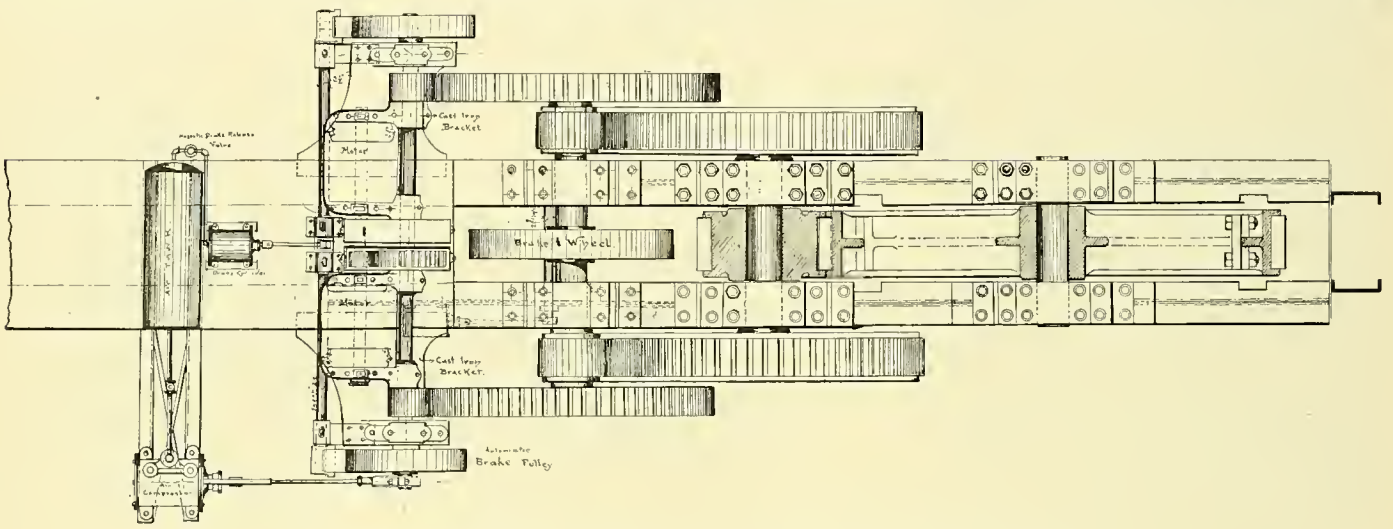



FIG. 4. ELECTRICALLY OPERATED ROLLING LIFT BRIDGE.—PLAN OF MOTORS, BRAKES AND GEARING.

lamps be also electric, two other batteries would be needed. The outside illuminators are not of the same shape and differ in principle from the interior lamp, but an india-rubber socket is used to reduce vibration. Accumulator or accumulators, as the case may be, are carried in the boot, under the coachman's seat, and are easily accessible. The coachman himself makes the necessary connections.

An eight-cell storage battery for an ordinary family carriage or brougham is simply a box eight inches long, four inches wide and seven inches deep. This supplies the current to keep the lamp lighted for eighteen hours, which, ordinarily, is sufficient to last the owner of the carriage from one to two months. The cost of recharging varies, according to wear and tear, from 50 cents to $1—not more than the expense entailed by the employment of oil lamps, which invariably give out an unpleasant odor and an uncertain illumination. The electric lamp does not wear out unless subjected to careless treatment, or unless it is weakened by the application of too strong a current. The accumulator, however, makes the latter contingency almost an impossibility.

There appears to be a fair prospect that, in the course of a few years, the majority of public conveyances in cities, as well as private vehicles, will be lighted by electricity, but the public will, of course, expect that electric lighting shall be superior to oil. This question seems to have been already quite well determined. It has been found that an electric lamp of 2½ candle power will enable any passenger to read in comfort while traveling. Apart from the actual amount of light to be afforded, which, of course, is capable of adjustment, it may be stated that the latest form of battery overcomes the difficulties which have hitherto stood in the way of the adoption of electricity for the lighting of street conveyances.

A tram-car battery, working two lights to illuminate the interior as well as the colored lamps seen from the front or rear of the car, will weigh about 30 pounds, and furnish a light equal to 2½ candle power, for forty-five to fifty hours. The battery is constructed to resist the jolting which accompanies the motion of a wheeled vehicle.

Lamps applied to omnibuses, trams and cabs differ in form. The omnibus light is fixed in a globe, smaller and flatter than the pattern which screws the oil lamps in European railway carriages. The incandescent carbon hangs downward, instead of projecting upward, as it does in table lamps. It is contained within a very small bulb. Behind it is a concave reflector of enamelled iron. There is no restriction as to the form of the tram lamp, as the same conditions do not apply, but in the cab lamp, where economy of space is a consideration, the globe, contained in a semi-circular reflector having a glass front, is placed upright at the back of the vehicle, over the passengers' heads. As these cab, tram and omnibus lamps are of the Edison make, and there has been of late such a great reduction in their price to the public, it may be understood that in order to fit up public carriages with electrical illuminating power much less expenditure is needed than is required to apply the light to a private carriage, the cost of such installation, including the accumulator, being only about $50.

## Electric Traction Discussion in England.

In the course of the recent discussion at the British Institution of Electrical Engineers on the papers of H. D. Wilkinson, R. W. Blackwell, P. Dawson and C. S. du Riche Preller, Prof. S. P. Thompson said that he did not propose to add anything to the technicalities of the discussion that had been going on. When he went over last autumn he had a lively recollection in his mind of the overhead wiring that disgraced American cities on the occasion of his visit nine years before; and he expected, when he remembered that he had to see something that had sprung up in those nine years, that his feelings of disgust at the fashion in which wires were strung overhead everywhere in a reckless way and in every direction would return with some intensity. But he must say that he came home with very different ideas, because our American cousins had mended their ways a great deal in regard to overhead lines. They did not have quite the unsightly arrangement of telephone wires of nine years before; the electric light wires were very much improved and in many cases were laid underground. As one who objected very much to all these networks of wires, he came back with this strong impression—that of all the different kinds of overhead wires one might see, whether in America or in this country, the overhead construction which least disfigured the landscape, was least of an eyesore of all, was the construction of overhead wires for modern tramway work. Having made that statement he would like to say that he thought that not even our American cousins had entirely realized the importance of what they had done in constructing so many thousands of miles of light rails carrying electric tramcars from the centers of population and industry away into the surrounding districts. He meant they had not realized the importance of this thing as a social factor. Anyone who visited, for example, Pittsburg now, and who knew what Pittsburg was ten years ago, would see that already the rapid transit from the center of a thickly populated town to the outlying regions had had a distinct social effect. The workmen, instead of crowding into barracks and tenements, to a very much larger extent lived in little villas each in its own little plot of ground, two or three miles from the center, where life was more healthy and children much happier, thus returning to the more primitive civilization of the village instead of to the more desperate civilization of the populous town, and this thanks largely to the fact that rapid transit was possible by means of electricity. Several other facts struck him in the social bearing of rapid electrical traction, and notably this, that a great part of the lines that were spreading out from town to town and from village to village across the state of New Jersey had been built—at whose expense? By money found, he was told, very largely from two sources, the insurance companies of New York and Philadelphia and the Penosylvania railroad. Now those two facts were very striking. If there was one body that looked out for a sound sort of investment he supposed it was an insurance company; and if there were any investments that were entitled to respect they were the investments of a railway company. Why should it pay any company like the Pennsylvania railroad to promote tramcar transit by means of electricity? Simply because of this—and our own great railway companies in England would find it out—that it was a distinct gain to the management of a railroad to clear out the local traffic as much as possible and allow the through traffic freer course. He believed we should find this an important factor here, that if we could have electric lines running out from our terminus stations a few miles into the country and feeding the terminus stations it would greatly lighten the main traffic. It was a question whether it was not advisable, having a well recognized gauge for our railways and well recognized style for our rolling stock, in all future schemes to consider a common gauge for electric tramways capable of running on the rails of the heavy railways of this country. That was, of course, a very large question, but it would be a greater disaster if we did not consider it now in all its bearings. We did not want perpetuated in electric traction the same kind of miserable mistake as was made when the battle of the broad and narrow gauges was fought out.

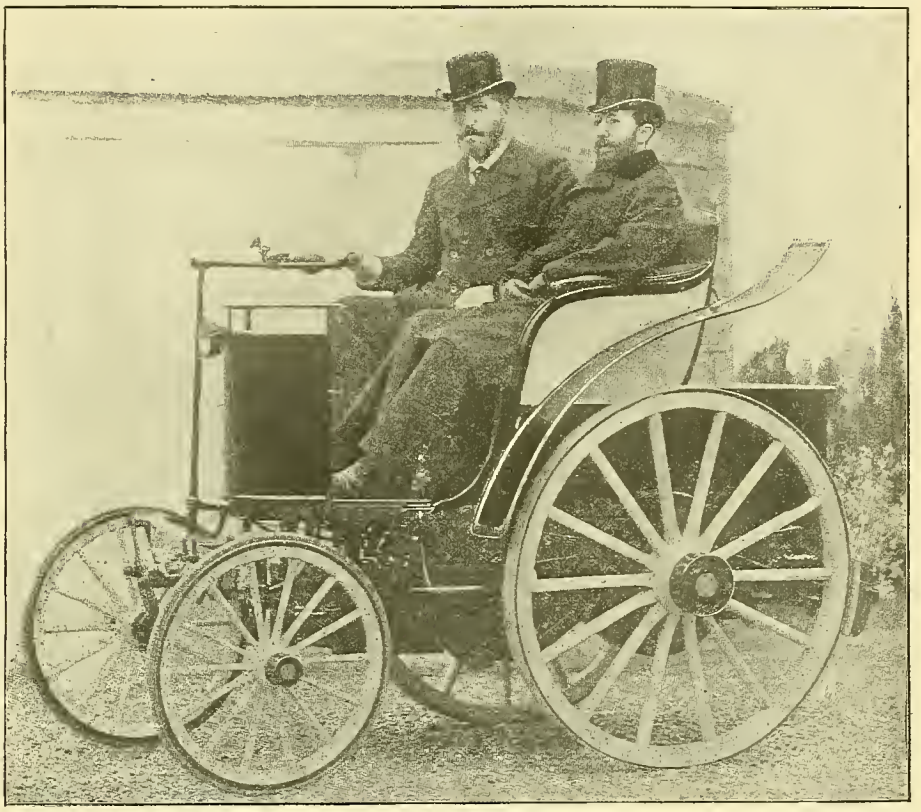
J. D. Dallas said that it was not perhaps generally known that one of the principal reasons for the great advance of electric traction in America was on account of the gearing they had adopted. In Richmond (Va.), on the first electric tramroad, Sprague placed single reduction gears on his motor, and because that was not successful he arrived at the conclusion that traction was not a success; but when the gearing was altered to double reduction, the road became a great success. But the fault did not lie really with the gear, but with the motor, which was not strong enough to do the work. Double reduction motors then became the vogue until 1891, when he thought nearly every road in America began to operate by double reduction motors. By the introduction of single-gear motors the gear losses, which had amounted to 15 per cent., were immediately reduced to 6 per cent. for all working loads. Many different forms of pinions had been used. Bronze pinions were about as good as could possibly be used for reducing the loss and also for reducing the noise. Hide gears at one time were thought to be excellent things, but were used for a short period only because they rapidly fell to pieces. The next improvement was to laminate the rawhide pinion by successive layers of rawhide and steel. But these, as soon as the edge was slightly worn down, cut the gear like so many saws, and were rejected. At present preference lay between forged steel milled out and bronze. He was in the testing department of the Thomson-Houston company for a long time, and he thought they had come to the conclusion that there were smaller losses from a cast-iron gear than in any other form, the cast-iron being close-grained, and with a considerable quantity of wrought-iron scrap mixed with it. This gave a very strong gear, which worked very well. He could give an illustration of the strength of these gears. He once saw a nut dropped by mistake into the gear, which was running at 900 armature speed. The nut was dropped in between the cast-iron teeth and a pinion. No mark could be discerned on the cast-iron, but the nut was very plainly stamped on the steel and the axle-box was broken. Gearless motors were scarcely ever of any use for street traction purposes; it was almost impossible to make a motor which had a satisfactory efficiency. He had heard very little mention of carbon brushes; he saw them used on one of the first roads ever worked in Boston, and where the commutators used before to be torn to pieces in a few days.

## Jeantaud's Electric Carriage.

In an article on electric carriages, *L'Energie Electrique*, describes a new form of these vehicles, which is illustrated herewith. Twenty-one elements of storage battery are enclosed in three boxes beneath the seat. The driver's hands are free to manipulate the direction and speed, as the switch and brake—the latter shown upon the rim of the hind wheel—are controlled by the foot. In applying the brake the circuit may be automatically opened, so that a very sudden stop may be made when necessary.

On a good road 20 kilometers per hour is accomplished. The batteries may be grouped at will for tension or quantity On down grades the battery is disconnected, and its energy is expended only on rising ground or on a level; so that a battery which would be good for 1½ hours on a level track, would do duty for two to three hours on rolling ground.

The weight of the carriage shown, which is the first of its kind, is as follows: Vehicle and fixed apparatus, 490 kilogrammes: accumulators, 420 kilogrammes; motor, 110 kilogrammes; two travelers, 150 to 180 kilogramms; total, 1,200 kilogrammes. The carriage is so arranged with springs as almost entirely to do away with the shock pertaining to a rough road, and the battery is but little affected by the jar. The inventor claims to have in view several improvements over the present arrangement.



JEANTAUD'S ELECTRIC CARRIAGE.

## American Institute of Electrical Engineers.

On account of dates conflicting with the convention of the National Electric Light association at Cleveland, February 19th, 20th and 21st, the regular monthly meetings of the institute at New York and Chicago have been postponed from February 20th to Wednesday, February 27th. The paper to be presented on the latter date is by H. Ward Leonard, and is entitled "Notes on Recent Electrical Engineering Developments in France and England," being the results of the author's recent personal observations in electric light, railway, central station and underground practice.

## A Flutter in a Contemporary's Office.

[From the *Electrical Review*.]

Four well-known houses—the Armington & Sims Engine company, the McIntosh & Seymour Engine company, the Okonite company, limited, and the Law Battery company—have discontinued their advertisements in the *Electrical World*. The impertinent circulars issued from that office did it. The proprietor, W. J. Johnston, with a record of three failures in the past, with a sawdust periodical in the present and a challenge ringing in his ears to produce a few paying subscribers, sends out a pathetic card headed:

"'Tis the wounded bird that flutters."

Poor flutterer!

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CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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## HIGH WATER MARK

CIRCULATION, 16,630.

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ONE of the numerous useless boards and commissions with which the people of New York are burdened is the Board of Electrical Control. The chief object of these boards seems to be to furnish positions for politicians. The patronage of the newly organized board will be controlled by Commissioner Kearney, who was chosen secretary and authorized to remove and appoint employes. It may be some consolation to know that Commissioner Kearney is familiar with the workings of this department, and that he is generally conceded to be competent and trustworthy. But this does not justify the existence of the board. It is costly and useless.

AN interesting review of the Brooklyn strike is presented in the financial columns of the New York *Sun* and is reproduced elsewhere in this issue. The writer takes the same view of the situation as that which this journal has maintained. The rights of property must be respected as well as those of labor, and no community can afford to sustain a lawless mob in a resort to violence, no matter what grievances the strikers may have. In this article, too, some very interesting lessons are drawn which it would be well for those who believe in governmental control to study. At the same time it would be well for corporations to take note of the predilection of the people generally toward restricting the vast powers that they have heretofore enjoyed, and the action of the city council at Brooklyn and the state officials at Albany to aid the strikers in their efforts to have these privileges and franchises revoked. The company has established the principle for which it contended and it can now afford to be generous in its treatment of employes.

THE action of a disgruntled farmer near Palmyra, N. Y., in refusing to permit an electric lighting company to put up poles on his farm has made it necessary for the company to secure the passage of a bill by the Legislature providing that "electric light and power companies may acquire land by condemnation proceedings if the price of land cannot be agreed upon by the owner and the corporation which proposes to purchase." The company was ready to furnish current last July, but was unable to effect a settlement with the farmer in question, and the community as well as the corporation was inconvenienced by his action.

THE *Chicago Tribune* gives the weight of its wide influence to the statement that "electricity has contributed many millions to the fire waste of the United States." This gives an impression that is far from being correct and one that does grave injustice to one of the country's leading industries. Let us take the figures of the underwriters themselves, who look upon electric light and power wiring and appliances with distrustful eyes. These gentlemen, to do them justice, indeavor to preserve a judicial mien toward electricity, but they are certainly not prejudiced in favor of it.

The Underwriters' Electrical Bureau of Chicago is in close touch with individuals and organizations of similar aim throughout the country and receives reports from all sections. It aims to cover the country exhaustively. And yet the electrical expert of this bureau, which is formed to ferret out all electrical fires and report upon their exact origin, reports for the year ended October 1, 1894, that the total fire loss of the country, so far as he had been able to ascertain, was less than a million and a half of dollars—to be exact, $1,415,610.25, as shown by the figures given in the WESTERN ELECTRICIAN of January 19th last.

Now it would take a considerable series of years at this rate to make good the extravagant assertion, "many millions." And yet electric light and power installations have only been in existence in the United States for about a dozen years and have been numerous for perhaps seven or eight years of that period. During this time the actual electrical fire hazard has, of course, grown with the extension of the industry, the maximum amount of loss being reached in the figure given for last year. Considering the ratio of growth and the maximum loss reported, it will be seen that the aggregate amount must be less than ten millions, while if the actual truth could be ascertained it would undoubtedly be found that the *bona fide* electrical fire loss of the United States has not yet reached the sum of $6,000,000. This is large enough; we wish that it was less. But it is not the terrible bugaboo that the *Tribune* makes out, especially in view of the inestimable service that applied electricity has rendered to the country.

RECENT advices from Washington indicate that the discussion over the proposed Pacific cable has had the effect of arousing Congress to a realization of the necessity of prompt and decisive action. According to the dispatches the House committee has made an important movement in this matter, and one that will be heartily commended. While it was generally known that an item had been inserted in the consular and diplomatic bill at the instance of the Senate committee on appropriations, providing for some preliminary work on the construction of a direct cable between the United States and the Islands of Hawaii, the extent of the proposition was not generally known. The amendment made to the bill as it came from the House is a significant one, as follows: "The president is hereby authorized to contract for the entire work of laying a telegraphic cable between the United States and the Hawaiian Islands, and to direct the prosecution of such work whenever such a contract shall be made, and as a part of the cost of such cable the sum of $500,000 is hereby appropriated." All the cable schemes proposed hitherto have involved the question of a subsidy to private corporations. This new appropriation is for the laying of a cable by the government of the United States, and $500,000 is appropriated to make the first payments on a contract for the construction of the work. One of the members of the committee, in explaining the action, said that the committee was practically a unit on the question, and that the adoption of the measure would be vigorously urged in the Senate as well asin the House. Furthermore, it was argued: "We consider the cable a military and naval necessity, and urge its construction on that ground chiefly, though, of course, when completed, it would be opened for commercial business on reasonable terms. This course will secure for this country a cable in advance of that proposed by Great Britain and France, and in connection with the proposed occupation of Pearl Harbor will be an important step in securing us some control of the Pacific." This is certainly an indication of an awakening to a sense of the importanee of the project.

THE daily papers of Chicago on Monday last announced that the Trade and Labor assembly on Sunday afternoon adopted resolutions condemning the proposition to place mail boxes on the street cars, and appointed a committee to present the resolutions to Postmaster Hesing. The leaders claimed that the project was an invention of the enemy and that it was a part of the plan of the companies to provide against future strikes on their lines. It is to be hoped that the postoffice department will place a proper estimate upon the value of the resolutions and consign them to the waste basket. Aside from the labor agitators the people of Chicago are in favor of the plan. Business men particularly want improved local service, and, as the *Tribune* points out editorially, all that Postmaster Hesing can do to expedite the delivery of drop letters will be accepted gratefully by the citizens of Chicago. At present, owing to causes for which he cannot be held responsible, it takes altogether too long a time to send a letter from one part of the city to another and to get a reply. If it were not for telephones and other means of private communication, people living in Lake View and Hyde Park would be almost as far apart as if they lived 200 miles from one another. The department has not shown until of late any disposition to deal justly with Chicago, and even now the city office has not the force it ought to have. Deficiencies for which the Washington authorities are to blame will be made good to some extent when the street car lines are utilized for mail purposes in accordance with the plan Mr. Hesing is working out. He may be able by means of it to get things down to a point where a person can mail a city letter in the morning and get a reply to it the same day. Then the postal service will become popular and there will be few complaints where there are many now.

How cheering it is in these days of wrangling and dispute over old inventions to encounter a brand-new departure in the electrical field, and that, too, one that is sure to remain to the uncontested credit of the original inventor. We do not know the name of the genius who has made the strange discovery in dynamo construction of which we shall presently speak, but the news comes from the rock-bound hills of New Hampshire, and it is fair to assume, therefore, that Yankee ingenuity has scored another triumph and added a greater name to the proud roll of New England benefactors of industry, already honored by a Howe and a Whitney, a Franklin and a Morse.

The news comes through the columns of the *Union* of Manchester, N. H., and was published on the 11th of January, 1895. It is well to be exact in noting these details, for, although no one is apt to attempt to snatch the laurel from the brow of the bold innovator, the future historian of electrical development may be very grateful for the thoughtfulness that preserved the data in the files of the technical press. It is curious to note, also, that the announcement was not heralded as of the greatest importance, as one would suppose, but is tucked away among other news items from Lancaster—whether the Lancaster of Coos county, New Hampshire, or the Lancaster of Worcester county, Massachusetts, is not stated, but probably the former. Undoubtedly, then, this is an instance of modest genius, shrinking from public gaze, but discovered by the shrewd correspondent of the *Union*. The newspaper man, too, with consummate art, so words his announcement as to make the news of the great invention come as a climax of what would otherwise be a very commonplace statement. "Another dynamo is to be added to the electric light plant," he begins. Nothing very remarkable about that, but observe how the wonders follow thick and fast: "It is to be of the latest improved specimen, and will have a capacity of 14,000,000 volts per second. It has been constructed especially for volts, instead of the common kind of electricity."

That this is a startling novelty in dynamo construction will be conceded by all electricians. There may be some who will doubt the authenticity of this news, and we beg to invite the incredulous to inspect the clipping from the *Union*, which we have reverently placed on file in this office. We do not intend to discuss the far-reaching importance of this currentless dynamo. We are still marveling at the mere fact of its invention. We observe that the amperes are eliminated, probably by some device resembling the ingenious ohm sifter that excited so much discussion a year or so ago, but the volts have been well taken care of. At the rate of 14,000,000 per second, how they would mount up in a year, ten years, of running! The mind is bewildered at the thought.

## The Brooklyn Strike.

Reviewing the strike on the trolley roads of Brooklyn, "Matthew Marshall," the financial writer of the *Sun*, says:

The strike at Brooklyn, with the rioting and violence which have accompanied it, has become nothing but an outbreak of lawlessness which will in due time be put down, as so many other outbreaks of the same kind have heretofore been put down, by the strong hand of the constituted authorities. In this respect there can be, among right-thinking people, but one opinion of it. Whatever may have been the grievances of the strikers, and however unjustly they may have been treated, society cannot, consistently with its own self-preservation, permit them and their allies to redress those grievances and secure justice by the means to which they have resorted. The progress of civilization for the last thousand years has been in the direction of taking away from individuals the forcible righting of their wrongs and vesting it in courts and in legislatures. In these closing years of nineteenth century a reversion to the methods of the dark ages is unendurable.

That this strike, therefore, like the many similar strikes which have within the past twenty years preceded it, cannot, as at present conducted, succeed, is a foregone conclusion. It has taken on the shape of a rebellion, and a rebellion to be justified must become a revolution. Unless the Brooklyn rioters are prepared to overthrow the government that exists and set up in its place one of their own, they must themselves be subdued and punished. It is a plain case for the application of the principle: "All they that take the sword shall perish with the sword." Men who assault their competitors and destroy the property of their former employers are not to be exempt from the treatment of malefactors merely because their number is great and they have the semblance of an organization. They must either conquer society or be conquered by it, and as society outnumbers them by a hundred to one, it is pretty sure of ultimate victory.

It is remarkable how blind to this truth so many otherwise enlightened and intelligent people are. Instead of an unanimous condemnation of the breaches of the peace and of the destruction of property which usually accompany strikes of this magnitude, we find a divided public opinion, with a numerous party favoring the lawbreakers. Thus, the mayor of Brooklyn has openly avowed his sympathy with the men whom it is his duty to treat as criminals; the police have fraternized with them; residents along the line of the railroads have aided and abetted them in destroying cars, beating motormen, obstructing tracks and cutting trolley wires; shop-keepers have refused to sell supplies to the soldiers called out to preserve order; newspapers have espoused the cause of the rioters, and villified their victims; and lawyers and judges have been found to use the machinery of the law to render them assistance. It is as though a man's neighbors should applaud and aid the incendiaries setting fire to his house, and should obstruct the firemen in their efforts to extinguish the flames, in disregard of the obvious fact that their own houses may be the next objects of attack. For, if one set of men are allowed to extort money from other men as the price of immunity from injury, another set may do the same, and the country would soon be overrun with bands of tramps living by pillage and ransom. A peaceable strike often comes very close to extortion by threat and intimidation, but a riotous strike is intolerable.

The explanation of this aberration of judgment lies doubtless in the fact that a vast number of men are governed in their conduct more by feeling than by cool reason, and consider immediate results rather than remote consequences. So many of them, too, are earners of wages themselves that their sympathies are with those in the same situation, and the payers of wages being in the minority, the preponderance of opinion is against them. The disparity is still greater between the employers of large numbers of laborers and the rest of their fellow-citizens. They are but a handful compared to a multitude. The men capable of directing profitably the exertions of other men are as few in number as are the generals capable of commanding an army, and nothing but stern necessity compels submission to them. Then, too, the amount of wages paid to each worker is so small, relatively, to the profits of his employer that it seems indequate and the refusal to increase it a trifle appears unreasonable. It is forgotten that a sum small itself is great when multiplied a thousandfold, and that an increase of a few cents in the daily wages of each of a multitude of employes comes at the end of the year to a very large amount. If the 6,000 Brooklyn railroad employes, for example, should be paid only 25 cents a day more than their present wages, they would in the aggregate receive in the course of 365 days an increase of $547,500. What the total increase would be if all other wage-earners obtained a corresponding addition to their present pay it is easy to imagine. The dispute in Brooklyn does not, therefore, involve a few cents, but hundreds of thousands of dollars, and those who censure the employers for not granting the strikers' demands have not sufficiently considered the matter.

Nevertheless this predilection of the public in favor of strikers, and its disposition to look kindly upon even their lawless efforts to gain an advantage over their employers, must be accepted as a fact and dealt with as such. Wise met treat other men as being not what they would like to have them be, but what they are; and since an ounce of prevention is better than a pound of cure, the prevention of riotous strikes, if it could be accomplished, would be better than their suppression by the police and militia. Thus far, as the Brooklyn strike and the other great strikes which have recently preceded it abundantly prove, no method of such prevention has been discovered. Compulsory arbitration has been urged for the purpose; but if the submission to arbitration is to be compelled, and the award of the arbitrators is to be enforced, it amounts to a government regulation of wages, the next step after which is the assumption by the government of the management of all great industries.

Everything indicates that under the pressure of the discontent which is an ineradicable element of human nature, civilized society is gradually shaping itself into a system in which private affairs will be much more regulated by law than they are now, and that the outcome eventually will be what is called state socialism. The sympathy of the public with the Brooklyn strikers, and its impatience with the inconvenience caused by the refusal of their employers to yield to them is one proof of this tendency. * * * Then, too, we have laws fixing the hours of labor, and the age at which young people of both sexes may be employed in factories, laws regulating the construction, ventilation and sanitary arrangements of the factories themselves, and laws for the inspection of food and drink. We are, therefore, already arrived at a point from which further steps in the direction already taken will soon land us where the government will make rules for every affair of life, and the citizen will not only not be permitted to do wrong, but also not to do right, excepting in a prescribed manner.

This is the goal toward which those who clamor for goverement interference in settling strike disputes, and for more stringency in the regulation of tenement houses, of factories, and of the liquor traffic, are driving society. To the same goal leads the policy of constructing railroads at the public expense, of which our own municipal rapid transit scheme is a conspicuous example. Fortunately, we can travel toward it no faster and no farther than suits the majority of our citizens, and it is possible that some day experience may induce them to halt and turn the opposite way. Meanwhile it is comforting to see in Brooklyn, as we saw in Chicago, that in spite of the prevalent fondness for raising wages at the expense of employers, a great deal in still left of individual liberty, and that men who are willing to work for the wages offered them cannot always be prevented by force from doing so.

## Echoes of the Brooklyn Strike.

At their meeting on Monday evening the Brooklyn aldermen adopted resolutions demanding the revocation of the franchises of the three objectionable trolley railroad companies of that city. The vote was 10 for and 8 against, the president of the board voting against the resolutions. There was a big demonstration of strikers in the vicinity of the city hall while the aldermanic action was being taken. From 8,000 to 10,000 people participated, but it was a well-ordered crowd, and shortly after the strikers' representatives had gone into the hall with the manifesto the gathering broke up gradually and peaceably.

In regard to the resolution passed by the aldermen, Mayor Schieren said: "When this resolution comes before me Wednesday next in the regular way I will have something to say about it. I decline to say in advance what I shall do."

President Benjamin Norton of the Atlantic Avenue Railway company was arraigned before United States Commissioner Morle in Brooklyn on the 4th instant, charged with the violation of a United States statute in displaying United States mail signs on trolley cars that were not carrying mail. United States District Attorney Bennett appeared for the prosecution. Ex-Judge Morris, counsel for Mr. Norton, contended that the agreement of the company with the United States government provided that they must be ready to carry mail on all trains or cars, and that while perhaps there might have been cars without mail actually on them, the cars when the sign was put on had been engaged in carrying mail.

The strikers have issued a manifesto asking the public to take note of the orderly manner in which they conducted themselves at the city hall, and denouncing the police for keeping them from assembling in the public square.

Judge Gaynor has handed down a decision on the application for a writ of mandamus against the Atlantic Avenue company. The application was made by James O'Connell, a mineral water bottler, who claims to have suffered great financial loss because the company has not operated its cars. Judge Gaynor allows the company twenty days in which to make answer before a judge and jury. The decision follows closely the lines of Judge Gaynor's rulings in the previous application for mandamus.

An Albany dispatch states that the hearing on the application in behalf of the Brooklyn trolley strikers to annul the charter of the Brooklyn Heights company because of its failure to operate its line was resumed before Attorney-general Hancock to-day. A decision is not expected for several days.

## Grievances of the Boston Street Car Men.

The West End Street Railway company of Boston will be requested to give the representatives of the conductors, drivers and motormen another conference. The articles of agreement fixing the rate of wages and hours of labor, as proposed by President Little and General Manager Sergeant, are not satisfactory to the members of the Conductors', Drivers' and Motormen's Union. The employes of the road ask for an advance of wages over the 1894 rate of 25 cents a day, and for a reduction in their hours of labor.

A barrel containing steel castings, but which had formerly contained alcohol, exploded at the Westinghouse works at Brinton, Pa., on February 2d. John Dugan was killed instantly, and Michael Purdy and George Long are thought to be fatally hurt.

## Interior Department Telephone System.

In the telephone field the event of the year was the awarding last week of the United States government contract for supplying telephones in the public buildings at Washington, D. C., to take the place of the Bell telephones heretofore in use there.

An effort had been made to obtain a reduction in rentals by the government, and the effort being unsuccessful, the secretary of the interior advertised for proposals under specifications for supplying the necessary telephone exchange switchboards, instruments and lines.

Considerable rivalry ensued, and the various telephone companies put forth their best efforts to obtain the business. A special expert committee was appointed by the secretary of the interior to examine into and make trial in actual practice of the apparatus submitted by the bidders.

These tests had been going on for some months and were somewhat exhaustive in their determinations. The contract was awarded to the Western Telephone Construction company for 115 telephones and three switchboards. The telephones are to be of the No. 1 dynamic type (magneto form), and the switchboards of the latest improved No. 1 type of that company.

It is said that the result of these tests showed a remarkable average of superiority for the Western Telephone Construction company's instruments, and the fact that the contract was awarded to that company at almost double the price for the apparatus offered by the next highest bidder is something to be proud of and reflects great credit upon the successful bidder.

The instruments will connect the secretaries' offices and chiefs of bureaus and chiefs of divisions with one another.

The main switchboard will be located in the Patent Office building, and the wires will extend to the Pension Office building, Bureau of Education and other buildings.

## Electrical Machinery in Coal Mines.

This journal has always taken a very active interest in everything that appertains to the use and application of electricity in mining, recognizing as it does that there is a great opportunity for the introduction of this agent of light, heat and power in a large variety of avenues, says *Black Diamond*. It commends itself upon many grounds, and there can be no dispute but that its adaptation under favorable conditions is time saving, labor saving and money saving, and a most economical investment. Many mines are practically electrically equipped. They have the whole mining, handling and to a certain extent transportation of their product from the mine to the cars conducted by electric power. In fact, electric machine mining is rapidly superseding manual labor, and one of the strong factors which commends its adoption and use is the fact that the machine is not liable to strike or indulge in violence. Practically every strike in the coal regions results in turning the drift of the thoughts of the coal operator very strongly in the direction of the use of mining machines to be run by electricity or compressed air, and the electric factor is therefore becoming a very important agent. We know that the owners and operators of the miners in the Massillon field are reported to be seriously considering the introduction of electric plants at their mines. Those working the thick vein mines are receiving propositions from the manufacturers of machine devices of a most favorable character, and on a basis which may result in developing a large amount of business along this line. Hand labor is rapidly giving place to machine methods, with the result that the output capacity of a large number of shafts is very much increased, and that the consequent average cost per ton for working expense and general cost of management is correspondingly decreased. Machine-cut coal, too, is much cleaner and can stand a journey better than that which has been mined with powder. It has not so great a tendency to become friable and it comes to market in a much better condition. The initial cost of the machine plant may appear to be an important point in its adoption, but it is a self-paying investment and rapidly recoups to the investor what outlay has been incurred in putting it in. Where machine methods have been introduced in mining coal they have been universally successful and have achieved results which have justified their adoption wherever the size of the vein and the extent of the mine are sufficient to warrant the initial cost. We might make an animadversion here to the interest and discussion which is going on in connection with the development of electricity direct from coal. It appears that a number of scientists are greatly agitated over the possibility of transmitting energy from the pit's mouth by force of wire to points where coal is distributed. It is said that the loss of coal occasioned by the transmission of electricity by wire for 100 miles is only 25 per cent., so that the purchaser of a ton of coal at the end of the 100 miles would practically receive the value of three-fourths of a ton for every ton consumed at the mines. We give this suggestion but very little credence, and doubt whether electricity will be developed on a basis that will enable its consumption in this manner. Even if it did, the loss on one hand and the cost and expense entailed in developing light and heat and power upon this basis, on the other hand, would be too great to permit of its competition with the present system of coal business. It is also questionable whether the average engine does not obtain a much greater percentage of steam power than it is credited with in running a plant. Thus it does not appear that after all, even if this idea, which is somewhat of a Gulliver nature, were possible, there will be much economy in its adoption. The fact of the matter is that coal has got its market; it has got its natural uses; and despite the adoption of oil and gas and other factors it will hold its trade

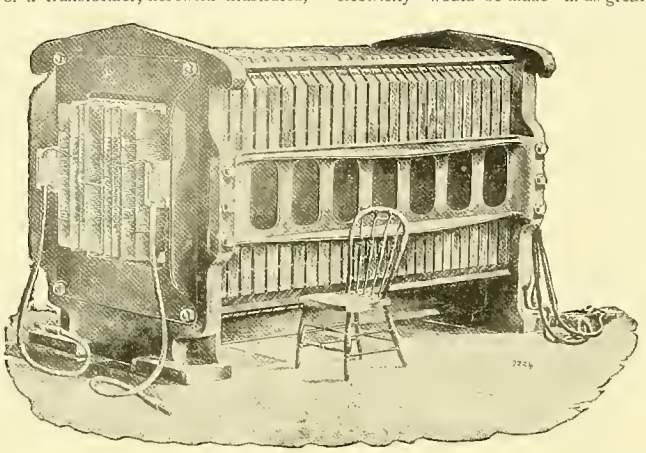
In this association, too, the appearance of machinery upon the field as a factor of labor in mines and as an economical agent becomes of still greater utility, and it may be said that mechanical method is becoming more and more the handmaiden of the coal industry.

## Air Blast Transformers.

In every city and in many of the large towns there are certain localities where a very large number of lights are used within a comparatively limited area. Such districts can be efficiently and successfully operated from a transformer sub-station within a building at or near the local center of distribution, the current being carried from the sub-station to the consumers over three-wire secondary mains. Outlying groups of lights also can be operated in this way to great advantage by large transformers connected to the central station by high tension feeders. One of the principal advantages of such methods is that it admits of large transformers, and they are essentially more efficient than smaller ones.

The principal difficulty met with in transformer work is the matter of temperature. All large transformers to be efficient and economical must be provided with artificial means of cooling.

Many methods have been from time to time proposed for the artificial cooling of large transformers; such, for example, as the circulation of oil through the transformer and a cooling tank, or the passage of water or other cooling fluid through pipes within the transformer. The General Electric company has devised a simple and efficient air blast system, which consists of a transformer, herewith illustrated,



AIR BLAST TRANSFORMERS.

having numerous air ducts through which cool air is constantly forced by means of a blower, the temperature being sufficiently reduced by radiation from the walls of the ducts. This system is practically the same as that by which all large dynamos are kept cool, differing only in that in the dynamo there is a rotating armature to create the necessary draft, while in the transformer a separate fan has to be used.

By means of the air blast the rise in temperature may be readily kept below 60 degrees Centigrade, or even lower if required, the 200 kilowatt transformers recently manufactured for the Cataract Construction company having a maximum rise of but 35 degrees Centigrade.

The power required to supply the necessary air blast of course varies with the transformer capacity installed, and also with the distance that it is necessary to convey the air from the blower to the transformer. Under ordinary conditions, however, it will not exceed one-half of one per cent. of the total capacity of the transformers cooled, and in large sub-stations it may generally be reduced to one-fourth of one per cent.

A simple method of installing one or more large sub-station transformers is to place them over a duct beneath the floor, having suitable openings beneath each transformer for the air blast, which is maintained in the duct by means of a blower driven from any convenient source of power, the duct at the same time serving as a convenient place to locate all wires coming to the transformers. The air passes through the duct upward through the transformer, and may either escape into the surrounding room or may be led away through other ducts, as may be found most convenient.

Transformers of the air blast type are built in the following standard sizes: Forty, 65, 75, 100, 150 kilowatts. Special transformers of intermediate or larger sizes can, however, be furnished almost as promptly as standard apparatus.

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The Postal Telegraph company is keeping pace with the development of the South by extending its lines as rapidly as possible in that section. It is now making arrangements to run a line into Knoxville and East Tennessee, and J. W. Kates, superintendent of the Southern division, has charge of the matter.

## Utilization of Culm.

A Wilkesbarre, Pa., correspondent of the *New York Tribune* writes as follows: The chief question of interest to coal operators and people in general in the coal regions at present is the proposed utilization of the hundreds and hundreds of culmbanks scattered throughout the coal territory. The scheme is an elaborate one; its practicability is open to considerable doubt in the minds of many. It is the use of the culm to produce electricity, which is to be transmitted to the large cities. Local capitalists and electricians and capitalists and electricians from other places are greatly interested in the scheme, and it is expected that sufficient money will be invested at least to test it.

If the plan is successful it will make a great deal of money for those interested. It is proposed to generate electricity in the coal regions, using the culm as fuel, and transmit it to New York, Philadelphia and other large cities by wire, there to be used for light, power or heating purposes.

The supply of culm is so great as to be almost beyond estimate. At every mine that has been in operation for a year or more, great heaps of coal refuse, rising as high, sometimes, as a four or five-story house, cover the ground for great distances, while at mines which have been in operation for twenty years or so, or at others which have long since been abandoned, the great heaps of culm cover acres and acres. There are millions and millions of tons of this culm in this village alone, and as it is nearly all close to railroad tracks it could be at little cost transported to the proposed plant.

This plant, according to the plan which has yet advanced no further than an outline in the minds of progressive capitalists and electricians, would be located near this city, in some place central to all the mines and close to one of the several great heaps of culm which are near and in some places within the city limits. Great furnaces would be erected, generators built, and, as the electricians say, electricity "would be made" in as great amount as desired.

The Wilkesbarre plant would be the central plant, and branch plants would be built in the Hazleton region near Pittston, at Freeland, near Harleigh and others in the region of Pottsville, with perhaps one or two in Lackawanna county. The company would use electricity to transport the culm from the banks in the vicinity of the plants and thus dispense with costly steam power.

Culm has been used in this region in some manufactories; and on the Delaware, Lackawanna and Western, the Lehigh Valley and the Jersey Central railroads special engines have been constructed to use the culm as fuel. They are called "dirt-burners," and a good many of them are in use on the mountain divisions. They are very powerful, and are of great service in taking freight and coal up the heavy grades. No trouble is experienced in burning the culm, as special grates have been invented for the purpose; a heavy draught is the chief requisite, and with this and the special grate the engines consume coal dust or culm in great quantities. As a steam producer the culm has given great satisfaction, and there is no doubt that it would be quite as successful a producer of electricity generating power as it is on the engines. Then, too, an improved grate is spoken of, and with the latest improvements it is expected to get a greater quantity of power out of a given amount of culm than is produced in the latest engines.

The cost of the culm will be very small; in fact it is now given away, and as in the majority of cases, valuable land will be recovered by the removal of the culm, the mine-owners will want but little, or perhaps nothing, for its use. It is estimated that the cost of culm per year, taking everything into consideration, will not exceed $3 per horse power, and as on another rough estimate it is calculated that the electricity can be sold on the average at $7 per horse power a year, it is easy to be seen that the enormous profits would make the investment a paying one. A ready sale could be found in all the big cities for a great amount of electric power, and though the original capital of the plant would of necessity be great, there could be found plenty of capitalists ready to place amounts aggregating several million dollars, with the prospect of the great percentage of profit that at present seems possible.

There are many large cities within easy communication of Wilkesbarre, the proposed center of the new plan, and the branch cities, and the power could be conveyed to them and distributed at a comparatively moderate expense. The wires and poles would be the chief item of expense, but New York is only 167 miles from here by railroad, and Philadelphia about 150; then there are Newark, Jersey City, Paterson, Trenton, Easton, Allentown, Reading, Bethlehem and a score of other cities of considerable size, to which the electricity could be supplied at a much lower cost than it is at present. As the wires could be run over the mountains, the distance as now known by railroad to these cities could be greatly reduced.

As compared with the estimated price to be paid per horse power for the Niagara Falls electricity, it is $8, or more than one-half less. A comparison of the two schemes greatly favors the "coal-dirt" plan.

If the culm scheme is ever carried out in the erection of a plant and the transmission of power to the large cities, the probabilities are that an electric road will be built from this city to New York and Philadelphia for rapid passenger transit, with a possibility of its being extended westward to Chicago, as a direct line. Wilkesbarre, fortunately, would be on a straight line drawn from New York to Chicago. This, however, is spoken of only as a possibility.

Apropos of the culm banks, an absurd story was recently circulated that legal action was about to be begun by an organization of miners to get possession of the culm banks on the ground that the miner is supposed to be paid for all he sends up from the workings, and that a great deal of the culm consists of refuse in the car, for which he is "docked" a certain amount. While the miners, perhaps, have a right to a certain portion of it, not all the lawyers and all the judges in the world could determine what proportion belonged to the miner and what to the operator, or how much to each miner. The only practicable scheme would be to apply all that is realized from the sale of the culm to the establishment of a miners' relief fund, or some measure of like nature for the benefit of the miners.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, February 2.—The week has witnessed the final ending of the Brooklyn strike. By Thursday all of the trolley lines which were closed by the strike were in operation on schedule time. All of the companies claim to have the necessary men to run all the cars which are in condition, and as soon as the necessary repairs have been made to the cars damaged by the mobs they will be put on the lines. The troops have been relieved from duty. The police, too, have been sent to their regular posts. The strike has left a legacy of considerable litigation. The strikers have made a new move in the legal war on the companies by invoking the aid of the federal authorities. Mirabeau L. Towns, representing District Assembly 75 (Knights of Labor) visited United States District-Attorney Bennett at his office in the federal building and made complaint against President Norton and Superintendent Quinn of the Atlantic Avenue company. They accused them of violating the United States law in placing United States mail signs on cars not actually used in carrying the mails.

At the annual meeting of the stockholders of the Edison Electric Illuminating company of Brooklyn the following named directors were elected for the ensuing year: Frank L. Babbott, E. LeGrand Beers, Charles E. Crowell, Ethan Allen Doty, Julian D. Fairchild, C. N. Hoagland, Darwin R. James, J. G. Jenkins, Martin Joost, Lowell M. Palmer, Edwin Packard, George Foster Peabody and George H. Southard. The inspectors of election elected were S. O. Burnett and W. W. Freeman. The election was unanimous, 23,397 shares voting out of a total of 28,423.

On Tuesday the board of experts appointed by the rapid transit commissioners, composed of Abram S. Hewitt, O. Chanute, Thomas C. Clarke, Wm. H. Burr and Charles Sooysmith, submitted its report to the commission. The board thinks it wise to suggest modifications of the commissioners' plans by which the cost will be brought within the $50,000,000 limit fixed by law. The main ideas of the experts are summarized in the following condensation of their report:

Briefly stated, the law which has been approved by the people of the city of New York provides:

That the first duty of the commission is to adopt plans which will secure rapid transit, by which is plainly intended transit in the limits of New York at as high a rate of speed as now ordinarily exists upon the railroads of the country outside of the city limits. If slower transit shall be provided, it must be only as incidental to the main requirements of rapid transit of at least twenty-five miles per hour, including stops, and a higher rate of speed, if practicable.

It is further provided that the plans adopted, whatever they may be, shall not involve an expenditure on the part of the city of New York of more than $50,000,000.

The board of experts has concluded to recommend the substitution of the Fourth avenue, Lafayette place and Elm street line for the Broadway line from Fourteenth street to City Hall Park. The reasons which have led them to this conclusion are as follows:

First—The cost of the structure will be reduced by the sum of $3,700,000 below the estimated cost of the line on Broadway, between Fourteenth street and the City Hall.

Second—The location on Broadway and consequent crowds at the stations would increase the congestion of travel which exists in that thoroughfare, and which should not be aggravated.

Third—The adoption of this route relieves Broadway, from Union Square to the City Hall, from the serious interruption of business which the construction of the tunnel routes through that thoroughfare would involve.

The board of experts recommends that above Fourteenth street the two express tracks be carried along Broadway in a tunnel in the rock, so as to avoid disturbing the surface of the street between Sixteenth and Twenty-fifth streets, and that four tracks be constructed along Fourth avenue to Twenty-third street, and thence two tracks for local service through Twenty-third street and under Madison Square to Twenty-fifth street, above which point the regular four

track system, as previously described, would be resumed on Broadway.

For the East Side line the board recommends the construction from Twenty-third street of four tracks under Foorth aveone to Forty-secood street, and thence under the Grand Central station, with two tracks, to Ninety-seventh street, and thence by a two-track elevated structure to Mott Haven, a point where the existing lines of travel may be easily made to converge.

In addition to this route, the board of experts recommends that two tracks shall be constructed in tunnel under Forty-second street, or one of the adjacent streets, to a connection with the West Side route heretofore recommended on Broadway, thus affording an independent as well as a connecting rapid transit route for through trains between the West and East Side lines. In time this tunnel may be extended west so as to coonect with the tracks of the New York Central railroad, now existing along the river front.

The cost of the line thus recommended above Twenty-third street on the East Side, including the Forty-second street line as far west as Broadway, will be $12,025,166, thus effecting a saving of about $10,000,000 on the estimated cost of the East Side line as proposed by the chief engineer.

The total cost of the lines herein recommended, including an allowance of 10 per cent. for terminals and side tracks, will amount to $42,063,721, in lieu of the sum of $56,870,000, cost above estimated.

The process of construction will necessarily be slow, at the best, and many unforeseen impediments, legal and accidental, may be expected to interfere with the early completion of an undertaking of such great magnitude and difficulty. Moreover, unless a responsible bidder shall be found for the franchise and cootract, the undertaking must, by the terms of the act, necessarily be abandoned. Construction by the city itself is not contemplated by the act.

The conclusions at which the board of experts have arrived may therefore be briefly summed up as follows:

First—That the provisional line approved by the Rapid Transit Commission may be regarded as impracticable, because its total cost will exceed the limit of $50,000,000 imposed by the Rapid Transit act.

Second—That the route and plan of construction may be so modified, however, as to bring the cost within the limits of the act, as will appear in the table hereto annexed, and still provide for a rapid transit route independent of any existing system, both upon the West Side and upon the East Side, coming together at Union Square and running thence by a trunk line through Elm street to the City Hall Park, and thence by Broadway to the South Ferry upon the line heretofore approved by the commission.

Third—That the cost of construction can be largely reduced if an arrangement can be made with the New York Central Railroad company for the construction of the East Side line above Fourteenth street. But if no such arrangement can be made, it will be perfectly practicable to construct the line as an independent route without interfering in aoy way with the tracks now occupied and being constructed by the railroad company.

Fourth—That the present condition and growth of business in this city require that all possible routes which may be made to afford rapid transit movement should be utilized, and with that view the Manhattan system, the New York Central railroad system and the New York & New Haven railroad system should all, as far as possible, be required to enlarge the means of transportation for passengers as well as for freight, so that the congestion which now seriously interferes with the growth of business and the value of property shall be reduced to a minimum.

Fifth—Wherever practicable the use of viaducts, adapted for high-speed trains, instead of subways, is recommended.

Sixth—It is recommended to use a form of construction for subways and viaducts that will allow of the construction at first of two tracks only where desirable, because trains composed of cars equipped with electric motors can be run at a speed of seventeen miles per hour with stations 1,500 feet apart, or at a speed of twenty-five miles per hour with stations half a mile apart, and with this kind of motor trains containing more than five cars can be run at the maximum speed, thus making the traffic capacity of the two tracks with electric traction very much greater than that of the present elevated roads with steam power.

Seventh—The following described route and number of tracks for present construction are recommended:

Two-track subway from South Ferry to City Hall Park, under Broadway, with loops at Battery and City Hall parks.

Four-track subway from City Hall Park, under Elm street and Lafayette place to Fourteenth street.

Two-track subway in rock tunnel under Broadway from Fourteenth street to Twenty-fifth street, for express trains, to be built without breaking surface of Broadway.

Four-track subway under Fourth avenue, from Fourteenth street to Twenty-third street, and two-track subway under Twenty-third street to Broadway for the local trains, joining the express subway at Twenty-fifth street.

Four-track subway under Broadway, from Twenty-fifth street to Ninety-second street, to be constructed on different levels at least as far as Thirty-fourth street.

Four-track structure, mainly viaduct (with subway under Morningside Plateau), along the boulevard and Eleventh avenue, from Ninety-second street to One Hundred and Eighty-fifth street.

Four-track subway under Fourth avenue, from Twenty-third street to the Grand Central station.

Two-track subway under Fourth avenue, from Grand Central station to Ninety-seventh street.

Two-track viaduct along Fourth avenue, from Ninety-seventh street, thence crossing the Harlem river to Mott Haven.

The length and cost of viaduct and subways are as follows:

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|---|---|
| Length of subways | 13.91 miles |
| Length of viaducts | 4 97 miles |
| Total length | 18.88 miles |
| Cost | $42,063,721 |

These figures are based upon the estimates of the chief engineer of the Rapid Transit Commission, heretofore approved as reliable, and include the construction of the railway and stations, reconstruction of sewers, restoration of the street surface, interest on cost during construction, with an allowance for contingencies and an allowance of 10 per cent. for shops, storage tracks, terminal yards, etc., but no allowance for the expenses of administration and engineering, which, by the act, are not a charge upon the fund. No account has been taken of the cost of property, property rights or damages to abutting property, but the difference between the estimate of the cost of the modified lines and the fund contemplated by the act ought to be sufficient to cover such expenditures.

A new corporation, known as the People's Traction company of the City of New York, to introduce lines of railroad in the annexed district, has filled its certificate of incorporation with the secretary of state at Albany, and proposes the establishment of routes covering a total distance of twenty-one and one-half miles of double track railroad. The capital of the new company is set down as $1,500,000, in $100 shares. The directors are Franklin A. Wilcox, Edward H. Hobbs, John A. Bensel, Martin J. Keogh, Daniel F. Cohalan, Charles B. Hobbs, John Foley, Jr., Edward Hassett and J. Clarence Davies. The new company will form a rival to the Huckleberry road, in which Senator Edward Murphy, Jr., and Richard Croker are so deeply interested. Mr. Wilcox said that he hoped to form such connections that passengers could be carried anywhere between the Bronx river and the Battery for a single fare. W. F. O.

## New England News.

BOSTON, February 1.—This summer will see the trains on two of the branch lines of the New York, New Haven & Hartford railroad run by electricity. This will be the first attempt in New England to use electricity as the motive power on any of the steam railroads, and if the experiment of the New York, New Haven & Hartford is a success there is every reason to believe that the other roads which thread New England will adopt electricity on some of their lines. Further, it is stated that the officials of the road will similarly equip other of the many branch lines if the experiment comes up to expectations. The Nantasket Beach and the Warren & Bristol branches are the two lines on which the company proposes to place motors this summer. The most important move in the changing to electricity, however, relates to the latter branch. Here it is proposed to start the line from the new station in Providence, R. I., and carry it to Watuppa station in Fall River, Mass., where a mile of new track will have to be built—a total distance of 21 miles. From Fall River the line will be extended to New Bedford, 14 miles, to the wharf, and later to other points, in all probability. From Warren the line will be run down to Bristol, four miles. The current for these lines will be supplied from two power houses—one located at Warren, which will run the cars from Providence to Fall River, including the Bristol branch, and the other at Westport Factory, on the New Bedford line. Both open and closed cars will be used on this line, which is 35 miles in length, and which, when completed, will be the most important thoroughly equipped electric road in the country. The Nantasket Beach branch, while not covering so great a distance as the first named, is nevertheless one of the most important of the summer lines operated by the New York, New Haven & Hartford railroad. The line, which is at present operated by steam, begins at Pemberton, Hull, and extends along the line of the seashore to Nantasket Beach, where it branches off and runs to the Old Colony House junction, where it connects with the main line, the distance being eight miles. It is the present intention to build a spur to Downer Landing, another summer resort, two miles distant, but now off the line of any railroad, and connect it with the Nantasket Beach branch. A splendid territory of seashore property would thus be opened up. The New York, New Haven & Hartford company believes the time has arrived when all the railroads throughout the United States having small branches in outlying districts should be turning their attention to electrical equipment if they desire to maintain their present patronage. This company has felt the effects of electrical competition on several of its branches and is willing to acknowledge that a formidable competitor has arisen which must be met by stubborn and active effort.

One of the most important moves in the line of electric railroad extension in New England is that contemplated by the incorporation of the Merrimac Valley and St. Lawrence railroad. A bill to incorporate this road has been drafted and is to be introduced shortly in the New Hampshire Legislature. It provides for the construction of an electric railroad from the state line, connecting with the Lowell, Lawrence & Haverhill system through Nashua and Manchester, N. H., and on up the Merrimac valley. The way electric railroads have been building in this section of New England during the last few years would lead to the belief that at no very distant day hundreds of miles of territory will be in direct connection through the medium of the trolley. Already the big mill towns and cities on the borders of the Merrimac river are brought in much closer touch than heretofore by this means, and the business and social life of this locality has been materially quickened. The electric railroads have made it possible to launch new enterprises, which would have been impracticable if there were no such connection between the different communities. Within a few weeks, for instance, a New England Base Ball League has been organized and franchises secured in several of the cities, including Lowell, Lawrence and Haverhill, where it is proposed to establish clubs. In former years the expense of transportation has had an unfortunate effect on the success of base ball enterprises. The promoters of this league, however, have taken advantage of a circuit where the connecting links of electric railroads will make transportation a very small item in the expense of running clubs. J. C. E.

## Milwaukee Notes.

MILWAUKEE, February 1.—State Senator William H. Austin of this city has introduced a bill in the Legislature to tax the gross earnings of the street railway companies instead of their real estate, rolling stock and other property. The bill, of course, provides that the taxes shall be paid into the treasuries of the municipalities from which the railway companies get their franchises. If the lines run through two municipahties, the taxes shall be divided between them in proportion to the miles of track within the limits of each. It is provided that on all gross earnings that exceed $350,000 the tax shall be 3 per cent.; between $350,000 and $250.000, 2½ per cent., and below $250,000, 2 per cent. The reason that the bill provides for a graded scale of taxation is that the author of the measure, according to his own account, does not wish to cripple the small companies. "The only way that you can fix the value of a street railway," he states, "is by its earning power. One year the franchise may earn lots of money and the next year it may lose a little. You do justice to the companies by taxing their gross earnings." Senator Austin, by the way, is held to be not very friendly to the Milwaukee Street Railway company. He originated the agitation that resulted in the increase of the company's assessment by the sum of about $2,000,000.

Another electric interest that is threatened with adverse legislation is the Wisconsin Telephone company. There is talk of a bill to increase still further the tax which that company pays to the state. Manager McLeod, when his attention was called to the report about a new tax bill, said that the telephone business was not so profitable as many people supposed; in fact, the company had been able to pay a dividend of only 6 per cent. on its last year's business. The company, besides, was threatened with serious competition. It had been reported that the Wisconsin company had withdrawn from Escanaba, Mich., but Mr. McLeod said that the trouble at Escanaba concerned the Michigan company alone. He said that the Michigan company was having the same trouble in its territory that the Wisconsin company was having in its field. He stated that there are now four companies engaged taking subscription lists in the cities of Racine, Sheboygan, Oshkosh, Neenah, Menasha, Chippewa Falls and Waukesha, with a view of asking for franchises as soon as they have sufficient business guaranteed. The companies in question are the Harrison International Telephone company, the Northwestern Telephone Construction company, the National Telephone company and another company whose name Mr. McLeod cannot remember. When asked about the liklihood of a general competition, Manager McLeod said that in small towns that can be served with a purely local service, his company was sure to have a very powerful competition. In Neenah and Menasha two companies, the Northwestern and a company of local capitalists, were both seeking business, each making propositions to construct lines as soon as sufficient business was guaranteed. He did not understand, he said, that the Berliner patents had been cancelled by the Carpenter decision, the case having been appealed; but aside from the patent question, he thought that the old line companies might expect a very busy time in maintaining their business, especially in the smaller cities.

It is now six months since Alderman Pawinski introduced his ordinance to compel the street railway company to reduce the fare from 5 to 4 cents during certain hours of the morning and evening, the idea of the measure being to provide low fares for the workingmen, but the measure is still in the hands of the common council committee on railroads, in whose box it has been slumbering all this time. At the last meeting of the council an attempt was made to have it recalled from the railroad committee and referred to a special committee of five aldermen, but it was explained that there had been a reason why no action could be taken sooner, and that the committee would proceed to consider the measure and report to the council as soon as possible. It is claimed for the measure that the company, since it abolished the sale of 25 tickets for $1 last spring, has been having very much heavier receipts, and it is expected,

of course, that the company will make a most determined fight against any lower fare. The company claims that an ordinance to reduce fares would be illegal, but City Attorney Hamilton, who has looked into the question, maintains that the Common Council has a right to regulate ares to a reasonable extent. There is a peculiar situation in connection with this matter. When the assessments of the Milwaukee Street Railway company and similar corporations were increased last spring it was promised that taxes generally would be lower as a result, but even though these assessments, which have been knocked out in the lower court, figure in the tax roll as though they had not been knocked out, taxes are higher and, besides, many people are paying from $2 to $4 a month more for street car fare than before because of the discontinuance of the sale of commutation tickets, the result of the assessment.

Street car transfers may be another subject of municipal legislation. The present transfer system is a very incomplete one and there is a demand for its improvement. Passengers are not transferred from any of the other lines to the Becker line, and for a man to get to the Northwestern railroad depot from a Farwell avenue car requires an extra fare. In general passengers are not transferred from lines running north and south on the West Side to lines running north and south on the East Side. The Vliet street cars, which constitute the belt line, run only at long intervals, and only transfer to some of the lines.

The Badger Illuminating company has elected the following named directors: H. C. Payne, F. G. Bigelow, Charles F. Pfister and C. D. Wyman of Milwaukee and C. A. Spofford of New York. Heretofore most of the directors have been residents of New York. The election indicates a change of policy similar to that which has taken place in the Milwaukee Street Railway company. The officers of the Badger company are: President, Henry C. Payne; vice-president, C. D. Wyman; secretary; W. L. Mason; treasurer, H. T. Boggis.

F. L. Humes, representing the Northwestern Telephone & Electric company of this city, has been in Appleton trying to get a telephone franchise in that city. The company has a list of the 130 subscribers to the proposed automatic telephone exchange, which went down as a result of the hard times, but instead of asking $42 a year, as the automatic company proposed to do, the Northwestern company will ask only $33 a year. The company offers to use copper wire exclusively, to erect neatly painted poles 50 feet high and to give Appleton the use of the upper 30 inches of the poles for fire alarm wires, etc. The company announces that it is arranging to put in exchanges at Oshkosh, Waukesha, Sheboygan and various other Wisconsin cities.

The Waushara County Telephone company, a co-operative enterprise, held its annual meeting a few days ago and elected the following named officers: M. Safford and J. J. Wood Jr., of Berlin, James Spencer of Auroraville, John Moffatt of Poysippi, Charles Kimball of Pine River, John P. Peterson of Mt. Morris. John Moffatt was re-elected president, Mahlon Safford was chosen vice-president, and Secretary Whitney and Treasurer Louis E. Davis were re-elected.

The plant of the Fond du Lac Power & Railway company, including the roadbed and rolling stock, has been sold by the sheriff in order to satisfy claims aggregating $5,000. M. D. Moore of Fond du Lac was the purchaser, paying $4,687.82 for the property. Orville Peckham, the attorney of the First National Bank of Chicago, attended the sale, and it is said that the bank really furnished the money for the purchase, as it holds a mortage upon it executed to the Great Western Manufacturing company, which failed recently. The plant is said to have cost between $75,000 and $100,000. The electric light plant is one of the best in the state. The street railway, by the way, has not been operated since last July.

The plant of the Citizens' Electric Light & Power company at Appleton will be ready to start February 1st.

A resolution was recently introduced in the Milwaukee county board to compel the Wisconsin Telephone company to take out all the telephones in the county offices, because it was averred the company had put in a metallic circuit whenever it was ordered to repair an instrument, and increased the rental correspondingly. C.

## Northwestern Notations.

MINNEAPOLIS, February 1.—In the case of R. E. Rust, receiver of the National Electric Manufacturing company, against the Electrical Engineering company, before Judge Pond, in Minneapolis, the sheriff was ordered to pay over $500. A judgment had been paid just before a levy was made, and hence was paid twice.

The Duluth-Superior Telephone company has established a distance schedule which amounts to a distinct advance over the former rates. The result is that a new telephone company has been formed by Wm. Pattison, Frank A. Ross and Frank A. Flower, to compel the old company to make reasonable rates, and, failing in this, to put in a system which will furnish good service at a fair price.

The Snoqualime Falls Electric Power company has been incorporated in Seattle, Wash., to transmit electric power from Snoqualime falls to Seattle and other points, with a capital stock of $2,000,000 and a bond issue of $1,000,000 authorized. The prospectus gives the height of the falls as 268 feet and the theoretical energy as 51,607 horse power. It is proposed to transmit to Seattle 5,000 horse power.

Work will be commenced on the West Burlington extension of the Burlington, Ia., electric line as soon as the frost is out of the ground, the line requiring five miles of track and switches. It is intended to equip it for 20-minute service. The new park extension will be built during the coming summer also.

George King contemplates establishing an electric light plant in connection with his mill in Hillsboro, N. D.

The Chamberlain, S. D., Electric Light company's plant was advertised for sale under a chattel mortgage recently, but the sale was stopped by an injunction issued by Judge Haney. There are seven liens against the plant which would have been shut out by the foreclosure of the mortgage. The other claimants have had P. J. Gerin of Chamberlain appointed receiver for the plant, and there promises to be a legal contest between the mortgagees and the miscellaneous creditors for preference. The patronage of the company has been good, but it has been hampered by lack of working capital. It is believed that the difficulties can be adjusted and the plant put in operation again soon.

The Ferris Electric & Manufacturing company has opened for business at 11 North Second street, Cedar Rapids, Ia., to do all kinds of electrical engineering, furnish apparatus and supplies, and manufacture electrical and combination fixtures. The Electric Light & Power company has discontinued the sale of equipments and transferred its stock to the new company.

In the case of H. B. Moore, receiver for the Great Western Manufacturing company, Duluth, appointed by the District Court, against John Kennedy, representing E. H. Fowle, appointed receiver by the United States court in Chicago, ordering him to show cause why he should not give up the property in dispute, Judge Moer has dismissed the case, holding it to be merely a question of title between the parties; the detendant, having acquired possession prior to action begun in the state court, cannot be summarily ordered to turn over the property, but is entitled to a trial. The judge declined to decide on the validity of his title. A new suit will be brought to determine the rights of the receivers, probably, as nothing can be gained by appealing it. Receiver Moore has also begun action against the First National Bank of Chicago, to set aside a certain sale of personal property, and to recover $5,000 in case the property cannot be returned. He alleges that the company gave and the defendant received the pretended bill of sale knowing that the company was insolvent, with the intention of giving the defendant a preference when the insolvency became known. Judge Moer has transferred the case to the United States Circuit Court. W. H. H. Stowell, assignee for the Blast Furnace company, has sued W. H. Simonds to recover $498 for pig iron sold to the Great Western company, for which Mr. Simonds is alleged to have become personally responsible.

A move is on foot in Sioux City, Ia., to organize a big telephone exchange in northwestern Iowa, to cover all the counties on the western border of the state as far south as Woodbury, by which all the large towns will be given connection with one another. A number of the smaller towns have put in systems of their own lately and it is proposed to unite these in one large circuit.

The South Sioux City & Covington Street Railway company contemplates extending its line from South Sioux City to Crystal Lake in the spring and change from horse to electric power.

Wells, Minn., will put in an electric light system with a 700 light capacity. The plant will be in operation by April 1st.

R. B. Ballard of Radcliffe, Ia., is moving to have a telephone connection with Eldora, connecting with Hubbard and New Providence. The line is estimated to cost $600 and Radcliffe will subscribe $300 to $400 if the other towns will take the rest.

There is a plan to build an electric line from Harvard, Wis., to the head of Geneva lake. The track is to be standard gauge to permit freight cars to run over it.

Representative Henry Feig of Kandiyohi county has introduced a bill in the Minnesota Legislature prescribing uniform rates for telephones, charging $4 per month for a business house and $3 per month for a private residence. All companies must comply with these rates and an attempt at evading them is punishable by a fine of $100 for each offense.

The De Pere Electric Light company of De Pere Wis., is planning to build a factory on its water power site and utilize the power in the daytime. It is now used only at night to drive the electric light machinery.

Channing S. Timberlake has sued the American Electric Heating company in St. Paul, to recover $562 for services rendered.

Mayor Smith of St. Paul vetoed the order to the St. Paul & White Bear Electric Railway company to run its cars every half hour, as it would work a hardship to the company and did not grant an extension of time to February 1st, at which time it is hoped to reorganize the road. The veto was sustained.

Maj. W. A. Jones, of the United States engineer service, has secured funds to build a telephone line to connect the government reservoirs of Winnebegoshish and Leech lake, and work has been begun. Heretofore when it was desired to open the dams it was necessary to telegraph to Grand Rapids to notify the men at Pokegama dam, whence a messenger would go to Deer River by rail, and thence on foot overland to Winnebegoshish and Leech lake.

There is trouble in Iowa Falls, Ia., over the proposed electric light system. A franchise was granted, stipulating that work should be begun December on 15th and be completed February 15th. Just before the time for beginning work expired, three poles were set and that is all that has been done to date. It looks as though the company did not care to hold the franchise, and the citizens fear they are doomed to at least six months more of darkness.

Swan M. Klarquist, a member of the Minneapolis Board of Trade, has a plan for a stock company to put in a telephone system in Minneapolis and St. Paul, with greatly reduced rates. He would secure 5,000 stockholders, limiting the stock held by each to $100, thus raising $500,000, which would be sufficient to put in 5,000 telephones and equip a central exchange in the midway district, where it could supply both cities. Being a mutual company, he thinks the expenses would be light and thinks the annual charges for service would not exceed $10 to subscribers. He says this rate is charged in Stockholm by a private company which pays large dividends.

The Winona General Electric company of Winona, Minn., which has been awarded the contract for lighting the city for three years at $87.50 per arc light per year, has refused the contract, although it is now lighting the city at that rate without a contract.

Thirty of the employes of the Muscatine Electric Railway company struck recently against a reduction in wages, but later the majority of them returned to work on the company's terms.

A telephone system has just been completed in Forest City, Ia.

State Senator H. F. Stevens has introduced in the Minnesota Legislature a bill providing for taxing sleeping, dining and parlor cars, and the property of express, telegraph and and telephone companies, if the latter are foreign corporations doing business in the state.

A plan is under way to connect the Dells of the Wisconsin with Devil's lake, a summer resort in Wisconsin, by an electric railway.

The electrical workers of St. Paul gave their annual ball in Labor hall on a recent Friday evening. The hall was illuminated with electric lights, and the decorations were of an electrical nature. An interesting programme was carried out.

The Council Bluffs and Lake Manawa electric line will be built this coming season, connecting Lake Manawa, a summer resort, with Council Bluffs, Iowa. It will run in connection with the Council Bluffs and Omaha lines.

Arrangements have been settled, and an electric street railway will be built in Hot Springs, S. D., soon. The ties and rails are already on the ground. The line will run from the Hotel Evans to the Minnekahta bathhouse and up Rose hill. Another line will run from the hotel to the plunge bathhouse.

E. Hughes of Bismarck, N. D., and Senator McGilvary of Dickinson have nearly completed a deal to put in an electric plant in Dickinson to use lignite coal.

In Portland, N. D., it is contemplated to run a telephone line from Portland to Fargo via Galesburg, Erie, Ayr, Absaraka, Wheatland and Casselton, or via Galesburg, Hunter, Casselton, etc. It is proposed to have transferable coupon books subscribed for, payable when the line is up. Lines are also in contemplation to Grand Forks, one west to Hope and another to Fargo via Hillsboro.

E. J. Hubbard thinks of putting in an electric plant in Ellendale, N. D.

The Wisconsin Interurban Electric Railroad company has been incorporated to build and operate a line from Oshkosh to Kaukauna via Appleton. The incorporators are: A. L. Smith, H. D. Smith and T. B. Reid. The Capital stock is $1,000,000. M.

## PERSONAL.

L. W. Collins of Lee & Collins, Chicago, has returned from a successful southern trip.

A. V. Abbott, chief engineer of the Chicago Telephone company, recently delivered a lecture on "Constructive Features of Transmission Lines" before the engineering students of the University of Wisconsin.

F. A. Mason, for several years treasurer of the Interior Conduit & Insulation company of New York, has accepted an important position with the Clonbrock Steam Boiler company of Brooklyn, N. Y. Mr. Mason has a wide reputation as an expert accountant, and his many friends in the electrical trade will be pleased to hear of his new connection and wish him continued success.

J. P. B. Fiske, lately of the General Electric company, in which as well as in the old Thomson-Houston company, he held the position of chief engineer of the motor department for many years, has just severed his connection with the Morgan Engineering company of Alliance, O. Mr. Fiske resigned his position at Lynn last June to associate himself at that time with the latter concern.

Robert Laidlaw, president of the Laidlaw-Dunn-Gordon Pump company of Cincinnati, was elected treasurer of the National Association of Manufacturers, which convened at Cincinnati the third week in January. Mr. Laidlaw was one of the leading spirits in organizing the association, and much of the success of the convention was due to his superior executive skill and untiring energy. The delegation was banqueted at the new plant of the Laidlaw-Dunn-Gordon Pump company.

Among the passengers lost by the sinking of the ill-fated Elbe was Dr. J. C. Dittrich, chemist and electrician of the Ozone company of New York and Chicago. Dr. Dittrich was a young, unmarried man of much promise. He was a native of Germany and had resided in this country for three or four years. He was thirty-three years of age. He was called to Europe by a cable message bidding him hasten if he desired to see his mother alive. Dr. Dittrich was highly esteemed by his business associates, who are much shocked by the sad affair.

## NEW INCORPORATIONS.

Mutual Antomatic Telephone company, Chicago, Ill.; capital stock, $6,000,000; Athal B. Maclin, Chicago, Ill.

Molyneux Electric Manufacturing company, Buffalo, N. Y.; capital stock, $30,000; to manufacture electrical appliances; Barton S. Molyneux, Buffalo, N. Y.

Central Wisconsin Electric Railway company, Oshkosh, Wis.; capital stock, $1,000,000; to operate a railway in the city of Oshkosh and between that city and Kaukauna, about 30 miles, for the carriage of either passengers or freight; also within the cities of Neenah, Menasha and Kaukauna; William F. Gruenewald.

## ELECTRIC LIGHTING.

Judge Thomas has ordered F. H. Jones and J. Foster, assignees of the Norwalk, O., Incandescent Light & Power company, to sell the plant to satisfy a claim of the Huron County Bank for $11,000 and other creditors. The sale will take place on the 1st of March.

At the last meeting of the directors of the Waverly, N. Y., Electric Light & Power company, officers for the ensuing year were elected as follows: President, J. George Kaelber; vice-president, secretary and manager, F. E. Lyford; superintendent, George C. Hoffman. The company is in a prosperous condition. It furnishes light for Waverly, N. Y., and Sayre and Athens, Pa. The plant will be improved to a considerable extent and will then represent an outlay of nearly $100,000.

The Town Council of Munich has granted the sum of £100,000 for the enlargement of the street lighting plant, and has again entrusted the work to the Elektricitäts Actien Gesellschaft, Nuremberg, late Schuckert & Co. The actual installation comprises 210 ten-ampere and 66 five-ampere arc lamps; 456 ten-ampere lamps and 48 lamps of five amperes are to be added. The additional power required, about 400 horse power, will be taken from the Isar river, which turns the turbines of the two old power stations. One of these will be fitted with steam plant to act as a reserve. The arc lamps have evidently given satisfaction. The total installation of about 800 arc lamps will probably form the most complete case of electric street lighting in Europe.

## ELECTRIC RAILWAYS.

To provide funds for extending its lines the Cicero & Proviso Electric Railway company, of Chicago, will issue $1,500,000 more stock.

To the pyramids by trolley may soon be a possible trip. The Egyptian government has just granted a concession for an electric railroad in Cairo, and the pyramids are only eight miles away.

The first step toward a consolidation of all the street car lines in Kansas City, Mo., and Kansas City, Kas., was taken at the annual meeting of the West Side electric road, when the system practically passed into the hands of the Metropolitan company. L. B. Hale of Chicago was elected president of the West Side company, and Mr. Hutchins of Kansas City, Kas., secretary. The New York directors have withdrawn.

A Denver press dispatch states that the boilers at the Denver electric power house, corner of West Colfax and South Third avenues in West Denver, blew up on the night of January 30th, completely wrecking the building and machinery and causing three deaths and severe injuries to several others. The building and machinery were valued at $150,000 and are a total loss. The explosion will seriously interfere with the street railways of Denver. Twelve boilers exploded.

A dispatch from Greensburg, Pa., states that the Ligonier Valley Railroad company will change the equipment of the road from steam to electrically transmitted power. Instead of two or three trains per day, as now, electric cars will be run from Latrobe to Ligonier every hour, or oftener, if occasion requires. The heavy freight will be carried over the road by steam. Superintendent Scenft is of the opinion that the use of electricity will result in a great saving. The road is ten miles long.

It is reported that Congressman Tom L. Johnson and his brother Albert will soon retire from the directory of the Cleveland Electric Street Railway company, which with the Cleveland City Cable company now controls every street car line in the city. It is believed that the retirement of the Johnsons will be followed by a consolidation of the electric companies. This would involve a deal of about $20,000,000 and result in a street car monopoly in Cleveland The stock of the electric company has risen rapidly within the last few days.

The Fort Clark Street Railway company, a corporation operating an electric car line in Peoria, Ill., has passed into the hands of a receiver on application of the Illinois Trust and Savings Bank of Chicago, the holder of its bonds. F. W. Horne of Chicago, president of the company, was appointed receiver by Judge Worthington in bonds of $20,000. The company was managed by local capitalists for many years, but went into other hands in 1892. Since then it has suffered from the hard times, the expense of electrical equipment and paving made necessary by city improvements. The Illinois Trust and Savings Bank applied for the receiver as the holder of $250,000 of the gold bonds of the company, payment of the interest on which has been defaulted. The receiver will operate the road as heretofore.

At a conference in Ottawa, Ill., it was agreed by Mr. Sunny, on behalf of the General Electric company, to sell the local electric line to a local syndicate, represented by Mayor Schoch, for $40,000 in bonds, on condition that the paid-up stock of the local company be not less than $20,000. A contract was drawn up and signed, the road to be run by the old company until March 1st, and then turned over to the local syndicate, which, it is understood, consists of Messrs. Schoch, Hapeman, Riale, L. H. Strawn, Porter, L. Leland, E. C. Allen, Milligan, Nertney and several others. Mayor Schoch says the syndicate will raise $15,000, but that the remaining $5,000 of stock must be subscribed by the general public or it will not be raised at all and the deal, in consequence, will fall through. Five hundred of this has already been subscribed by Attorney-general Moloney.

## TELEPHONE.

The directors of the Missouri & Kansas Telephone company have elected N. R. Ferguson, treasurer of the company, to the office of secretary and superintendent, which was made vacant six weeks ago by the death of W. W. Smith. Mr. Ferguson will continue to act as treasurer of the company. The newly elected directors, nearly all of whom have served in that capacity before, are: John E. Hudson of Boston, A. G. Fuller of Omaha, J. R. Mulvane of Topeka, E. R. Wilder of Topeka, S. A. Walker of St. Joseph, N. R. Ferguson, J. S. Chick and A. Burt.

## MISCELLANEOUS.

Mail cars with postal clerks receiving and distributing mail are to run on Chicago's street car lines by the 1st of April. Chicago is the second city in the United States to achieve this advance in postal service (Brooklyn being the first), and Postmaster Hesing has scored another triumph. By an agreement made between him and Charles T. Yerkes, orders were given by the latter for the immediate construction of four postal street cars. As soon as they are completed they will be placed on the Madison street cable car line, which will be the first to gain this advantage.

In connection with the engineering course of the University of Minnesota, the *Quarterly Bulletin* announces that a magnetic station has been established at the experimental station at St. Anthony Park, and the initial observations taken for a systematic study of field magnetics for that locality, covering intensity, dip and declination, including the diurnal, annual and secular changes. This work is carried on in co-operation with the Coast and Geodetic Survey. Practice with steel tape in ten modern methods of base-line measurement has been very satisfactorily carried on by the last two classes in geodesy, rendered possible by the loan of the necessary apparatus by the Coast Survey.

"It is only a matter of a very short time," said a member of a well-known car-building firm to a Philadelphia reporter recently, "when wealthy people will be placing orders for private trolley cars, which they will be able to maintain at much less expense than they incur in keeping private teams, and in which they will be able to make much longer trips. At the present rate of trolley introduction, the man with an elegantly fitted private trolley car can whizz over the country, right through the big cities as well as the suburban towns, with long stretches of country in between the centers of population in which to enjoy the contrast, all the way from New York to Chicago, and that, too, within a period of less than two years. Believe me, the private trolley car is a thing of the near future."

A press dispatch from Schenectady says: Within a short time past the General Electric company at Schenectady has come into possession of information which implicated several foremen in the various departments in a systematic scheme of extortion exercised upon men employed under them. It is said that in many instances the foremen sold positions which their authority enabled them to bestow, and other cases are cited in which it is related that employes were forced to pay tribute to the accused men in order to retain their positions. When the matter was brought to the attention of the company, the management took prompt action, the first step being the employment of a detective. It was found that the reports were true, and as a result two foremen and one assistant were discharged. There is little probability that they will be prosecuted.

A Washington dispatch says: The cars used for the transportion of the United States mails will hereafter be lighted by electricity. The use of the oil lamp has been attended with so many inconveniences that the postal authorities have decided to adopt the American railway electric light system in its stead. The system consists of a dynamo attached to the axle of the car, connected with a storage battery. The advantages to be derived from this change in the work for the transportation and delivery of mail are apparent. The assorting of letters by the clerks is largely done at night, though in the daytime as well artificial light is used, and owing to the poor light given by lamps the work has been greatly retarded. By means of a good light the clerk is enabled to work much more rapidly and with greater precision. The saving of a few minutes in completing the sorting and pouching of matter frequently effects the making of close connections at distributing points and hastens the delivery of letters by several hours.

## TRADE NEWS.

The Electric Appliance company, Chicago, is making a specialty of theatrical electrical devices, and has secured control of a number of lighting specialties particularly adapted for this work. In fact, this has become so important a department of the business that the company has found it necessary to issue a special catalogue of this material, entitled "Catalogue of Theatrical Lighting Devices," which is now being extensively distributed. The Electric Appliance company will be pleased to send a catalogue to all interested in this line who have not received a copy.

On January 26th the board of directors of the Standard Underground Cable company held its first regular meeting after the annual stockholders' meeting of January 22d, and elected the following named executive officers of the company for the ensuing year: George Westinghouse, Jr., president; Joseph W. Marsh, vice-president and general manager; Frank A. Rinehart, secretary and treasurer; Charles M. Hagan, auditor. At the annual meeting of the stockholders Joseph W. Marsh was also re-elected director. Mr. Marsh is now entering upon the fourteenth year of his connection with this successful corporation, during most of which time he has been its general manager.

The Law Battery company of 85 John street, New York, has issued formal notice "that certain unscrupulous parties have infringed and are infringing patents for galvanic battery cells and their parts owned exclusively by this company, viz., No. 400,126, dated March 26, '89, and known as the double carbon cylinder patent; No. 477,645, dated June 28, '92, and known as the carbon button connector patent; No. 500,284, dated June 27, 1893, and known as the carbon screw button connector. And that, therefore, we caution all parties against purchasing or using said electrical cells or parts thereof infringing said patents, and respectfully state that if they do, justice and equity demand that we take such steps as will protect our interests without further or other notice."

On January 16th the Clonbrock Steam Boiler company of Brooklyn, N. Y., was incorporated and the capital stock largely increased to meet the rapid growth of the business. The officers elected were: T. F. Morrin, president; T. J. Lawler, vice-president and general manager; M. B. Morrin, treasurer and secretary. These gentlemen have been for a long time interested in the boiler trade and are widely known for their progressive ideas and the excellence of apparatus manufactured, a large share of which during the last year has been placed in electric power plants. During January 15,000 horse power was sold to the electrical trade alone. The works of this company now occupy two blocks, and there is under consideration the further extension of the plant in the near future.

## BUSINESS.

The Standard Paint company, 2 Liberty street, New York, is remembering its friends by distributing a very convenient card-case, with a space for memoranda. The souvenir is a useful one and can be had upon application.

The Metropolitan Electric company of Chicago has just taken the agency for the American Carbon company's products and will carry a full line of this celebrated carbon. The company will complete its stock in a very few days and will be able to meet the demands of the market. This adds another high-class specialty to the Metropolitan company's list.

The Eureka Compound company of Sioux Falls, S. D., is calling attention to the new commutator compound for dynamos and motors which it is introducing to the trade. The company announces that this compound has been thoroughly tested by expert engineers, who assert that it works to perfection on any commutator with either copper or carbon brushes. It lasts longer than any other compound, and it puts a finer gloss or polish on the surface of the commutator and brushes, thus increasing the life of both.

Users of incandescent lamps will be interested to know that Treasurer Chas. H. Rockwell of the Buckeye Electric company of Cleveland recently closed a contract with the Electrical Engineering company of Minneapolis, by which the latter company will hereafter handle the Buckeye lamp exclusively. The Buckeye company feels much elated over this arrangement, as the Electrical Engineering company covers the northwestern territory from the Twin Cities to the Pacific coast, and has a reputation and trade second to none.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued January 29, 1895.*

533,078. Primary Battery. Richard O'Toole, Mechanicstown, Md. Application filed August 3, 1893.

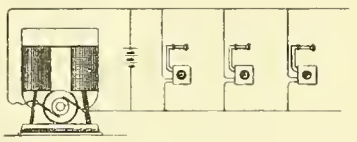
The claim reads as follows: In a primary battery, such as one containing oxide of copper as depolarizing material, caustic soda or caustic potash in solution and zinc, the combination of a perforated jar, containing the depolarizing material, fitted with a cover at top and bottom, and a suspensory rod passing through the top and bottom and secured to a cover or bridge across the jar.

533,083. System of and Apparatus for Controlling Electric Circuits. William B. Potter, Lynn, Mass. Application filed July 24, 1893.

In a system of electric distribution the combination is claimed of a plurality of dynamo-electric machines, of electrically operated circuit-controlling switches, one in the circuit of each machine, magnets adapted to operate said switches, having coils connected to a common controlling circuit, a switch adapted to control such common circuit and switches arranged to connect any of such magnets in a local controlling circuit at will.

533,084. Rectifying Commutator and Method of Making Same. Henry G. Reist, Schenectady, N. Y. Application filed October 19, 1894.

In a rectifying commutator there is the combination of a double flanged ring, having an internal groove, slots alternating in position upon the two flanges, wooden pins in the slots, cuts extending from the face of the commutator, partly through the wooden pins, insulation in such cuts, clamping rings and bolts to hold the parts together, and insulation between the rings and the commutator.



NO. 533,146.

533,100. Electric Arc Lamp. Hans O. Swoboda, New York, N. Y. Application filed March 2, 1894.

A movable carbon support, stationary supporting pieces, a tilting frame pivotally supported in the stationary supporting pieces, a pivoted arm for moving the tilting frame, adjustably attached thereto, and having its pivotal axis identical with the axis of movement of the tilting frame, a brake and brake wheel carried by the tilting frame and moving with the latter when the same is moved, mechanism connecting the brake wheel with the movable carbon support, a magnet or solenoid for moving the tilting frame by means of the adjustable arm, and a fixed stop for co-acting with an adjustable extension of the brake.

533,107. Electrical Measuring Instrument. Edward Weston, Newark, N. J. Application filed March 11, 1891.

In an electrical measuring instrument the combination is claimed of the electro-magnets, having coils and ring pole piece secured to or formed on one of said cores and surrounding the other core, the coil surrounding the ring pole, the bar supporting said coil, and a suspension device carrying said bar, and an index needle with means for passing an electrical current through the coil and for returning the latter to starting point after the deflective impulse has ceased.

533,108. Electric Motor. Charles Wirt, Chicago, Ill. Application filed April 23, 1894.

One claim reads: A chrono-electric motor, having in combination a pendulum, a contact moved thereby, an electric actuating device, a contact having a retarded movement toward the pendulum contact and a free movement in the opposite direction, and an adjustable cut-out device withdrawing the current from the electric actuating device at a predetermined point during the closure of the circuit by the pendulum and retarded contacts.

533,142. Telephone System. John I. Sabin and William Hampton, San Francisco, Cal. Application filed April 14, 1894.

Among the claims of this invention is the following: The combination with a metallic circuit telephone line extending to the central station and normally closed thereat through a battery and indicator, of sub-station telephone sets included in normally open bridges between the opposite limbs of said line, a switch at each of said sub-stations for closing the bridge to complete the battery circuit through said indicator to actuate the same, means for cutting said indicator and battery from the line by the act of making connection therewith, a battery and clearing out indicator adapted to be at the same time connected in a bridge between the opposite sides of said line, a call device at one sub-station in a bridge between the two limbs of the line, a second call device at another sub-station between one of the limbs and ground, and means for connecting a calling generator between the two limbs of said line or between ground and the limb to which said second call device is connected.

533,146. Apparatus for Smoothing Currents of Dynamo-electric Machines. Charles E. Scribner, Chicago, Ill. Application filed January 16, 1892.

In the arrangement illustrated there is a source of electricity in combination with separate parallel branches joining the poles, a telephone transmitter and the primary helix of an induction coil included in series in each of the branches, a telephone line circuit connected with a telephone receiver and including the secondary helix of each induction coil, and a source of counter-electromotive force connected in shunt with the working circuit.

533,147. Telephone Switchboard Apparatus. Charles E. Scribner, Chicago, Ill. Application filed May 13, 1892.

Two connecting plugs, each having three contact pieces, one contact being insulated from the remaining two, the remaining two being electrically connected, each plug being adapted to be placed in either of two positions in a spring-jack, the contact pieces of the plug being disposed to make contact, one at a time, with the line contact of the spring-jack, the line contact pieces of the two plugs being connected by conductors, a grounded source of calling current connected with one of the contact pieces of the plug, a metallic socket adapted to receive one of the plugs when idle, and to connect with the remaining contact piece thereof, a listening plug attached by a flexible conductor to the socket, and a grounded telephone set also connected with the same socket.

533,148. Spring-jack for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed May 23, 1892.

The features of this invention are: A spring-jack having an insulated thimble and three insulated contact springs, two of the springs being of equal length, a connecting plug in the jack having three insulated contact pieces, one of which makes contact with the thimble of the jack, another of which makes contact with both of the springs of equal length, and the remaining contact piece of which makes contact with the remaining spring.

533,154. Circuit Closer for Railway Rails. Edgar C. Wiley, Bristol, Tenn. Application filed May 29, 1894.

Claim three reads as follows: In a circuit closer for railway rails, the combination with the main rail, of a box or casing, a supplemental rail arranged above the cross ties beside the main rail and rigidly fixed to the box or casing about its middle, and to the main rails at its ends, and a stem attached to the main rail and carrying a friction drag-side within said box or casing adapted to close electrical contacts by the initial downward movement of the drag-slide, and to open them by the initial upward movement from the springing of the main rail in relation to the supplemental rail.

533,183. Automatic Electric Signal. Henry C. Storrs, Hartford, Conn. Application filed April 20, 1894.

The claim is as follows: The herein described automatic circuit controller for electric circuits, comprising two circuit terminals, a switch controlling said terminals, and a hold-back device for said switch, embodying two members, located one within and wholly surrounded by the other, and movable longitudinally relatively to each other when held against lateral movement, and a fusible or soluble sealing medium filling the space between the circumjacent surfaces of said members and normally connecting said members.

533,211. Electric Arc Lamp. Eugen Conrady, Keighley, England. Application filed December 16, 1893.

This invention relates particularly to a feed mechanism for electric lamps, comprising in its construction an elongated member coupled to the movable carbon through elastic connections, and gripping devices to act on the elongated member, as shown.

533,223. Incandescent Electric Lamp. George R. Lean, Cleveland, O. Application filed November 29, 1893.

An incandescent electric lamp bulb is shown, having a temporary opening, combined with tubular metallic guides permanently sealed in the bulb, and leading-in wires having insulated material applied thereto, secured to the filament and adapted to be inserted in and extending through the guides and positioned through the temporary opening in the bulb.

533,244. System of Distribution by Alternating Currents. Charles P. Steinmetz, Schenectady, N. Y. Application filed April 2, 1894.

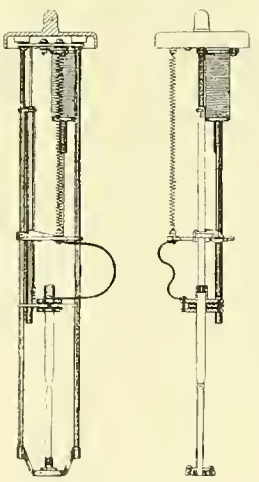
The method of maintaining polyphase elect omotive forces in the different mains or branches of a polyphase distribution system is described, which consists in inducing alternating electromotive forces in a stationary or moving electro-dynamic mechanism of the single-phase type, to whose terminals some of the mains are electrically or inductively connected, and inducing an electromotive force of different phase relation in a supplementary conductor connected to one or more other mains, which, acting to modify the first named electromotive force, creates the desired difference of phase between the mains.

533,245. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y. Application filed April 13, 1894.

In this invention there is claimed the combination of a three-main inter-connected polyphase circuit, with means for maintaining between such mains electromotive forces substantially 60 degrees apart in phase, with a transformer connected on one side to the mains, and on the other side to a corresponding set of mains, and means for changing the phase relation of the transformed currents from 60 degrees to 120 degrees, or vice versa.

533,246. Winding for Dynamo-electric Machines. Charles P. Steinmetz, Schenectady, N. Y. Application filed July 14, 1894.

In a polyphase dynamo the combination described consists of the armature and field core, coils arranged in sets on the core, each coil having a breadth substantially equal to the distance between the poles developed in the core and the coils of each set overlapping each other, but not overlapping coils of other sets.



NO. 532,211.

533,247. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y. Application filed September 24, 1894.

The last claim reads: In a system of electrical distribution the combination of a generator of alternating single-phase currents, single-phase mains connected to said generator, two or more alternating multiphase motors having a portion of their coils connected to the single-phase mains, and a balance wire connecting points of the multiphase motors, at which an out-of-phase electromotive force is generated by the normal operation of the motors.

533,248. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y. Application filed September 24, 1894.

In a system of electrical distribution the claim is made for the combination of single-phase mains, carrying a single-phase alternating current—a third wire—means for developing between the third wire and mains, electromotive forces out of phase with that on the single-phase mains and translating devices connected across the single-phase mains, and also connected to the third wire, the energy required for the normal operation of such translation devices being derived substantially from the single-phase mains.

533,249. Monocyclic Motor. Charles P. Steinmetz, Schenectady, N. Y. Application filed November 20, 1894.

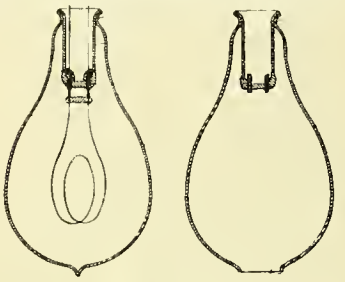
A generator having interlinked main and teaser coils, an induction motor having a closed circuit secondary member and a primary member wound with interlinked main and teaser coils, the main and teaser coils of the generator and motor being so proportioned that the counter-electromotive force in the main primary coil of the motor is less than the impressed electromotive force at the terminals of the coils, while the corresponding impressed and counter-electromotive forces in the teaser coil are substantially balanced.

533,250. Monocyclic Motor. Charles P. Steinmetz, Schenectady, N. Y. Application filed November 24, 1894.

This is an alternating current motor provided with main and teaser coils interlinked, and a field winding energized from a source of direct current.

533,254. Signaling Telegraph. Frank A. Turner, Chelsea, Mass. Application filed July 27, 1893.

One or more transmitters, each adapted to send signals of various kinds, a receiving apparatus consisting of a strip of paper, a device for punching the paper in accordance with the



NO. 533,223.

character of the respective signals, and a series of indicators at the receiving station corresponding individually to the respective signals, the indicators being respectively controlled by the corresponding perforations in the strip.

533,261. Bonding Device for Electric Railways. John J. Zimmele and Antoine Bournonville, Philadelphia, Pa. Application filed November 30, 1894.

The last claim follows: A bond or connector for an electric conductor, having limbs on the end thereof, and a kerf or slot extending in said limbs into the body of the bond or connector, whereby a wedging device may be inserted in said kerf or slot from either side of the rail or other conductor.

533,269. Recording Ampere Meter. William H. Bristol, Hoboken, N. J. Application filed July 26, 1894.

Among the claims for this invention are a stationary coil or solenoid, a movable coil or solenoid, two flexible conducting supports for said coil or solenoid connecting with the terminals of the same, an indicating or recording arm, a flexible support for the same, knife-edge bearings formed on the movable coil or solenoid and the flexible support, a notched rod connecting the bearings, and a spring bearing on the rod.

533,270. Electrical Measuring Instrument. William H. Bristol, Hoboken, N. J. Application filed September 24, 1894.

In this device there are a coil or solenoid, an armature arranged adjacent to it, a core moving with the armature and entering the coil or solenoid, a damping device operated by the movements of the armature, and an indicating or recording arm

533,318. Controller or Switch for Electric Motors. William J. Pohlman, Woodbrook, Md. Application filed November 17, 1894.

In this arrangement there is included the combination in a controller for an electric motor, of a controller box having an insulating disk or plate, two pairs of radially movable contact arms supported by the disk or plate, means for clamping the disk or plate to a suitable support, a shaft provided with a circuit breaker, an escapement wheel mounted on the shaft, means for holding the contact arms out of contact with the circuit breaker in one position of the latter, an oscillatory pawl carrier provided with a spring pawl for intermittently rotating the escapement wheel, and means for oscillating the pawl carrier.

533,323. System for and Method of Electrical Distribution of Energy. William Stanley, Pittsfield, Mass. Application filed November 3, 1894.

This method of distributing electrical energy from several alternators consists in running the alternators so as to generate currents of like phase, transforming the separate currents into currents of a different potential, and combining such transformed currents so as produce in the working circuit a combined current of a potential like that of the transformed currents.

533,378. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y. Application filed April 5, 1894.

The method of distribution is described as consisting in generating single-phase currents in an electric circuit, deriving therefrom an electromotive force of displaced phase, maintaining such electromotive force upon an additional main, and operating translating devices from such main and the mains of the single-phase circuit.

533,379. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y. Application filed April 11, 1894. Renewed December 24, 1894.

The method of distribution described consists in generating and distributing polyphase currents approximately 60 degrees apart in phase, and operating motors of the three-phase type by reversing the direction of the current flowing in one of the windings of the motor.

533,398. Automatic Electric Safety System for Railroads. Rene R. Snowden and Albert C. Ives, Ocala, Fla. Application filed January 26, 1894.

Among the features of this invention is the combination with the track rails laid in insulated and alternating sections and an intermediate and continuous trolley rail, of a battery and trolley wheel carried by the train, an electro-magnet included within the circuit, automatic mechanism for controlling the throttle valve and air valve through the electro-magnet and the throttle valve lever bearing an electrical contact moving over other contacts in the circuit and arranged to direct the current from another train either through the battery and electro-magnet or alternately close the distant line circuit without passing through the battery and magnet.

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## Three-phase Wiring and Lighting Fixtures in Concord, N. H.

Ever since the announcement was first made in the WESTERN ELECTRICIAN, some three years ago, that Concord, N. H., was to have the first plant in the United States for the distribution of light, heat and power by the three-phase system, the attention of electricians has often been drawn in that direction. And now, in the new state library building, there has just been completed the first large installation of lights upon this system in this country. The contract was awarded the Northern Electrical Supply company of Concord; and for workmanship, artistic effect and general adaptability the construction is certainly deserving of high praise, as inspection of the accompanying illustrations will show.

The building is lighted by 1,000 incandescent lamps, wired on the Edison three-wire convertible system applied to the three-phase current. The system is so laid out that by changing the connections on the main distributing board five distinct wiring schemes may be made use of—three-phase current, three-wire direct current, three-wire alternating, two-wire direct and two-wire alternating. Any one of these plans is available at any time.

Current is taken from the 2,250 volt primary mains of the Concord Land & Water Power company, which, encased in lead cables, lead down through hollow steel tubing at the curbing, thence through a brick duct into the basement and to three transformers which are placed in the rear of the distributing board and which have a capacity of twenty kilowatts each. From this distributing board all the secondary mains are run in brass armored conduit to the nine centers of distribution and also to the fifteen horse power three-phase motor which is used to drive the heating and ventilating system. The distributing board carries several Hill 300 ampere jack-knife switches with the instruments and secondary fuses. In Fig. 1 is shown a front view of the main distributing board, while Fig. 2 gives a rear view. Fig. 3 represents one of the equalizing boards.

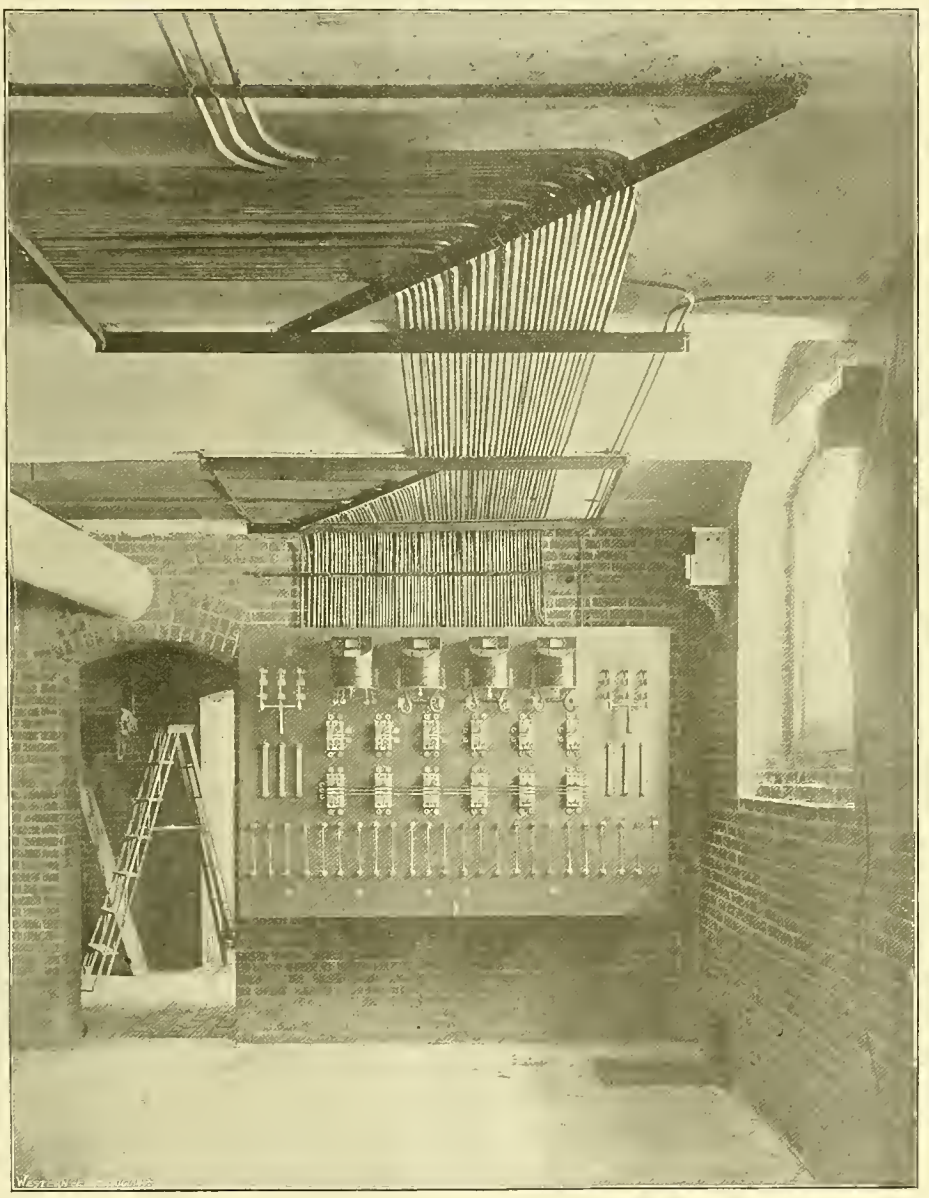

FIG. 1. THREE-PHASE WIRING AND LIGHTING FIXTURES IN CONCORD, N. H.—MAIN DISTRIBUTING BOARD.

While it is difficult to particularize, perhaps the court-room may be selected as presenting the best example of the novel lighting effects obtained. This is shown in the picture of the dome circle lamps, Fig. 4. With the exception of two clusters of five lamps each, this circle does the entire lighting for this room. It consists of ninety-six 32 candle power lamps in ground glass globes controlled by a bank of six Cutter automatic push switches, and by which the most complex combinations may be obtained. One switch will light every seventh lamp around the entire circle, another every third and another every other one; then the lamps may be lighted in pairs skipping three, by threes skipping two, or by fours skipping three, and so on through ten or twelve different changes. Some idea can be obtained of the wiring necessary for these combinations by a glance at Fig. 5, which represents the outside of the dome, showing the entrance and course of the conduits.

The library, reading rooms and corridors are lighted upon the same plan, except that the lamps are crest light fixtures, with ground glass round globes; they may be operated in the same manner. Fig. 6 shows the fixtures in the art gallery.

In the corridor, on either side of the tablet, Fig. 7, are two beautiful standards carrying ten lamps each in ground glass globes. A single electrolier is shown by Fig. 8.

The entire installation was designed and executed by E. O. Sessions, E. E., and the work was done under his personal supervision. It does much credit to his taste and skill.

## Electrical Power for Buffalo.

Much disappointment is expressed in Buffalo at the announcement of the secretary of the Niagara Falls Power company that all electricity likely to be developed by the plant of that concern has been contracted for and that none will be delivered to Buffalo for many months to come. The Niagara Falls company has applied for a franchise to string wires and lay conduits in the streets of the city, but the interest manifested now is not nearly so great as was the case when it was supposed that the Niagara Falls Power company would be ready to deliver power to manufacturers within the city of Buffalo within a short space of time. The firm of Schoellkopf & Matthews seeks a similar franchise, and the competing claims are now under consideration.

## Death of A T. Hay.

Of the late A. T. Hay, who died in Burlington, Iowa, recently in his sixty-ninth year, the *Burlington Gazette* gives an appreciative sketch. Mr. Hay was born near Philadelphia. When a young man he adopted the occupation of telegraphy. He had original ideas and methods, and soon made for himself a distinct reputation in the business. In 1851 while at St. Louis on telegraph business he was made division manager of the Iowa branch of the Illinois & Mississippi telegraph line, taking up his residence in Burlington. He afterward studied law and was admitted to the bar, although he never practiced in the Iowa courts. His leisure hours were devoted to scientific pursuits, and especially to experiments with the metals. This study he followed at first from inclination and for personal satisfaction. He devoted considerable attention to the causes of steam boiler explosions, and advanced a theory that they did not come from low water in the boilers alone, but were attributable also to organic matter and to the electrical conditions of the boilers. He also pointed out the great dangers from hydro-carbon oils which were carried on vessels and presented a condition of affairs in the cargoes favoring combustion. He invented and patented an electrical device for the safety of boilers in which lime water was used in the early days. His device was known as the boiler anti-incrustator. Beside these accomplishments, Mr. Hay was the discoverer and inventor of many useful devices in electricity and the natural sciences. In 1866 he began an investigation into the constituent properties of iron and steel, and this labor was rewarded by the production of what is known as Hay steel, a product combining many of the useful qualities of both iron and steel. Several important bridges were built of this material. In later years he had been engaged in the development of a new and economical method of making laminated steel.

In many respects Mr. Hay was a remarkable man, although never widely known. He was a pioneer in the development of electricity as a commercial and manufacturing agent. He was the first superintendent of telegraph lines west of the Mississippi river. It is also said of him that twenty-five or thirty years ago he demonstrated the economy of welding by electricity. By this means he welded a shaft in the old Hawkeye woolen mills in Burlington. The *Gazette* sums up Mr. Hay's interesting career as follows: "His honorable career was carved out by his own hand from the beginning, against a future that was almost continuously hard and dark. He was a skilled chemist, a

lawyer of considerable ability, a great metallurgist, an expert telegrapher, a machinist, an electrician, a deep thinker and student of politics, a good historian, a man of fine mental perceptions and altogether a rare combination of genius and acquired intelligence. He was blunt of speech and in respect to any of his scientific enterprises he was extremely modest and reserved."

## The Origin and Development of the Telephone Switchboard.[1]

By J. E. Kingsbury.

The telephone itself has been the subject of various papers read before this institution, but the same remark does not apply to apparatus which has become allied with the telephone in its commercial applications. The most important of such apparatus is the switchboard used in exchange service. It is because this subject does not appear among your records that I have treated it in the manner indicated by the title of this paper. To those who have been long engaged in telephone work such a title will not raise expectations of novel information, or suggest exhaustive treatment. To those who are not so engaged I can only hope that it may be of interest to the same extent that it is of interest to trace the development of any enterprise or apparatus.

The switchboard has been described as the brain of the telephone system. In seeking anatomical similes I hardly know whether to choose the brain, the heart, or the backbone. It is the brain in so far that it is the nerve center, all communications going through it; it is the heart in that it is the life of the telephone system as we know it to-day; and it is certainly the backbone—of the exchange business.

The telephone, itself a marvel of simplicity, has become involved in a network of considerable complexity known as an "exchange system"—a means of intercommunication of which the switchboard is the center-piece. The exchange system seems necessarily identified with the telephone, but it existed before the telephone was invented.

I am indebted to American sources for the information that the first idea of exchange working is to be found in a British patent granted to an inventor bearing a French name. T. D. Lockwood says: "The first idea of exchange work which to my knowledge occurs in history is found in a British patent issued as far back as February 7, 1851, to F. M. A. Dumont. This clearly describes an exchange system of dial telegraph instruments, connecting by short lines with branch central stations, which branch stations were provided with trunk lines connecting them with a principal station." Mr. Lockwood remarks that "the idea was far ahead of the times."—(Tel. Con. Rep., 1887, p. 50.)

At Newcastle the postoffice arranged a system of connecting subscribers provided with Wheatstone A B C instruments. In New York such a system was introduced in 1874 or 1875. The founder of that system was not aware that intercommunicating exchanges had previously existed. He had observed the success attending the telegraphing of stock quotations to subscribers, who each received identical information despatched from a central office, and he assumed that a like success might be obtained by furnishing information to legal firms as to the course of proceedings in the courts. The legal firms did not take kindly to the idea,

FIG. 3. THREE-PHASE WIRING AND LIGHTING FIXTURES IN CONCORD, N. H.—ONE OF THE EQUALIZING BOARDS.

but one of them offered an alternative suggestion, intimating that a system which would enable lawyers to communicate with each other by telegraph would be worth paying for. Confirmation of this idea was obtained from others, and the result was the establishment of a telegraph exchange. As the exchange was exclusively used by legal firms, the company was called the "Law Telegraph company." Telegraph instruments were subsequently replaced by telephones, and the particular system adopted for working the exchange became known as the "Law" system.

Notwithstanding that this telegraph exchange was already in existence at the time of the invention of the telephone in 1876, it was not until January, 1878, that the first commercial telephone exchange was started. In the meantime, Bell's invention had been greatly improved, and shortly afterward the introduction on a commercial scale of the Edison carbon transmitter and the Blake microphone placed telephony upon such a practical basis that its progress became assured. It was the microphonic era when was commenced that activity in telephone exchange work which necessitated attention being given to switching mechanism.

In addition to the public exchange system every large telegraph office was the center of numerous lines, which were connected together as required by means of a switchboard. An illustration of part of a well-known telegraph switchboard shown to the meeting consists of vertical and horizontal bars, the vertical bars being the lines, the horizontal bars providing the means of connecting any one vertical line with another by inserting plugs. The vertical lines terminate in springs resting on contacts. A telegraph instrument can be looped into circuit by a double-contact plug inserted between the spring and its contact. These

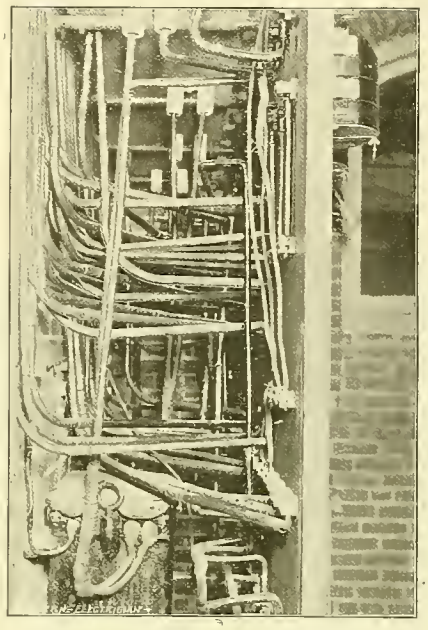

FIG. 2. THREE-PHASE WIRING AND LIGHTING FIXTURES IN CONCORD, N. H.—CONNECTIONS IN REAR OF MAIN DISTRIBUTING BOARD.

springs were known to telegraphists as "spring-jacks." Those who started telephone exchanges, like all other founders of new industries, adopted in the first instance that which already existed, so far as it was within their knowledge, available for their purpose. All the first telephone switchboards have been traced by competent hands to a telegraphic origin. Hence the origin of the telephone switchboard is the telegraph switchboard, with the addition of indicators already in use for signaling purposes.

It will be remembered that telephone exchange business was started almost simultaneously in London by two different organizations—the Bell and the Edison companies. The Edison company had an experimental exchange at 6 Lombard street. It was publicly opened on September 4, 1879, with 10 subscribers connected. The switchboard then used formed the subject of the first specification for a telephone switchboard in the English Patent Office (No. 3,794, September 20, 1879). The switchboard used by the Bell company in its first exchange at 36 Coleman street was of a different character. It is a rather curious circumstance that the two drawings of these, in addition to showing the first switchboard used simultaneously in English telephone exchanges, are also examples of two types of board—viz., plugboards and cordboards, of which there were several varieties. The "Edison board"—as it is called here, because it was used by the Edison company—is the upper part of the telegraph switchboard. The vertical strips are continuations of subscribers' lines; the horizontal strips are normally insulated from the vertical strips; but any vertical strip may be placed in electrical contact with any horizontal strip by placing a metal plug in the hole which is drilled at the point of intersection. Another metal plug similarly applied will place the same horizontal line into electrical connection with any other vertical line. Thus two subscribers' lines are connected together by means of a crossbar and two metal plugs. There are no flexible cords whatever; even the speaking instrument is connected to a rigid bar. A different method is followed in the board used by the Bell company, and consequently called here the "Bell board." The crossbars remain, but the vertical bars are dispensed with. The subscribers' lines end in a spring-jack like the lower part of the telegraph switchboard, connections being made by means of flexible conducting cords having suitable plugs at each extremity. The one, therefore, is a plugboard, the other a cordboard; and for a while these two types provided the necessary material for the holding of opposite views amongst practical telephonists. The plugboard was preferred because it was free from the liability of broken cords, had its construction and circuits readily traceable, and also perhaps because it was generally more in accordance with previous practice in switches. The cordboard, however, had greater flexibility and possibilities of concentration.

Numerous varieties of plugboards were made, differing considerably in appearance, but having exactly the same method of working. It is not possible for me, in the time at my disposal, to describe in detail the various differences. It will suffice to say that the general idea was the same. The differences were either in construction or in the method of connecting the vertical with the horizontal bars. In some the plugs were loose, as in the one shown; in others, —as in those originally used, I believe, in Manchester and Sheffield—the connecting plugs slid over a rod with notches for each horizontal bar, and were held in place by a spring clip fitting into the notch. These are differences of detail, and need not now be considered. It is of more importance to trace the methods of operation.

In the Edison board, while the majority of horizontal bars are free for use as connecting strips, two of them are appropriated for specific purposes. The seventh bar is connected to the operator's telephone, the twelfth bar to the earth. In order that each subscriber's line may be complete, so that the exchange may be called, the plug must be normally in contact with the earth bar. Where the fall of the indicator shutter shows that a subscriber is calling, the plug has to be taken out of the earth bar and set into the instrument bar. When the number of the subscriber required has been ascertained, the peg has to be again removed from the seventh or instrument bar and set into one of the other horizontal bars which may be unoccupied. The peg of the called subscriber is also removed from the earth bar and placed in contact with the horizontal bar already selected. The two subscribers' lines are then connected. No provision being made for ringing from the exchange, one subscriber calls the other. This act throws down both indicators, which the operator must replace.

In the Bell board the work is divided between two operators. One does the switching, the other the talking with the subscriber. The switching operator connects the subscriber with the table of the talking operator, who, upon learning the number required, instructs the switching operator to make the necessary connections, which he does with the flexible cords. Without detailing the various movements, it will suffice to draw attention to one point. The subscriber's line comes to a spring, and the spring rests on a contact. The contact is the earth. The plug with which connection is made removes the line from the earth, and that is one step in advance of the Edison board. A line needed to be broken and diverted. These requirements were separately met in the Edison board, while in the other case they were combined. In the development of telephone switchboards that is equivalent to making two blades of grass grow where one grew before.

The cordboard offered facilities in this direction which the pegboard did not. According to the Telephone Convention Report for 1883 (p. 33), plugboards were the most popular in 1881; there being among the companies reporting to the association 11,904 subscribers on plugboards, and 8,893 subscribers on cordboards. By 1882 the conditions were changed, cordboards having 16,799 subscribers and plugboards 12,755. By 1883 the change was shown to have some substantial foundation, the figures being 21,432 for cordboards and 12,763 for plugboards. These figures do not refer to the identical boards illustrated to the meeting, but to all varieties of their respective types. They show that the intervening period was sufficiently active and exacting to have had some influence in deciding which was the fittest type of board for survival. That type was the cordboard, and it may be desirable now to trace briefly the development of the most generally used form of cordboard for small exchanges.

For this purpose it is necessary to call your attention to a patent specification which I think may be called a classic in this branch of invention. It is dated November 29, 1879, numbered 4,903, and granted to C. E. Scribner. In the "universal jack-knife switch" there are the indicators and the individual connecting springs for the lines as in the Bell board, but arranged in distinct groups, and there are the horizontal connecting bars also. Although there are these points of similarity, there are improvements over each. In the Bell board the line comes to the indicator first, then through the spring-jack to earth. Inserting a plug into the spring-jack cuts off the earth, but the indicator

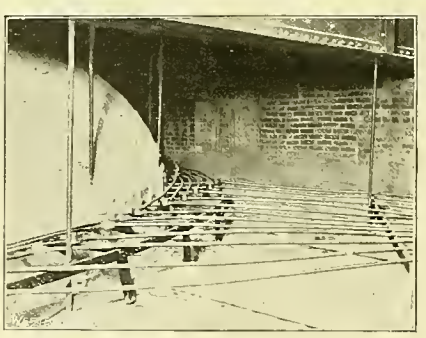

FIG. 5. THREE-PHASE WIRING AND LIGHTING FIXTURES IN CONCORD, N. H.—EXTERIOR WIRING FOR COURT-ROOM DOME.

remains in circuit. Scribner cuts off both drop and earth in one operation by the simple device of putting the drop on the earth side of the jack, so that both subscribers' indicators are cut out of circuit instead of both remaining in. This is another step forward. The horizontal connecting strip is also improved by being turned round when engaged.

In connecting the two subscribers' lines together, two cords were used, as in the Bell board, each cord having a plug at either end, and the calling subscriber's line was connected to the revolving bar by one cord, and the same revolving bar connected to the called subscriber's line by the other cord. But as both subscribers' indicators were cut out, some provision must be made for the reception of a disconnection signal. This switchboard brings us one more step forward in the inclusion of signaling apparatus in the connecting cords or bars at the central office, and I would invite particular attention to the way this was done, because I think that it has been overlooked by some writers on telephone subjects. To each bar an indicator was connected in derivation, one end of the coil being connected to the bar, and the other to earth. The specification says: "The earth connection of the coupling

1. Read before the Institution of Electrical Engineers, London, January 24, 1895.

bar being through the coils of a magnet in no way interferes with the telephonic conversation;" which remark you will apply to the lines then prevalent with the electro-magnet then used. The clearing-out drop was not mounted on the switchboard—there was a relay operating an audible signal; but a complete indicator is allowed for in the description. Although a clearing-out drop was connected to the central office circuit, the operator's telephone was still at the extremity of a separate cord, and needed to be plugged into or out of a spring-jack in order to be brought into or out of the subscriber's line circuit.

The circuit made up by the operator for the purpose of joining two subscribers' lines consisted of two cords and a bar. There were the operations of putting two plugs into spring-jacks and two plugs into a bar. If the two cords were permanently attached to the bar, a part of the work would be saved. If, further, the operator's telephone were to be switched into or out of the line by a key, the operations required would be more quickly performed.

The rapidly increasing numbers in the exchanges rendered the bar system impracticable, whether of the fixed or revolving pattern. The bar therefore was discarded; the cords were lengthened, joined together, and the circuits so arranged that the ringing battery or generator, the operator's telephone, or the clearing-out drop, could be brought into use as required by the easy manipulation of keys placed in the most suitable position. This stage was reached in the switchboard now generally known as the standard switchboard. Its development dates from 1879, the germ being found in the universal jack-knife switch. The keyboard was an entirely new feature in switchboards, and was the logical result of the combination of connecting cords and plugs with clearing-out drops. The arrangement of the parts was strictly decimal—an obvious advantage hitherto neglected. Some of the keyboard circuits, being also applicable to multiple boards, were patented here, such as in specification No. 3,116, 1883, whereby the operator's telephone is in circuit immediately a plug is inserted in a jack. This is inserted by means of the other plug of the pair resting on a plate to which the telephone is connected, and accounts for the metallic heel-piece to the plug which then came into use. This board has been greatly altered in the parts of which it is composed, but in general arrangement and in the methods of operation very little, if any, improvement has been found possible, and for small exchanges it has been extensively adopted, or imitated substantially in its original form. Sufficient thought had been bestowed upon it to enable it to assume a form based on sound principles. The board was upright, with a shelf for keys and plugs. What was needed to be seen or handled was placed in the front of the board, but nothing else. All the connecting wires were placed at the back of the board, so that they could be attended to by the mechanic without interrupting the operator. The importance of this arrangement is very apparent now.

The introduction of the standard board probably accounts for the figures which I have already referred to as indicating the change in general estimation of plug and cord boards. Although the flexibility and concentration available with cords must have led to their general adoption, it is of interest to note how the placing of the operator's telephone into the cord circuit overcame one of the principal objections to cords. The existence of a broken cord must become known to the operator in the process of making a connection, and it could therefore be laid aside for another.

While the standard board remains the most effective of what may be called "simple" switchboards; that is to say, those in which a subscriber has only one spring-jack or point of access to his line; it also forms in its constructive and keyboard arrangements the foundation for the more elaborate multiple board, which, although previously invented, soon borrowed the general disposition and the simple and practical mode of operation of the standard board.

The multiple board, as originally designed, employed the Scribner "jack-knife" switch, which was never used in England, I think. It consists of a metallic frame, with a blade pivoted at one end and resting on an insulated stud at the other. There are two holes. These are for plugs—one for the instrument plug, and the other for the connecting plug. The insertion of either plug will lift the blade from the stud and so break the earth and indicator contact. The importance of space on the front of a switchboard led to a change in the jack-knife switch at an early date. Instead of lying lengthwise across the front of the board, the blade or spring followed more after the fashion of the spring in the Bell board—*i. e.*, having its length from the rear to the front, instead of from side to side. Though entirely different in appearance and construction, the modified switch was the equivalent of the jack-knife electrically. While previous springs, as in the Bell board, were operated by flat plugs, the designer of the new spring-jack retained the round plug as used by Scribner, altering the shape so that it should be retained in position by the tension of the spring. This spring-jack and plug remain in their essential features the patterns now in use. The adoption of a round instead of a flat plug may seem a small matter, but it would require a very considerable amount of calculation to estimate the aggregate saving in time and money which has resulted theretrom.

It may be of interest to state that the inventor is J. C. Warner, one of the oldest of the expert staff of the Western Electric company. Mr. Warner designed not only the jack, but also the indicator used on these switchboards. He brought to the design of telephone apparatus a wide experience, and you will probably agree with me that he graduated in a good school. Born in London in 1822, Mr. Warner became engaged in the manufacture of electrical apparatus in the workshop in which instruments were made for Cooke and Wheatstone. Subsequently he made some apparatus for experimental use by Morse on the line between Baltimore and Washington.

Having traced the simple swithboard to the stage in which it is supplied with an indicator and a spring-jack for each line, with pairs of plugs and connecting cords in whose circuit are placed convenient keys whereby the calling generator and the operator's speaking instruments can be quickly brought into circuit with either subscriber's line, consideration may be given to the more elaborate outfits required for large exchanges. It was on such a foundation that the multiple board was practically introduced, though it was designed at a much earlier period, and was being gradually matured.

For the purpose of illustrating the prior condition of affairs, I will recall attention to the Edison board, which, as I have mentioned, was installed in 1879. About the middle of 1880, the Edison company amalgamated with the Bell company. Some recommendations were then made for alterations in the switching arrangements. It was suggested that the operating should be divided between talking operators and switching operators, as in the Bell board, with the difference that the subscribers' liens should be continued to the talking table. Seventy-five lines were to be assigned to one talking operator, who was to be assisted by two others as switching operators. On the fall of an indicator the talking operator would depress the key pertaining to that line, would ascertain the number required, and then instruct the switching operator to make the required connections. If it should happen to be with a subscriber in another section—say 200 in the third section—the switching operator would fix the peg in his own board, and then go to No. 3 board, fixing there the proper peg to connect No. 200 of that board with No. 1 of his own, using therefor the special connecting strips set apart for connecting each and every board individually with the other. It was asserted that "by this means an exchange can never become unwieldy." How soon that anticipation became falsified only those concerned with the practical work of exchanges are able to appreciate. The method of connecting separate boards by special "strips" or bars was very much improved by "transfer" systems, as they were called when applied to standard boards, but by dire experience it became evident that the rapidly growing exchanges could not be satisfactorily or economically conducted when there was only one connecting point to a subscriber's line, and when communicating conductors had to be made up by sundry operators to enable a connection to be made.

I will show you an attempt to provide a remedy. It is recorded in a United States patent (No. 252,576), which was filed January 7, 1881, and from the wording of the specification I gather that the system was in actual use. The subscriber's lines passed through a number of boards on which (it was on the "Law" system and easily done). The subscribers' numbers were inscribed on a signal-board placed in a central position. These numbers could be obscured by shutters. When a subscriber was put through, the operator would instruct the attendant at the signal-board to obstruct the number. On disconnecting, the reverse instruction would be given. Before connecting a line, the operator would look at the signal-board to see if the subscriber required were disengaged. This method was crude, but none the less deserves commendation as an attempt to overcome the difficulties which were becoming apparent. It is a multiple board without a test system. I cannot claim it as a link in the chain because, as a matter of fact, the solution of the problem had already been in the Patent Office for over a year. It is in the specification to which I have already called attention—Scribner's, November, 1879. Numerous connecting points, without some prompt and certain means of indicating whether the line were engaged or disengaged, would be a remedy worse than the disease. A triangular conversation would be likely to produce more bad blood than a triangular duel. Now, in November, 1879, the exchange system in London had just commenced. It had certainly had a longer start, and assumed somewhat larger proportions, in the United States, but even there the necessity was not so great as to give rise to the idea which this invention conveys.

The idea is really twofold—firstly, to enable one operator, while answering the calls of a given number of subscribers, to connect them with any other subscriber in the exchange without requiring the aid of any other operator or making up any combination circuit; secondly, to inform the operator of the condition of the line with which connection was desired—whether engaged or disengaged. The first part of the idea was attained by increasing the number of spring-jacks indefinitely according to the number of operators required to carry on the work of the exchange. The second part of the idea is really the establishment of an information bureau in connection with every line, the bureau being supplied with information automatically, and giving up its information on demand. Three ways are shown for giving this information: one is a visual signal electro-pneumatically operated; another is the provision of double connecting blocks; the third forms the foundation of the multiple-test system as practically developed. In the diagram shown to the meeting only the local or test circuit is shown. The jack-knife switches illustrate two subscribers on three boards. When a plug is inserted in a jack a spring, insulated from the blade, and by the operator arrived at the last-mentioned stage be-

FIG. 4. THREE-PHASE WIRING AND LIGHTING FIXTURES IN CONCORD, N. H.—DOME LIGHTING IN COURT-ROOM.

connected with one pole of a battery, is brought into contact with a stud, which is connected by a line to similar studs on every other jack pertaining to the same subscriber. Over the studs are finger keys connected with the other pole of the battery. Depressing the key will close the local circuit and operate a bell or signaling instrument if the line is engaged, otherwise not. The information required was "engaged" or "disengaged." A local circuit partially closed at one jack would be completely closed by depressing the finger key at another jack of the same line; then the line was engaged. Depressing the finger key at one jack would not close the local circuit unless some other jack of the series had a plug inserted in it, then the line was not engaged. Here was no talking between operators, no passing of calls, or making up of lines. The information was obtained as the result of testing a local circuit, and hence the term "test circuit" as applied to multiple switchboards. I believe that the invention in the exact form shown in the 1879 specification was only used in one exchange; but it was the subject of continued experiment and study, and was being systematically developed so that it might be ready when required. At this stage it had a test circuit entirely distinct from the line, and a test key for each jack. We might reasonably expect that the development would be likely to take the form of simplification, and such was the case.

Before I relate briefly the line of that simplification I would like to remind you that we are dealing with a comparatively early period of the telephone industry—not too early to appreciate the advantages of metallic circuit lines, as contemporary records show, but a time when the commercial side of the telephone exchange business practically settled the nature of the lines to be run, so that single lines were the rule. It is possible that some may be surprised to hear that metallic circuit multiple boards are provided for in Scribner's 1879 patent, the necessary modifications to the apparatus being clearly described so as to adapt them to metallic circuit use; the plan would not be considered satisfactory now, as only one side of the indicator is cut out. At any rate, switchboards were required to be developed for single lines, and this enabled a simplification to be proceeded with. The separate test line gave way to a much simpler contrivance, which was communicated by C. E. Scribner and patented here on June 22, 1883 (No. 3,116).

To illustrate this improvement I must again refer to the spring-jack already described in connection with standard switchboards. It consists of three parts—a frame, a spring, and a contact stud. As a standard board jack the spring is in metallic contact with the frame. To make this jack suitable for use on a multiple board it is only necessary to insulate the spring from the frame. Place a number of these jacks in a row, connect a subscriber's line with the spring of the first jack—the spring rests on the contact beneath—connect the contact with the spring on the first jack, and you thus have a line through the board which may be broken at any jack. This is the subscribers' line wire, which continues from section to section through the hammer and anvil contacts of the jacks, which contacts are mechanically sustained by the frame, though they are electrically distinct from it. If all the frames of a series of spring-jacks are connected together by another wire, you have two lines through the board—the subscriber's line and the test line. Insert a plug in any spring-jack and you break the main line, but connect together electrically the spring and the frame. In other words, the test line becomes a branch of the main line. The main line has an earth on it. Touch the frame of a jack (which is electrically a part of the test line) with a plug forming the extremity of a partial circuit, including a signaling instrument and a battery earthed at one pole, and it will be seen that you complete the test circuit if the line is engaged and you don't complete it if the line is disengaged. The same result is attained as by the 1879 system, but by a much simpler arrangement of parts.

Another simplification was made in the apparatus for testing. The finger key contacts on each jack (1879) were so many branches from one side of a battery. Instead of having numerous branches, the same effect could be attained by having one movable branch. This was attained (1883), one separate test plug being provided for each operator. The test plug shown to the meeting is in the form of a thimble easy of application to the frame of a jack. The drawings show a bell, or buzzer, as a signal, but a "telephone" is suggested as an alternative, and it needed only a slight change to make a still further improvement by discarding the separate testing plug, making the operator's telephone the signaling instrument, and the connecting plug the testing medium. On touching the frame of a jack with the connecting plug the operator hears a click in her telephone if the line is already engaged. This method of test-

fore the multiple board was put into practical operation in England, and so it remains to-day, although the electrical circuits are very different.

The early multiple boards were very much like overgrown standard boards, the cords being below the keyboard. As then designed the cords were not long enough, and so in the Liverpool boards (the first used in England) the cords were overhead and longer.

After the Liverpool board, an important change was made in the introduction of what is variously called the "local section," or the "answering jacks." The latter term seems preferable, since it corresponds so well to the answering plugs used with them. The Liverpool board was arranged for 200 subscribers to a section, the spring-jacks being of the Warner pattern, mounted on wood. The jacks being arranged in blocks of 100, placed in numerical order, it will be seen that, taking, for example, the first section, the 200 subscribers' jacks of that section were all at the operator's left-hand end of the board, and all three operators had to reach those two jack panels. This difficulty was met by adding yet another jack for each subscriber—the answering jack. These answering jacks were spread out along the board, so that the answering was more promptly done and an operator had not to reach past another in responding to a call. This plan was first introduced in the multiple board shown at the Philadelphia Electrical Exhibition. There was a further modification in the design, which has sometimes been called a "double-deck" arrangement. At the top of the board were the general jacks, then the clearing-out drops, then a shelf containing half the plugs—one of each pair—then the indicators, below them the answering jacks, then another shelf with the remaining plugs and the keys. This double keyboard arrangement has been retained, but the disadvantage attending the separation of the plugs became speedily apparent. Even so slight a change in the relationship of the plugs slowed down the operating, and their separation also involved a risk of using the wrong plug for completing a connection. The separation of the plugs was therefore abandoned. The plugs were both placed on the upper shelf, the clearing-out drops and the answering jacks changed places, and this arrangement of parts is still retained. The arrangement of indicators and jacks was rendered uniform in all sections—a great advantage in changing operators from one section to another.

Another problem was met in this 1884 board. Exchanges were growing larger and larger. More subscribers had to be provided for. More spring-jacks had to be placed on a section, the face of which could not be enlarged. The limitation of size in a multiple section is easily understood. It is the limit of reach of the outstretched arms. That is about six feet. The height is a little more variable, as the reach in that direction does not interfere with other operators. If, therefore, it becomes necessary to put an increased number of units in a given area, it can only be done by reducing the size of the units. A reduction in size of parts was then made, and further reductions have since been made. So far as designs and patterns are concerned, the size has been reduced so as to attain a capacity beyond the requirements of any exchange under existing conditions.

With the reduction in size came a radical change in the method of construction. Instead of each jack being made separately and then mounted on a base, the base and the jacks were incorporated. Twenty jacks were made into a strip, which was a combination of metal springs and insulating material. This was simply a constructive change, carefully carried out so as to make no change in the method of operation; the same round plug being used, and the same bush, carefully shaped so as to make the act of testing easy and the completion of the connection quick. Although various changes in size and construction of parts were introduced after 1884, the general design and the circuits of the board were not materially altered for some years.

During these years the telephone exchange business had been very rapidly extending. Long-distance lines were being erected; overhead wires in some places were having such violent hands laid upon them that burial became necessary; the development of electric lighting and traction and the production of powerful currents disposed to extend unduly their sphere of influence—all these causes had their effect upon telephone switchboards. Metallic circuit service had to be provided for, and as the change must necessarily be gradual mixed service had to be given first. This requirement was met with a minimum of change in existing apparatus. The earth circuit multiple had in the test wire a line which could be made available as a metallic return by a slight change. The engaged test, as you will recollect, depended upon there being an earth connected to the test circuit. Put an earth on a metallic circuit line when engaged, leave it off when not engaged, and you have the necessary dual condition for negative or positive information. This earth was attached to one or both limbs of the cord circuit, and formed a part of the local circuit, which was completed by the plug in the act of testing. Between the earth and the cord is placed a retardation coil, which prevents currents of high frequency from either entering or leaving the telephone line, but is no bar to the simple battery current required for the test. This may be termed a transition board, but it is a very practicable one.

The importance of accurately balancing the talking lines, as well as the certainty of the test signal, showed the advisability of going back to the original 1879 plan of using a test circuit entirely distinct from the line circuit; and I think that this importance was insisted upon by none more strongly than

FIG. 8. THREE-PHASE WIRING AND LIGHTING FIXTURES IN CONCORD, N. H.—AN ELECTROLIER.

English telephonists. But here a difficulty presented itself. Experience showed that as the jack contacts in a board increased, so did the troubles due to poor contacts between the line spring and its contact stud. Supposing a 4,000 line board of normal dimensions, on the single or mixed circuit system, there would be 21 jack contacts in the line. To adopt the system of cutting out the indicator with metallic returns, and to employ a separate test circuit as well, would require three contacts in each jack; so that a 2,000 line board of such a character would have 33 jack contacts, or about 50 per cent. more than a single or mixed circuit board of twice its number of subscribers.

With the general improvement in the quality of external lines, it is obvious that it would not do to put into the switchboards apparatus of such a design as would lead to defects in the very portion of the circuit under the electricians' immediate control. This consideration led to another new departure — the last to which I shall call attention—and that is the arrangement of the subscribers' lines in an unbroken circuit throughout the board, with no contacts whatever in the jacks, and the automatic restoration of the indicator. The branching of the line contacts and the use of bridging indicators in themselves are no new departure in switchboards. The post-office use branched line contacts and bridging indicators. It is of interest also to note that their indicators need no manual restoration, but the means by which these results are accomplished are not available for the methods of exchange working generally adopted. New means had to be invented. The idea had been "in the air" for a considerable time, but, as usual, lacked the final touches to make it practicable, like the invention of the telephone itself. I will indicate one of the principal difficulties. Let us suppose that two subscribers are connected, say No. 1 and No. 3,000, the connection being made at No. 1 board. The indicator of No. 3,000 is at the other end of the room. On sending a clearing-out signal, both indicators would drop unless cut out, as in the older system, or prevented in some new way. One of the earliest attempts at meeting this requirement was in Scribner's English patent No. 20,099, December 9, 1890, which was one of the preliminary steps in the branching system so far as the jack contacts were concerned. The desirability of the separate line for test purposes, however, helped the solution. This test circuit might very well bear an additional burden. The application of a locking device on each indicator, and controlled by a battery in the test circuit, was the first stage. The locking was a necessity, but it is only natural that it should have led to the restoration of the shutter to its normal position, thus rendering another of the switchboard operations automatic. The first design for the circuit of this board was by Mr. Bell, one of the switchboard experts of the Western Electric company. But, in addition to the Western Electric staff, the design of the board was so fully discussed by the switchboard committee appointed by various telephone companies, that I am unable to give, as I should like to do, the individual credit for details.

The indicator spring-jack and plug are illustrated in the diagram. The indicator consists of two coils mounted on opposite sides of a plate. The longer coil is the operating coil, and it is connected in bridge across the line. The short coil is the restoring part, and is connected in the test circuit. The operating coil when energized attracts the armature, to which is attached the arm holding up the shutter. The shutter opens out if the test circuit is incomplete. But if the test circuit is completed by having a plug in any jack of its line the restoring coil is energized and the shutter prevented from opening. The spring-jack has three springs, a bush and a testing ring. The short spring is the contact from one limb of the line, the bush the contact for the other limb. The two springs of even length are the contacts for the test circuit. The plug has three contact surfaces. The point engages with the short springs, the sleeve makes contact with the bush of the jack, and the ring between the sleeve and the tip connects together the two test springs, thus closing the test circuit and restoring the indicator. The advantage of this construction is that there are no make-and-break contacts in the jacks whatever, and in this switchboard we reach the highest development so far in combining the most perfect talking circuit, a mechanism free from the liability of previously existing troubles, and at the same time a reduction in the manual work.

Comparing 1880 with 1894, it will be observed that in an exchange to which I have already referred, having about 300 subscribers, it was considered necessary to provide a minimum of one operator to 25 subscribers. In the latest London switchboard to which I have referred, fitted for over 3,000 subscribers, there is a maximum provision of one operator for 50 subscribers, and in other places on boards of the same system 100 subscribers are attended to by one operator. The number of operators to subscribers is entirely dependent on the load line of the exchange, and there will be necessarily great differences, according to the nature and number of the calls. It will therefore be seen that the development in switchboards has followed the general law of enabling more work to be done with less labor.

The latest switchboards fitted in London are on the branching system, and it is needless to say that they contain many features originated by those who have the responsibility of their fitting up and maintenance. I hope the omission of detailed information on these points and many others will not be construed as an absence of recognition of the value of the work done outside the limited number of persons to whom I have referred.

I have advisedly limited this outline sketch to a record of what has been accomplished in the line of switchboards whose merits are to some extent guaranteed by general recognition, and I have also advisedly omitted any reference to complex problems, such as trunking systems between separate exchanges. I do not propose to anticipate the result of experiments now in progress, or presume to speculate on the possibilities of the future, but I would like to be permitted to make one comparison of the present with the past. The progress of telephony has been the subject of some comment. There are differences in that progress—of course local circumstances and conditions will mostly account for them—but let us make a comparison without going away from home. Between the setting up of the first and the last telephone switchboards to which I have drawn attention, there has been an interval of 15 years. We are accustomed to regard 1837 as the date of the introduction of the electric telegraph, although, of course, active work in a commercial way had not then commenced. Fifteen years after 1837 there was no public telegraphic communication between London and Brighton. The charge for a message of about 100 words to Liverpool was £5. These charges were regarded as high. "But no doubt," says a contemporary record, "these will be diminished when the company's arrangements get more matured, and they are better able to transact any amount of business which may be offered to them. The directors appear to be acting on the policy of checking, rather than encouraging, the use of the telegraph by the public until their establishments are everywhere in perfect working order." Now the most maligned telephone companies have never, I think, been accused of turning away customers. Notwithstanding the novelty of their business, they have been able to invite additions instead of requesting withdrawals. That undoubtedly was largely due to the extent to which the telegraph had prepared the way. Men experienced in the laying of lines and the management of instruments were already obtainable; but there is one direction in which there had been no previous experience of any moment, and that is in the methods and mechanism of intercommunication. The invention of the telephone was defined by judical authorities as the creation of a new art. The greatest utility of that new art has been found in the development of that means of intercommunication, the exchange system, and the most important feature in the exchange is the switchboard. It has been a very easy task for me to pick out landmarks and put them together to show the route which was probably traversed; but the

FIG. 6. THREE-PHASE WIRING AND LIGHTING FIXTURES IN CONCORD, N. H.—ROUND GROUND-GLASS FIXTURES IN ART GALLERY.

members of this institution are too familiar with such matters to need reminding that it was by no means so easy a task to devise and manufacture or to set up and maintain in working order intricate apparatus, which should keep ahead of the ever-growing public demand for telephonic communication. I think, however, there can be no doubt that but for the invention and adoption of the multiple switchboard there would be some parallel between telephonic communication now and telegraphic communication at the date I have mentioned; its progress would have been checked by the impossibility of doing the work required.

## Electric Traction in Baltimore.

A correspondent of the *Chicago Tribune* has been investigating the electric railway systems of Baltimore and vicinity. He writes: There seems to be no limit to the development of electrical railroads in this city and vicinity. Mile after mile of trolley wire is going up in every direction. Soon every suburban roadway leading out of Baltimore will have electric lines on it running to all the towns within a distance of twenty miles and even to Washington.

With the extension of the lines comes the consolidation of a number of them, until now the City & Suburban company, the Central company, the City Passenger railway and the Traction syndicate control all the lines in the city and suburbs. By the purchase of the Lake Roland elevated lines the City & Suburban company, which is also constructing a line to the Maryland Steel Works at Sparrow's Point, on the Chesapeake bay, has increased its trackage to eighty-eight miles, the largest of the four companies. The Traction syndicate, however, is likely to absorb the old City Passenger lines, which will enable it to do away with one or two parallel lines. Rapid transit has paid the car companies well in Baltimore. Everybody rides now, whereas under the old slow horse car system nearly everybody preferred to walk. The companies are required to pay 9 per cent. of their gross receipts as a tax for maintaining public parks. The totals of park tax paid last year—$224,065.02—indicate gross receipts of $2,489,500.22. At a uniform rate of five cents for each passenger these gross receipts would be the revenue from 48,156,057 passengers in 1893 and from 49,700,004 passengers in 1894.

Taking into consideration the unpaid taxes on railway receipts in the annex, it would be a fair estimate to say that the number of passengers carried in 1894 by all the companies would approximate 55,000,000.

Several of the recent deals have been on a big scale. The City & Suburban company, for instance, paid $1,250,000 for the Lake Roland elevated, which runs to the first suburban town in the state. The capital stock of the Lake Roland road is $1,000,000, and in addition there is a mortgage of $1,000,000 on the property. The City & Suburban assumes the mortgage, and in addition has paid $250,000 for the stock, thus practically paying $1,250,000 for the road.

The terms of the deal were agreed upon in New York by Nelson Perin, president of the City & Suburban company, and Samuel M. Jarvis of the Jarvis-Conklin syndicate, which controlled the stock of the Lake Roland road. The affairs of the Jarvis-Conklin syndicate being in the hands of receivers, it was necessary to obtain an order of court in New York authorizing the sale.

At the time the bonds on this road were issued the Jarvis-Conklin syndicate put in the hands of Alexander Brown & Sons, who floated the loan $100,000 to pay the interest for two years. This sum has been expended except $25,000, which will be used in paying the half-yearly coupons due March 1st. It is also known that of the total issue of bonds many still remain in first hands.

City & Suburban officials say that before closing the deal they made a careful examination of the earning capacity of the Lake Roland road, and when operated in connection with the City & Suburban system conservative estimates place the earnings at $60,000 a year. This assures the interest on the bonds and leaves a surplus to apply to the stockholders. The bonds bear interest at 5 per cent. and the fixed charges on the road will therefore be $50,000 a year.

The Traction company proposes to pay off its floating debt by the loan just negotiated through the Maryland Trust company. The Traction company has executed a collateral mortgage trust loan for $750,000. The mortgage is to run five years and will bear interest at 5 per cent. Under its terms coupon bonds for $1,000 each will be issued to the full amount of the loan.

The new loan is a direct obligation on the Traction company and is secured by the deposit in trust of all the bonds of the Pimlico and Pikesville railway, amounting to $350,000, and of the Walbrook, Gwynn Oak and Powhatan railway, amounting to $100,000. In addition, all the stock of the two first named companies and at least 70 per cent. of the stock of the last named company are also deposited with the trustee as security.

With the loan it is intended to pay off the floating debt of the Traction company, to pay for the Gwynn Oak road and Gwynn Oak Park, and to furnish the Traction company with the funds necessary for improvements and extensions.

The Traction company in April will for the first time open its lines with a practically complete rapid transit system. The Gilmor and Fayette street line, which was one of the finest laid cable roads in the world, has been changed to the trolley system, and the Tractioncompany now only has one cable road in Baltimore.

A novel arrangement has been effected between the Lake Roland Elevated system and the Western Maryland steam railroad. To avoid paying the Pennsylvania Railroad company $80,000 a year station and tunnel charges, the Western Maryland will slightly change its route of entering the city. Work will begin next month on a new passenger station on North avenue. Here all passengers for the central, southern and eastern sections of the city will be transferred to theelectric elevated and whirled right in to the city hall.

The Washington & Baltimore Boulevard company and the Edmondson Avenue, Catonsville and Ellicott City railroads are to be consolidated into the Washington & Baltimore electric railroad. The grading of fourteen miles of the Washington section is now under way. B. N. Baker, one of the parties largely interested, states that New York banking houses are ready to take all bond issues that may be made, and the capital needed can be obtained immediately to complete and equip the system. Most of the route is along a private right of way, and public highways are only utilized in the vicinity of the terminal cities. The distance from city limit to city limit is about 27½ miles.

"The relation of the Elkins-Widener syndicate to this project," said Mr. Baker, "is this: They may be stockholders to a certain extent, but will not hold a controlling interest. We shall retain over one-half of the stock absolutely.

"While New York capital may be invested in the bonds, the system will be built, operated, and controlled by Baltimoreans. Arrangements will be made with the Baltimore Traction company to transfer passengers from the Baltimore terminus to any part of the city over its lines."

The road complete will cost about $100,000,000. It will be operated by the block signal system and twenty 100 horse power motors will cover the distance from city to city in about thirty-five minutes. The route traverses an attractive section and the promoters believe that in a few years suburban homes will be built along the entire line.

J. W. Marsh, vice-president and general manager of the Standard Underground Cable company of Pittsburg, was in Baltimore recently in consultation with the promoters of the Susquehanna River Electric company. Mr. Marsh has accepted the presidency of the last named company and will be elected at the next meeting of the incorporators. He is closely connected with the Westinghouse company and is one of the counselors of George Westinghouse. Surveys of the route to be followed by the Susquehanna River Electric company are now being made by a corps of engineers. The company will be capitalized for $6,000,000, of which $3,000,000 will be in stock and about the same amount in 5 per cent. interest bearing bonds.

Mr. Marsh says that the works will be able to supply motive power and lighting facilities to Philadelphia, Wilmington and Baltimore.

## Sad Accident in Milwaukee.

On February 4th a trolley car loaded with passengers ran into an open draw on the Russell avenue line of the Milwaukee street railway at the Kinnickinnic bridge. The passengers were all dumped into the icy water. Hundreds of people were on the spot at once, and the people were fished out as fast as they appeared on the surface. The motorman and two women passengers were drowned. There were eleven persons on the car, five of them women. Several of the passengers were slightly injured. Motorman Kennedy did not, apparently, try to stop his car until within five feet of the draw. He then set the brake, but the car slid into the river. It plunged headforemost on the ice and stuck there, half in and half out of the water. The coroner's jury found that the motorman was unable to check the speed of the car by brake because he was numb with cold.

## Reporting Defects in Street Lighting.

The allowance to be made for lamps not burning is often the cause of dispute between city authorities and central station companies. In Cincinnati much difficulty has been encountered in adjusting the conflicting claims of the city and the Edison company growing out of a dispute of this character. The city claims that if fines were assessed against the Edison company for all the outages of arc lamps reported by the police, the city would recover at least $3,000. These fines cannot be assessed because the contract between the city and the company provides that as soon as outages are discovered by the police, they shall be reported to the company. General Manager Beggs claims that this is not done. Long lists of outages of the night before are sent in the morning to the city electrician's office, while but a small proportion of these outages are reported by the company. In December 2,400 hours of outage represented the difference between the Edison and police reports. Under the circumstances Mr. Cabot, the city electrician, was compelled to take the company's statement.

He now proposes to put an ink register at police headquarters, and Mr. Beggs has agreed to put a similar instrument in the company's main office. When an outage is reported at headquarters word will be transmitted to the Edison office. An "O. K." will come back and be recorded on the register. Thus an accurate record will be had, and the company can at once repair the burnt out connection or whatever has caused the outage. It will be compelled to pay whatever fines the outages occasion, but by repairing breakages at once will save many hours of outage, and the city will be better lighted. As Mr. Cabot says, "The city wants the light, not the fines."

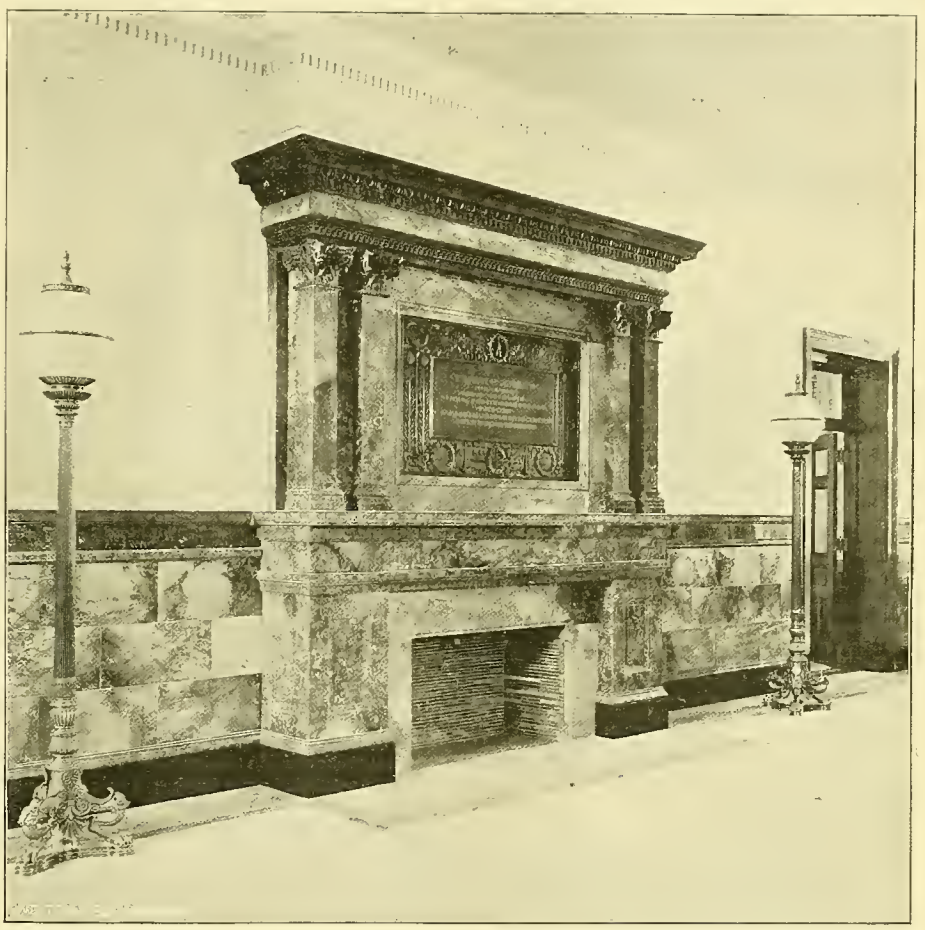

FIG. 7. THREE-PHASE WIRING AND LIGHTING FIXTURES IN CONCORD, N. H.—TEN-LIGHT STANDARDS IN CORRIDOR.

## Withdrawal of Patent Cases From Issue.

The commissioner of patents has issued a notice to inventors and patent attorneys that hereafter all amendments proposed to allowed applications which involve a withdrawal from issue, and all petitions and requests relating thereto, shall be filed with the docket clerk, J. M. Emory, and transmitted by him to the primary examiner for report. If the examiner shall report favorably to the admission of such amendment, the matter will be laid before the commissioner for immediate determination. If the examiner shall report unfavorably, the case will be docketed and will be heard and decided by the commissioner in regular course unless good reasons shall appear for immediate action.

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ONE of the most important documents that have been published in connection with the Brooklyn strike is the letter of Justice William J. Gaynor to the State Board of Mediation and Arbitration, in which he calls attention to the condition of affairs in Brooklyn and points out the causes that led up to the great conflict between the companies and their employes. In this letter Justice Gaynor emphasizes the facts to which we have referred several times in discussing this and similar controversies. It contains a warning which should be heeded by the men who have made fortunes out of public franchises. The community will suppress every outbreak of disorder, but every time that the occasion comes for such suppression the reaction against the corporations becomes stronger as well as the resentment against the recklessness of labor leaders and the indignation against mobs. As a consequence the drift toward state ownership is becoming more and more rapid. All companies holding public franchises must recognize these facts and guard against a repetition of these difficulties.

AMONG the ambitious electric railway projects now under discussion that for the construction of a line from Haverhill, Mass., through the White Mountain region of New Hampshire and the province of Quebec to the city of Quebec is one of the most interesting. Such a railway would be about 280 miles long, 180 miles being in the United States and the remainder in Canada. It would be essentially a scenic and tourist's route, and the financial returns must necessarily be carefully considered. Over a large portion of the route the traffic would be very small except in the summer months, but, on the other hand, the electrical system offers comparatively inexpensive construction, and an effort would undoubtedly be made to utilize in the power houses the abundant water power of the region. The scheme abounds in interesting possibilities. If carried out it will afford a delightful trip through some of the finest scenery of New England without the annoyances of steam travel.

IT is a real pleasure to encounter such excellent, thorough construction and such beautiful, well adapted lighting fixtures as are shown by the illustrations of the electrical equipment of the new state library building in Concord, N. H., as presented in this issue. The fact that the three-phase current is used gives added interest to the installation and makes it of particular value to the electrical student and the electrical contractor. The construction and equipment of American public buildings are too often only a reproach; but New Hampshire appears to have one building which, in its electrical applications at least, leaves nothing to be desired.

THE new rule governing elections of the Institute is presented elsewhere, and members who are interested in the advancement of the organization should give the matter of the selection of officers careful attention. It is to be presumed that most of the members desire a change by this time. Many of them wanted it a year ago, but at that time there was no organized effort made by the opposition, while the clique in control made a careful and thorough campaign. It is not known whether the present officers desire further vindication or approval of their administration. Unless it is the desire of the Institute to confer a life tenure on the present incumbents, it would be well to make a change while there is yet something remaining of the organization aside from the personal machine for the aggrandizement of the spirits now in control.

NUMEROUS isolated cases have been recorded in which invalids desiring to hear their favorite preacher have been enabled to listen to a sermon transmitted by telephone from the pulpit to the sick room, but it remained for a southern preacher to take advantage of telephony for securing a large "audience." On last Sunday, according to the press dispatches, the Rev. J. B. Hawthorne, pastor of the First Baptist church of Atlanta, Ga., preached a sermon over the telephone, and all in Atlanta, Athens, Griffin, Macon and Madison who had telephone connections were enabled to listen to the discourse without leaving their homes. Some such arrangement would have been hailed with delight by many northern church-goers on last Sunday, and in fact on several preceding Sundays when the inclemency of the weather prevented many from occupying their accustomed places of worship. It is not expected, however, that this plan will be encouraged by the clergy generally.

AN interesting paper on "The Origin and Development of the Telephone Switchboard," read by J. E. Kingsbury before the Institution of Electrical Engineers at London, is presented elsewhere in this issue and is worthy of special note. Very little is known by the general public, and not much more by the electrical fraternity aside from those directly engaged in telephony, about the progress that has been made in this most interesting department. The telephone switchboard is certainly a marvel of mechanical skill and ingenuity, and its development has been accomplished only by much study, experiment and patient labor, and at great expense. It is, as Mr. Kingsbury says, the brain, the heart and the backbone of the system. The very creditable part which American inventors and mechanics have played in developing the switchboard is alluded to, and it is interesting to note the comments that are made on the enterprise exhibited by Americans in this particular line. In commenting upon the prominence which America has attained in telephony, one of the members, Mr. Addenbrooke, who had endeavored to design switchboards, explained in discussing the paper that English telephonists were handicapped in comparison with their American brethren. As an instance he mentioned that an American company, in touch with all the telephone companies, had an invention department where ideas and details were worked out to the general benefit. It would seem as if this was one of the highest compliments that could be paid to American enterprise.

MOTORMEN and gripmen are human and there is a limit to their endurance, but the street railway companies in many cities operating cable and electric lines appear not to appreciate these facts. These corporations have persistently disregarded the appeals of their employes to provide vestibuled cars, in order that they might be protected from the extremely cold weather to which they are now exposed. During the last few weeks these men have endured untold hardship, and in one case, at least, the company and patrons of the road have been obliged to share with the motormen in the suffering and consequent loss. The daily newspapers have published the details of the sad accident at Milwaukee in which human life was lost and much suffering was caused, and it has been made evident that the catastrophe was due to the fact that the motorman in charge of the car that plunged into the river last week was benumbed by the cold and was unable to operate the brake and save the car. The coroner's jury has called attention to the fact that the "lack of caution" on this occasion was caused by the exposure of the motorman to the intense cold. The jury's recommendation that "all electric railroad cars for use in the city of Milwaukee during the winter season should be provided with vestibules to protect the motormen in extreme cold weather and storm," should be considered by the Legislature and a bill should be enacted which would compel the company to do this. The management of the road announced its determination recently to oppose any measure of this kind, but now it may find it convenient to reconsider its policy, as public opinion is unanimously opposed to the position which the company assumed at that time. An organization known as the Amalgamated Association of Street Railway Employes of America is urging the adoption of bills of this kind in several states, and its president in an interview said last week: "We shall introduce in the Common Council of each city and the Legislature of each state in which we have organizations ordinances and bills requiring street car corporations to furnish protection to their motormen, gripmen, drivers or others who may be intrusted with the movement of the cars and the lives of the passengers." This is a movement in which all good citizens can join. The demand of the men is just and reasonable, as many companies have already introduced vestibuled cars on their lines and are now operating them satisfactorily.

TELEPHONE rates are once more under consideration at Albany, and there is a strong demand for the enactment of the measure now before the cities committee of the Senate and the electricity committee of the Assembly. The present measure is practically the same bill as that introduced by Mr. Gerst last year, which failed of passage through the intervention, it is claimed, of the telephone company's agents in the lobby. It was this activity on the part of these friends of the monopoly that directed public attention to the proceedings and caused the retirement of several members at the last election who were deemed unfriendly to the proposed bill. The fate which overtook these members may prove a warning to their successors and others in the present Legislature, and it is due largely to this influence that hopes are entertained for its passage at this session. There is considerable doubt as to the constitutionality of such a measure, but the friends of the movement are confident that it can be enforced if enacted. The right of the state to regulate telephone rates is predicated on the fact that the telephone is a public necessity and telephone exchanges cannot be operated without the use of public highways, which are the property of the state or its municipalities, or the exercise of the right of eminent domain. The right to regulate, it is claimed, is still stronger when the business in question is a monopoly. The Supreme Court of the United States has decided in a somewhat similar case that the right to regulate was based on the ground of the exigencies of commerce and of the power of the Legislature to protect the community from the exactions of monopolies, and also on the ground that whenever the service is of such a nature as to be a public necessity the right to regulate flows therefrom.

The provisions of the proposed bill include the following schedule of charges: In cities of 1,000,000 inhabitants or over, $78 a year; 500,000 to 1,000,000 inhabitants, $66; 100,000 to 500,000 inhabitants, $48; 20,000 to 100,000 inhabitants, $36; 8,000 to 20,000 inhabitants, $30; less than 8,000 inhabitants, $27. The population is to be based upon the United States census of 1890, and the rates once fixed are not to be changed by reason of an increase of population. The comptroller, attorney-general and state engineer and surveyor are charged with the duty of enforcing the law, and their expenses, to the amount of $10,000 a year, are to be paid by the telephone companies. In order that the bill shall not work hardship upon the companies it is provided that if the rates be deemed unremunerative upon the actual capital invested, the companies may appeal to the state officers mentioned, and if they find upon investigation that the rates will not yield to individuals or firms supplying telephone service a net profit of 10 per cent. upon the capital invested, they may advance the telephone rates to such a point as will yield this amount of revenue; and the new rates shall continue until they produce a revenue in excess of this amount. But the bill provides that applications for investigations must be made within thirty days of the passage of the act and the new rates must be fixed, if there is to be any change at all, within six months. It is claimed that the outlook for the passage of the proposed bill is excellent, although the telephone people are strenuously opposing the measure.

## Power Required in Electric Traction Under Varying Conditions.[1]

By James Lyman.

The results here presented are based upon actual electric railway tests. That they may be clearly understood, I venture a brief description of the conditions, and the way these tests have been made.

The sudden starting and stopping of cars, often occurring on grades, and frequently with cars more or less grouped together, causes a fluctuating demand for power at the station, which makes the measuring of both the car consumption and the station output a tedious, if not a difficult matter. Instantaneous readings of current and potential must be taken in each case, as rapidly as circumstances will allow, in order to obtain a fair average measure of the power used and power produced. The more cars there are in the service, the less, of course, is the fluctuation of station output and the less is the possible power required per car, and the more readily can the station efficiencies be determined. It is usual to divide the test of the plant into (1) a test of boilers, engines and station output, and (2) a test of car and line efficiencies, making them on two separate days. The station test lasts from ten to fifteen hours, and generally consists in taking readings every ten or fifteen seconds, of the current output, either from each generator separately, or from the bus-bars.

These readings can be plotted direct on cross-section paper by the observer and need not be otherwise recorded. The line joining the points gives a record diagram which can be easily integrated. The potential, which is much more uniform, can be read every few minutes by the same observer. The power supplied by the engines fluctuates approximately in unison with the output of generators, so that by obtaining simultaneously from each engine and its generator indicator cards and readings of current and potential, from no load to full load, the relation between engine output and generator output can be quickly determined. From the generator output for the run can be calculated the total effective engine power supplied. A better way to obtain the relation between the indicated horse power of engines and the electrical horse power output of generators is to make a short run with a dead resistance included in the generator circuit in place of the outside line circuit. By adjusting this resistance to accommodate a series of loads ranging from zero to full capacity of generators, indicator cards and electrical readings can be taken with a load which varies step by step from zero to a maximum, but remains constant while readings are being taken.

The test of the boilers and other mechanical accessories is conducted in the usual way and needs no mention here; it is made at the same time with the output test.

The cars are tested in various ways. It is generally desired to know the average and the maximum power required by them, when running on schedule time and under normal conditions, and the motor and car efficiency under these conditions. Instantaneous readings are taken every five seconds, of the line potential, the counter electromotive force of motors, and the current entering the car, noting the time of passing poles, the number and duration of stops, and the number of passengers on the car between the stops. From this data, with a proper survey of the road, and a knowledge of the internal losses in the motors, which is easily determined by a special test, it is possible to obtain approximately the required information. Other special runs are sometimes made, as over a level piece of track at uniform speed, to determine the traction necessary to keep car moving on a level or up a grade. The traction is also obtained for the various conditions required, by using a motor car as a trailer and coupling it to leader by a traction dynamometer.

So varied are the conditions of the cars, motors, grades, track, motormen, etc., that it is only as the results of each comparison reduce the power required by them to power required per ton of car.

First plant: Rochester, N. Y. Test made in 1891 by Dr. Frederick Bedell. About 20 miles of track and 40 cars in service. Cars equipped with two 15 horse power Short double reduction motors and weighing eight tons. The road nearly level except in the heart of the city, where several moderate grades of from 3 to 4.7 per cent. appear. Track in good condition.

The first car test was made to obtain the traction of a motor car moving uniformly on a level. Car was run as a trailer coupled by a recording traction dynamometer, and a round trip was made over a level stretch of road. The average traction proved to be 38 pounds per ton. The second car test was made to determine the maximum and the average power required by car when running under normal working conditions. Four trips were made over the four principal branches of the road on schedule time (the load being constant). Electrical readings were taken every five seconds from a Weston voltmeter connected across the brushes of one of the motors, and from a Weston ammeter

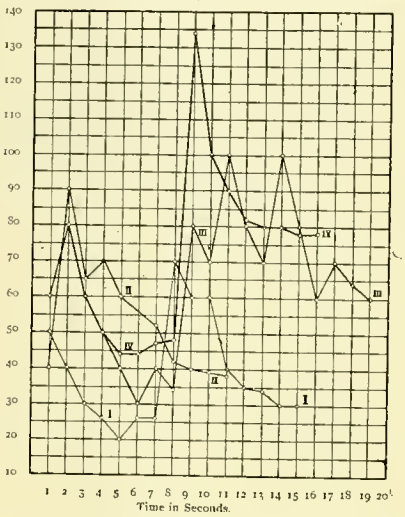



FIG. 1. POWER REQUIRED IN ELECTRIC TRACTION UNDER VARYING CONDITIONS.

connected in circuit with the main current entering the car; and speeds were taken by noting time of crossing streets. The results are as follows:

| | Distance in Miles. | Average Speed in Miles pr. hr. | Electrical H. P. Required. Mean. | Max. for ½ min. | Max. Momentary. |
|---|---|---|---|---|---|
| First run ... | 2.5 | 6.8 | 17.3 | 40. | 50. |
| Second run... | 2.5 | 7.6 | 9.5 | 31. | 43.2 |
| Third run..... | .. | .. | 13.1 | 34. | 54.7 |
| Fourth run.... | .. | .. | 13.8 | 41. | 37.1 |
| Average while running.... | | | .....13.5 | | |
| Av., including stop at end of each line. | | | 11.75 | | |

This last should be taken as true average power. Car and occupants weighed 8.375 tons.

$$\text{Average power required per car-ton} = \frac{11.75}{8.375} = 1.4 \text{ horse power.}$$

Average speed here was 6.5 miles.

It must be remembered that the above includes the power required to start the car after every stop on normal running, as well as the time of stops when no power was required. The average traction here would be 81 pounds per ton, or about twice the power required to keep the car moving on a level, and would be, of course, a fair average traction for the whole system.

The test of efficiency of line was made in the regular way, as described above, and was found to be about 90 per cent.

That of the station, namely, $\frac{\text{E. H. P.}}{\text{I. H. P.}} = 64.8$ per cent., so that the indicated horse power required of the engines to run the cars under the normal conditions over this road was 20 indicated horse power per car or 2.4 indicated horse power per ton, and maximum load about 70 indicated horse power per car or 8.4 indicated horse power per ton.

The accompanying cut, Fig. 2, is a graphical diagram for one of the above runs which illustrates better than figures the fluctuating consumption of power. The upper curve shows the potential supplied the motors; the lower curve, the total current taken; the middle curve, the electrical horse power averaged for half minute intervals. The location of feeders is indicated by circles. The five curves in the route are as follows, the radius being measured to the center of the track:

| No. of curve..... | I. | II. | III. | IV. | V. |
|---|---|---|---|---|---|
| Length..... | 50° | 90° | 40° | 103° | 90° |
| Radius, feet..... | 59.5 | 50 | 90 | 40 | 80 |

In general the route is quite free from grades, the heaviest being a grade of 4 per cent. at Burke's Hill.

Second plant: Buffalo, N. Y. Tested by Messrs. Wood and Palmer. 1892. This is a large, well arranged plant having at the time 54 cars in service. There are few grades, the maximum being only 2½ per cent., and the track was in good order. The tests included a number of round trip runs on schedule time by different cars over their regular routes. The log was kept much as in the previous test at Rochester, and the efficiencies of the station and line were determined for one all-day run. Five of the cars equipped with two 15 horse power Thomson-Houston motors (weights not given, but we can assume them from description to be about 8 tons) were run over the main route on Niagara street.

Results—Average power at line 11 horse power per car or 1.4 horse power per ton.

Maximum power at line 53.2 horse power per car or 6.6 horse power per ton.

Two large cars, one equipped with two 25 horse power Thomson-Houston motors, and another with two 25 horse power Edison motors were run over the same route on schedule time. The average applied horse power for their runs was respectively 17.5 and 18.6 at line, and their maximum applied horse power was respectively 110 and 63.9.

The weights of these cars are not given, therefore the power per ton cannot be determined. The efficiency of the line was found to be 92 per cent. and that of the station, $\frac{\text{E. H. P.}}{\text{I. H. P.}} = 86.9$ per cent., for the all-day run. Therefore in this case we find:

Average indicated horse power required per ton of car

$$= \frac{1.4}{.92 \times .869} = 1.76 \text{ indicated horse power.}$$

Maximum indicated horse power required per ton of car

$$= \frac{6.6}{.92 \times .869} = 8.3 \text{ indicated horse power.}$$

The third plant was in a large western city. The test was made in 1892 under the direction of the local superintendent. Five cars equipped with different types of motors were run over the same route. The power required in each case and the description of car, and conditions under which the test was made are shown in the table on page 80.

The first three cars were equipped with series parallel controllers; the fourth with ordinary rheostat; the Thomson-Houston, s. r. g. with Thomson-Houston controlling stand. All the cars were run on regular schedule time, on duty for the trip. The weights given above for the cars do not include passengers. To get the applied horse power per ton, an average load of one-half ton has been assumed and added to the weights of car in each case. The average stop is obtained by dividing the aggregate stop by the number of stops. The number of stops includes the number of times the car slacked up without coming fully to rest.

With the exception of the splendid record of the Short gearless motor, it will be observed that the average applied horse power per ton of car for time on road is approximately 1.2. This is 14 per cent. lower than the Rochester and Buffalo plants, which required about 1.4 horse power. This difference may be accounted for partly, if not entirely, by a very level track and probably better roadbed. Nothing is said of the power plant. With a total line and station efficiency of say 70 per cent., the indicated horse power per ton of car, would here be 1.72.

A test made on the street railway in Minneapolis by

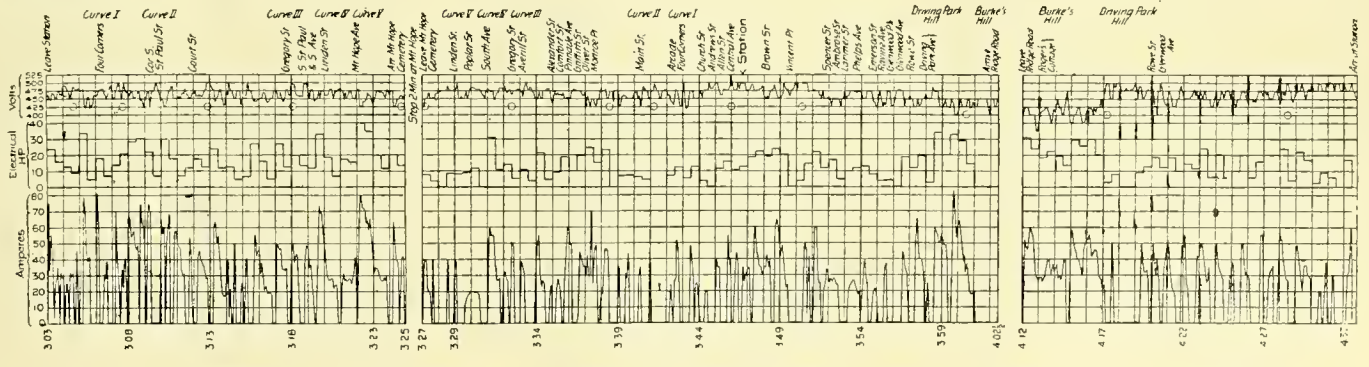



FIG. 2. POWER REQUIRED IN ELECTRIC TRACTION UNDER VARYING CONDITIONS.—GRAPHICAL DIAGRAM OF ROCHESTER ELECTRIC RAILWAY TEST.

Professor G. D. Shepardson and E. P. Burch of the University of Minnesota in 1892 gives some interesting data regarding traction under different conditions of track. Three runs were made with the same car and motorman on the University line of Minneapolis on successive days, the condition of the track being respectively dry, wet, and snowy.

| | Feb. 5. | Feb. 6. | Feb. 7. |
|---|---|---|---|
| Condition of track..... | Dry | Wet | Snowy |
| Number of stops..... | 38 | 50 | 36 |
| Average voltage..... | 445 | 450 | 440 |
| Average amperes ..... | 15.15 | 14.9 | 17.5 |
| Av. amperes while running.... | 23.4 | 20.9 | 28.1 |
| Average applied H. P..... | 9.05 | 9. | 10.3 |
| Av. applied H.P. while running | 14. | 12.6 | 16.6 |

A series of thirteen tests was made for ascertaining the effect of wetting or greasing the rails on a curve. Two cars were coupled by a spring dynamometer and the pull noted

1. From the *Sibley Journal of Engineering* for January, 1895.

1. "Electric Railway Motor Tests." Transactions of American Institute of Electrical Engineers, Vol. 9, p. 578.

while rounding the curve at ordinary speed, which was kept nearly uniform by means of a brake on the motor car. The average pull on the dynamometer was as follows:

| | Dry. | Wet. | Greased. |
|---|---|---|---|
| Outer track..... | 500-800 lbs. | 400 lbs. | 300 lbs. |
| Inner track..... | 650 lbs. | 400 lbs. | 400 lbs. |

It is noticed that wetting the track reduces the power required about one-third and greasing reduces it one-half. It was found that the inner track was not so thoroughly greased as the outer, on account of the lateness of the hour.

| General Description of Motor and Car. | 25 H. P. W. P. 30 T.-H. motors. McGuire double truck. Weight 12 tons. | Edison No. 14 motors. 18 ft. car and 16 ft. trailer. Fulton foundry truck. Total weight 10½ tons | Westinghouse single reduction 25 H. P. motors. 18 ft. car and 16 ft. trailer. Fulton foundry truck. Total weight 11 tons. | Short *gearless* motors 16 ft. St. Louis car and 16 ft. "Short semi-radial" truck. Total weight 11 tons. | T.-H. single reduction motors, one car with Robinson radial truck, 25 ft. body. Weight 8¾ tons. |
|---|---|---|---|---|---|
| Number of stops. | 67 | 56 | 66 | 52 | 68 |
| Average time of stop in seconds | 6 | 11.6 | 6.3 | 8 3 | 5 |
| Average maximum starting current | 170 | 70 | 65½ | 89 | 81 |
| Current at full speed on the level... ... | 47. | 32. | 32. | 24. | 26. |
| Average applied H. P. per ton of car for time of running.. | 1 31 | 1 37 | 1 52 | .93 | 1.28 |
| Average applied H. P. per ton of car for time on road. ..... .. | 1.22 | 1.21 | 1 20 | .86 | 1 22 |
| Av. maximum applied H. P. per ton of car when starting..... | 8 8 | 3.8 | 3 5 | 4 7 | 5.3 |
| Temperature of motor after run.. | Warm | Cool. | Very Hot. | Cool. | Warm. |
| Weather..... | Rain and cold. | Cloudy and dry. | Clear and dry. | Clear and dry. | Rain and sleet |
| Time on road in minutes... .... | 84¾ | 83½ | 74½ | 77½ | 80 |
| Time of running in minutes.... . | 48¼ | 74¼ | 68 | 70 | 76½ |
| Passengers carried | 66 | 65 | 100 | 73 | 76 |
| Remarks. | Track clean and wet. Motorman poor. Truck seemed stiff, but did not heat. | Track clean. Motorman fair. | Track clean. Motorman fair. | Track clean. Motorman fair. Car built for rapid transit suburban service. | Track clean and wet. Motorman fair. |

The following is a report of a test made for traction on the Ithaca street railway in November, 1894, by C. E. Hewitt and the author of this paper. The object was especially to determine the traction pull necessary to run a car at a uniform speed of six and again of ten miles per hour; also to determine the traction on grades. It was decided to employ a recording traction dynamometer and electrical observations to measure the power applied, one method in a way checking the correctness of the other. This was done by coupling the baggage car by means of the dynamometer to No. 9 passenger car, which is equipped with two twenty-five horse power Thomson-Houston motors. A round trip was made on State street to the L. V. R. R. station at a very nearly uniform speed of six miles per hour. No electrical readings were taken on the return trip from the L. V. R. R. station to the lower switch, because the cars could not be reversed, and the baggage car had to tow No. 9. There the end of the recording pencil on the dynamometer broke and failed to give any record for the remainder of the run. A second round trip run was then made from Aurora street to the lower switch crossing, at a speed of ten miles per hour. On this run the speed was too high to interpret the dynamometer record. The electrical readings on both of these trips checked well with the time, and the results are reliable. There is a slight grade from the lower switch crossing to where the L. V. R. R. crosses the street and here the trailer brake was touched slightly; this appears on the log for that run as a considerable dynamometer traction where there should be almost none. A run was next made with the same cars up the State street hill to Eddy street at a nearly uniform speed of five and one-half miles per hour.

Returning down the hill, brakes were used only on No. 9 to allow the dynamometer to indicate the traction pull of the baggage car on the grades (cars not reversed in position). Observed readings of the dynamometer were taken every five seconds. It was intended that the speed down should be the same as on the run up, so that one-half the difference of the tractions would be the true traction necessary to overcome the friction of the motors, gearings, axles and wheels. The speed was in fact about eight miles per hour, so that this friction could not be accurately ascertained.

The plan to determine the power required at starting, both on the level and on grades, by taking readings of the current every second as the cars got under way, had to be given up for lack of time. Fig. 1 shows some very fair starting current curves taken in a previous test with the same car (No. 9), which weighs about eight tons. Curves I. and II. were taken when starting on the level, curve III. on a grade of 5.6 per cent., and curve IV. on a grade of 11.6 per cent. They are interesting as showing the sudden and widely varying consumption of power and explain much of the fluctuation in the station output. The sudden increase of current which takes place about eight seconds from the start, as seen in each of the curves, indicates the instant when the motors were changed from series to parallel.

Before drawing conclusions from the data obtained, a word should be said about the calibration of the instruments and preparation for test. Two Weston 600 voltmeters and one millivoltmeter with 200 ampere shunt were used for measuring respectively the trolley electromotive force, the electromotive force across the brushes of one motor, and the current entering the car. They were easily and quickly connected. The 200 ampere shunt was put in the trolley circuit at the base of the trolley-pole on the car roof, the long flexible terminals to the millivoltmeter running down through the chimney-hole of the car to the instrument inside. One of the 600 voltmeters was connected across the line from the trolley to the ground conductor on motor through the floor door, and the other voltmeter was connected through the same door to the conductors running to the two brushes of one of the motors, by removing the tape from joints in these conductors. The recording traction dynamometer was connected by links to the car couplings and was protected by a bar of iron 2 inches by ¾ inch pinned fast to one of the couplings and connected to the other coupling pin so as to take compression strains but not tension. The results obtained with the dynamometer are not very satisfactory. The movement for the recording drum is very slow for the work, and the vibration of the springs as the load varies is so great and so constant that the path of the true curve of traction is difficult to determine. The areas are so small that though integrated with great care there is a large chance for error, and the results obtained are not to be too much relied upon. Each of these instruments was carefully calibrated by a standard in the laboratories of the college. The cars were weighed by means of a hydraulic jack. One end of car being raised off the track by a screw jack at the end of car frame and blocked firmly at that point; the other end was then raised by a hydraulic jack placed at exactly the corresponding point on frame, until the car was not only clear of the track, but until it was perfectly level as indicated by a spirit level and straight edge on car floor. At this point the jack gauge indicated the weight of one-half the car. As a check upon our work on the passenger car, we reversed the position of jacks and obtained nearly the same weight. The jack being intended for much heavier work and the gauge reading only in tons, the weights obtained are accurate only to within about 500 pounds. Car No. 9 weighed 8.0 tons, baggage car weighed 8.4 tons.

A map of the track over which the runs were to be made was drawn from one used in a previous test, giving grades and distances between poles and a new survey was made, as the location of many of the poles seemed to be changed. During the runs electrical readings were taken every five seconds and the time of passing poles was noted both on recording dynamometer and on log.

CONCLUSIONS.

| Data for level track. | 1st run, round trip. | 2d run, round trip |
|---|---|---|
| Average speed, miles per hour. ..... | 5.93 | 10.18 |
| Ave age trolley current in amperes... | 18.7 | 35. |
| Average trolley electromotive force... | 456. | 456. |
| Average effective motor counter electromotive force. ... . .....188. | | 384. |
| Average applied horse power..... | 11.5 | 21.5 |
| Average applied horse power per ton.. | .7 | 1 3 |
| Average delivered horse power..... | 9.4 | 17.85 |
| Average delivered horse power per ton .... ..... ..... | .57 | 1.09 |
| Average motor efficiency ..... | 81.5 per cent | 84.0 per cent. |
| Average electrical traction in pounds.. | 596. | 657. |
| Average electrical traction in pounds per ton ... . ..... ..... | 36.3 | 40. |
| Average dynamometer traction in pounds per ton ..... | 53.6 | |

During the first run the two motors were in series with full field and no rheostat resistance in circuit. During the second run the two motors were in parallel with full field and no rheostat resistance in circuit. We have here, therefore, the two typical conditions of running with the series-parallel controller. The range of speed here is the normal for city work, viz., six to ten miles per hour and load light. In both cases the efficiency of motors is good. The motor efficiency here considered is the ratio of the effective counter electromotive force of the motor to the trolley electromotive force, and it has been assumed that the load was equally divided between the two motors. The traction per ton varies from 36 to 40 pounds through this range of speed, or from 1.8 to 2 per cent. of the weight of car. The mean of this value, 38 pounds or 1.9 per cent. of car weight, is the value found by Dr. Bedell in the Rochester test referred to above.

From the third run on State street hill we get:

| | |
|---|---|
| Length of hill in feet.....1,793. | |
| Average per cent. grade..... .. .... | 8.85 |
| Average speed in miles per hour..... | 5.45 |
| Average trolley current in amperes ... | 156. |
| Average trolley electromotive force.... | 412. |
| Average effective motor counter eledtro motive force..... ..... | 308. |
| Average applied horse power..... | 87. |
| Average applied horse power per ton... | 5.3 |
| Maximum applied horse power per ton.. | 6.8 |
| Average delivered horse power..... | 64.5 |
| Average delivered horse power per ton.. | 3.9 |
| Average motor efficiency..... | 74.7 per cent. |

To find from this run the *actual* traction per ton per one per cent. of grade, we have taken from the log the traction for each section, subtracted from this the average traction necessary to keep the car moving on level track (as found above to be 36 pounds) and divided the remainder by the per cent. of grade. The average of all the sections thus determined is, from the developed electric horse power, 30.8 pounds, and, from the traction dynamometer, 41.8 pounds, per one per cent. of grade per ton.

These results would indicate that the assumption commonly made in estimating power required for grades, namely the weight multiplied by per cent. of grade, or 20 pounds per ton is incorrect. The friction of motor gearing which increases rapidly with the traction is probably the cause.

The regular passenger cars on this road weigh about eight tons and therefore require at line about 40 horse power when running up State street hill empty and about 50 horse power when loaded with passengers. The average trolley electromotive force on hill (412 volts) when compared with the same on the level (456 volts), indicates that the line efficiency is there rather low, though not so low as the figures show, because under ordinary conditions the weight of the cars would be about one-half the weight of the two cars used. Assuming a station and line efficiency of 60 per cent. of the indicated horse power required at engines or turbines, the indicated horse power would be for the regular service on the hill about 75 indicated horse power per car. The run made was a severe test of the capacity of the motors. It lasted four minutes. The average current consumed by each motor was 78 amperes and the maximum current was 98 amperes.

The armature conductors are made up of band copper .34" by .04"=13.600 cir. mils. The average current density was therefore $\frac{13600}{.5 \times 78}$ = 350 mils per ampere. From the normal rating of these motors the current density in their armature conductors is calculated at about 700 cir. mils per amphere. This low density was assumed in anticipation of the extreme strain the motor would be called upon to meet. In this case it was about double their rated capacity and they held up under the load very well.

It should be remembered that all that has been found in this test regarding traction refers to cars equipped with two motors connected to the axles by intermediate gearing. The traction of the regular "trailer" is per ton undoubtedly very much less. A motor car should therefore in practice never be used as a trailer where it can be avoided, because of the power lost in overcoming this internal friction.

Two tests were made, one in 1892 by Messrs. Hutchinson and Cross and one in 1893 by Chapin and Wessling on this road. Though the car tests were made under different circumstances and conditions, so far as a comparison can be made, there seems to be substantial agreement. In these tests the motor efficiency ranged from 80 to 90 per cent.

In general electric railway construction where grades are moderate and where there is to be a car service of not less than 10 cars on duty at once, probably 2.5 indicated horse power per ton of car, or, for an eight-ton car, 20 indicated horse power would be a correct estimate in determining the power that should be supplied by engines. Where there is to be a car service of not less than 20 cars on duty at one time, probably 2.2 indicated horse power per ton of car, or, for an eight-ton car, 17 indicated horse power would be a correct estimate.

## American Institute of Electrical Engineers.

In view of the approach of the annual meeting of the Institute the secretary has issued a circular explaining the present regulations concerning the election of officers. It will be remembered that the rules were amended at the last annual meeting, and as this is the first election to be held under the new arrangement the regulations as at present in force are herewith presented:

During the first week in February of each year the secretary shall mail to each full and associate member of the Institute a list of members; a list of the offices to be filled at the ensuing annual election in May, giving the names of the incumbents and a copy of this rule, with the request that nominations, propositions and suggestions as to desirable candidates be made promptly and prior to March 1st.

The secretary shall submit all answers to the Council, who, during the month of March, shall prepare a complete ticket to be headed "Council Nominees," containing the names of members whom they deem best suited, all circumstances considered, for the offices falling vacant. This ticket shall be printed on the same sheet with a second list headed "General Proposal List," containing the names of all eligible members proposed, with a memorandum stating the reason of ineligibility of all other names proposed, and with the statement that the nominations by the council are in nowise governing, but are intended only to assist members in making a choice. Opposite the name of each nominee in each list shall be printed a number indicating the number of nominations received by him, and a suitable explanation of these numerals shall be placed on this sheet. The voting shall be restricted to the names on this sheet. This sheet, together with an envelope, on which shall be printed the address of the secretary and the words "Voting Envelope—Enclosing a Ballot Only," shall, not later than the fifteenth of April, be mailed by the secretary to every member in good standing. Provided, that the secretary shall also mail such ballots, sheets and envelopes to members qualified after April 15th, before the annual meeting, and that any member not having ballots and envelopes shall be entitled to obtain them from the secretary at any time before the calling to order of the annual meeting.

Each member may cast three votes for vice-presidents, and he may cast all three votes for one candidate, or two for one and one for the second, or one for each of three. Each member may cast four votes for managers, which he may in like manner divide between from one to four candidates. The division shall be specified by the appropriate numerals marked opposite the desired name.

All names voted for shall be written, printed, or otherwise marked on a single ticket or ballot, which shall be enclosed in a sealed, unmarked and unidentified "inner envelope" of any suitable character, to be in its turn enclosed either in the "voting envelope" (received from the secretary or in any other envelope marked on its face "Non-official Voting Envelope—Enclosing a Ballot Only"). The outer envelope of either class must be identified by the signature of the member on its face, and must be sealed, and must reach the secretary prior to the hour of the actual opening of the annual meeting.

At the annual meeting these outer "voting envelopes" shall be opened in the meeting room by two tellers, then and there appointed by the presiding officer. After all the inner envelopes shall have been thoroughly commingled they shall be opened and the votes shall be counted by the tellers,

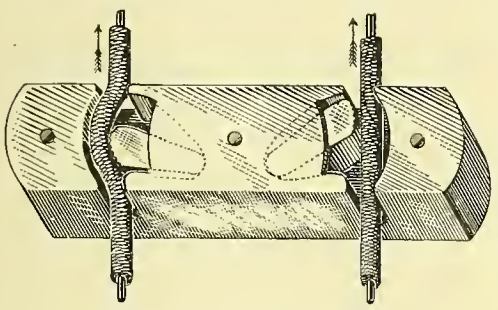
who shall report the results in writing. The eligible persons receiving the greatest number of votes for the respective offices shall be declared duly elected. The tellers shall reject all names that do not appear on the "Council Nominee" list or the "General Proposal" list, and they shall also reject that part of a ballot which shall name for any office or offices more candidates than there are vacancies.

This method of election shall apply to the offices of president, vice-president, treasurer and manager. No unsalaried officer except the president and treasurer shall be eligible to immediate re-election to the same office (as provided in rule IV.) The secretary and other salaried officers shall be chosen each year from among the members of the Institute by the council. The secretary shall be a member of the council, but shall have no vote in its proceedings.

In accordance with the provisions of the rule just quoted, the list of members was forwarded by the secretary to all members as a part of the January, 1895, issue of the Transactions, for reference in making nominations.

## Creager Self-locking Cleat.

A simple yet ingenious cleat for electric wiring is shown by the accompanying cut. It is the invention of F. O. Creager, a practical electrician, and is being placed on the market by the Creager & Connard company of Marseilles, Ill. The illustration is almost self-explanatory. The arrows show the direction in which the wire is being drawn. All that is necessary to secure the wire is to draw the line taut as possible or desirable and release it, and the serrated face of the dogs catches it and crowds it into the curved wall, thereby holding it taut and firm. This cleat will take Nos. 16, 14, 12 and 10, and all intermediate sizes of insulated wire. Larger cleats are made to hold larger wire. The use of this cleat does not require one man to pull and one to fasten, as one man can erect all the cleats necessary for an installation, and then, by reversing the first cleat, or the starting point of line, throw up all wire and simply draw the line up between each cleat, or even two cleats, and let go of it and it



CREAGER SELF-LOCKING CLEAT.

is taut and firm. This cleat is made of porcelain throughout, and appears to be a thoroughly practical and useful device.

## English Accuracy.

The average English newspaper writer is nothing if not sensational and ill-informed in treating of American affairs. Here is the London *Spectator's* view of the Brooklyn strike:

The contest between capital and labor in the United States, though it always ends in one way, is more bitter than in England. The tram-car-drivers of Brooklyn, for instance, have gone out on strike, and the contest has at once developed into a small civil war. The strikers stop all cars by force; all telegraph wires are cut; and the men who remain faithful to the company are threatened with revolvers. The governor of New York has, accordingly, called out the militia; and the 7th regiment has tried to guard the cars in starting. It has not succeeded, however, and the militia have been so heavily brickbatted that on one occasion the men replied with their rifles, and "thirteen casualties" are reported. We can form no opinion on the merits of the original quarrel, which was about wages, and only record the fact that under the republic the resort to force on both sides is at least as precipitate as under a monarchy. In this country thirteen casualties would be a subject for parliament, but in New York life is cheap, and in Chicago the railways kill that number every few days out of pure indifference and hurry.

## Electricity in Tooth Pulling.

One of the various items going the rounds of the press in relation to the use of the electric current to deaden the paig of extracting teeth has called out the following interestinn note from an anonymous Port Chester correspondent of the New York *Sun:*

I noticed in your Sunday edition, January 20th, an article headed "Extracting Teeth by Electricity," taken from the London *Nature.* I wish to say in reference to the article that in 1858 or 1859 Dr. B. F. Smith, dentist, of New Orleans, corner of Canal and Baronne streets, extracted a tooth for me by the aid of a galvanic battery, which amounts to the same thing, I think. The battery was a small box 2½ feet by 8 inches by 8 inches. One wire was atattached to the forceps, the other held in the hand. As well as I can remember, the shock was as bad as the aching tooth. The doctor was of an ingenious turn of mind and thought that there was millions in everything he invetend, which were many.

## Bryant Angle Receptacle and Weatherproof Socket.

It is frequently a desirable arrangement to have the incandescent lamps for store windows or those placed around the border of a room project at an angle of 45 degrees. To meet this demand the Bryant Electric company has devised the receptacle shown in the accompanying cut, Fig. 1. The receptacle is arranged so that the shade holder and shade may be fastened to it. The receptacle when placed on the wall gives the lamp an angle of 45 degrees.

The Bryant Electric company has also recently placed upon the market a weatherproof socket, well made and of good material, as in Fig. 2. The company has issued a

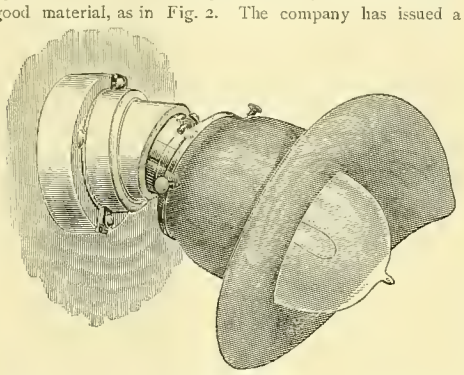


FIG. 1. BRYANT ANGLE RECEPTACLE AND WEATHERPROOF SOCKET.

little book in which some of its latest specialties are illustrated. The book will be distributed at the convention.

## Electrolysis Question in Omaha.

The damage done to water mains by escaping current from the ground returns of electric railway lines is considered very real in Omaha. In that city the receivers of the American Water company are not content with the existing situation. Their attorneys have had some talk with the street railway company's lawyers, and one of them says that they are considering bringing suit against the railway company. Just in what form he is not prepared to say. The water company served notice a year ago that it would hold the street railway company responsible for any damages to its pipes by electricity from escaping railway current. There was a report on the street that the water company would ask $250,000 damages of the street car company. The street car company has laid parallel mains and wires in some parts of the city, with a view of diverting the current from the water mains. It would appear that the water company did not view these as wholly effective.

## A Rising and Promising Industry.

[From the New York *Sun.*]

A young American who has entered an institution to study electrical engineering asks us to tell him whether he will be sure of finding employment as an electrical engineer when his studies are ended. We cannot see very far ahead, but we think he is likely to have a good chance of finding it. Electrical engineering is one of the rising industries of the country, and it is a very promising industry. There is reason to believe that it will yet become far more extensive than it has been at any time during the brief period of its existence. Every year we see electricity put to new uses,

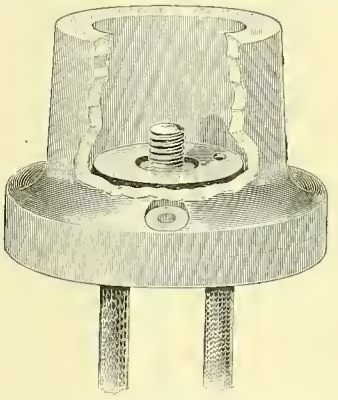


FIG. 2. BRYANT ANGLE RECEPTACLE AND WEATHERPROOF SOCKET.

and the probability is that the measure of its utility will be increased indefinitely. Thus new opportunities will be opened up, from time to time, for those who are ready to take advantage of them, and more especially for those who are of an inventive turn of mind. First-rate electrical engineers are not over-numerous, and there is a constant demand for them. They are very well paid, too.

Our young inquirer will certainly have as good a chance of procuring employment at his chosen pursuit as he would have in any branch of professional activity, the law, for example, or in any of the ordinary industries. We believe his chances of success are greater than if he were to become a lawyer, a grocer, an author or a knifegrinder.

There always has been, and there always will be, a good chance of success in the world for any young man who is faithful, industrious, patient, earnest and true. If, besides these invaluable qualifications of high manhood, he be so happy as to possess a mind open to the solicitations of life, he must be unlucky indeed if he fail to carry out any reasonable desire in the course of a lifetime.

## Nowotny Telephone.

In the accompanying cut is shown the Nowotny telephone which is supplied with a battery transmitter, the principle of which is similiar to the Blake. The receiver is of modern pattern and is of the type known as a compound receiver. The magneto call bell used in connection with this instrument is capable of ringing through a resistance of 10,000 ohms. The Nowotny A No. 1 battery is used in operating the transmitter in this instrument. This telephone, it is claimed, will convey articulate speech a distance of 1,000 miles.

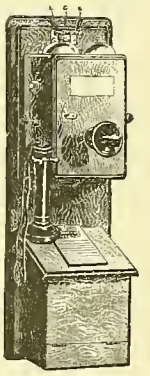
The instrument is handsomely finished in either antique oak or walnut, with nickel-plated trimmings. The best possible electrical and mechanical principles have been embodied in this telephone, the result of years' careful research of the underlying principles of transmitting and receiving speech or sounds at a distance.

The factory of the Nowotny company of Cincinnati, which manufactures these instruments, is equipped with modern machinery and appliances the best material that the market affords is used and skilled workmen are employed.

These telephones, the makers say, do not infringe any patent rights, since the suit brought by the government against the Bell Telephone company has been decided. This statement is based on Judge Carpenter's order: "Let there be a decree issued that letters patent No. 463,569, issued November 17, 1891, to Emil Berliner, are void, and shall be delivered up to be cancelled as prayed for, and costs."

## Indiana Electric Light Association.

A state organization of electric light companies doing business in Indiana was recently effected at a meeting held



NOWOTNY TELEPHONE.

in English's Hotel, Indianapolis. The meeting was the result of a call issued by representatives of the companies located at Decatur, Huntington, Washington, Goshen, Hartford City, Montpelier, Kendallville, Union City, Valparaiso, Delphi, Vincennes, Ligonier and Rochester.

The object of the Indiana Electric Light association, as the organization was named, is the mutual benefit to be derived from an interchange of ideas born of practical experience, to the end that the members may not alone cheapen the production of electric light, heat and power and protect themselves from imposition from whatever source, but also render better service in all branches of their business, thus benefiting their patrons while furthering their own interest in a legitimate business way.

The meeting was called to order after dinner and a permanent organization was perfected. A constitution and by-laws were adopted. The following named officers were elected:

President—J. W. Roney, Richmond.
Vice-president—W. K. Smith, Union City.
Secretary—Dallis Edwards, Decatur.
Executive Committee—H. A. Smock, Martinsville; C. C. Perry, Indianapolis; J. W. Morrison, Frankfort; H. W. Friend, Vincennes, and J. D. Edwards, Decatur.

The following named gentlemen were present: H. W. Friend, Vincennes; E. W. Boden and C. H. Kerlin, Cambridge City; J. W. Cole, Greencastle; L. Wohlgemuth, Rochester; L. F. Putnam, Attica; Joseph S. C. Sorro, Brazil; T. W. McNamee, Wabash; O. C. Irwin, Greenfield; Z. F. Graham, Washington; W. C. Smith, Union City; Joseph A. Halstead, Brazil; H. A. Smock, Martinsville; O. L. Mooman, Winchester; E. W. Smith, Brazil; J. D. Edwards, Decatur; Victor E. Seiter, Logansport; J. W. Morrison, Frankfort; J. W. Roney, Richmond; James Boyce, Muncie; C. E. Latta, Goshen; H. Wilkemeyer, Evansville; J. W. Draper, Ligonier; Mr. Root, Michigan City, and C. C. Perry, Indianapolis.

Meetings will be held in Indianapolis every year on the first Wednesday in February.

## National Electric Light Association.

The Chicago delegation to the Cleveland convention of the National Electric Light association will leave Chicago on Monday evening and arrive in Cleveland early Tuesday morning. The Lake Shore & Michigan Southern railroad has been selected as the route by which the western delegation and their friends will go from Chicago to the convention. All the necessary arrangements have been completed and special Wagner cars reserved for the use of the party, the management of the road having promised every comfort and convenience. A large number of applications have already been made for reservations, and everything points to an unusually large contingent from the West. The train will leave the Lake Shore & Michigan Southern depot, corner Van Buren street and Pacific avenue, at 8:45 P. M., Monday, February 18th. A special rate has been granted on the certificate plan of a fare and one-third for the round trip from Chicago and all points east.

The headquarters of the association during the convention will be the Hollenden Hotel. The meetings will be held at the Army and Navy Hall. The programme is as follows:

TUESDAY, FEBRUARY 19th.

Meeting of the executive committee at 9 A. M., parlor 138 Hollenden Hotel.

*Morning Session, 10:30 o'clock.*

Address of welcome, by mayor of Cleveland.

President Francisco's address.

Paper by N. W. Perry: "The Storage of Energy Essential to Central Station Economy: How it May be Accomplished and the Economies Resulting;" discussion, John W. Langley, W. M. Stine, M. J. Perry.

Report of committee on relations between manufacturing and central station companies. Frederic Nicholls, chairman.

*Afternoon Session, 2 o'clock.*

Paper by E. J. Houston and A. E. Kennelly: "A New Method of Measuring Illumination;" discussion, W. A. Anthony, C. D. Haskins, W. S. Howell, Edward Weston, L. Stieringer.

Report of committee on data, H. M. Swetland, chairman; discussion, W. R. Gardener, E. L. Powers, H. W. Sexton.

Paper by Walter E. Harrington: "Correct Method of Protecting Electric Circuits."

Questions and answers. What is it you wish to know?

Executive session.

WEDNESDAY, FEBRUARY 20th.

*Morning Session, 10 o'clock.*

Paper by Edward Weston: "Some Economies in Electric Light and Power Stations."

Paper by C. N. Black: "Large Arc Dynamos;" discussion, S. M. Hamill, J. J. Wood, F. W. Rollins, E. R. Weeks.

Topic: "How to Light Large Cities;" discussion, Frederic Nicholls, Geo. A. Redman, Jas. I. Ayer, E. F. Peck, C. R. Huntley, Robert Lindsay, F. H. Clark, T. C. Smith, J. F. Morrison.

Report of committee on finance. John A. Seely, chairman.

Question and answers. What is it you wish to know?

Executive session.

*Afternoon Session, 2:30 o'clock.*

Paper by E. A. Leslie: "The Operation of High Tension Currents Underground from a Physical and Financial Standpoint;" discussion, H. J. Smith, W. H. Browne, C. H. Wilmerding, John A. Seely, C. L. Edgar.

Paper by L. B. Marks: "Arc Carbons and the Rating of Arc Lamps."

Topic: "Incandescent Lighting vs. Other Methods;" discussion, H. T. Edgar, E. F. Phillips, W. S. Barstow, E. A. Armstrong, J. Gwynne, B. P. Holmes.

Questions and answers. What is it you wish to know?

Executive session

*Evening Session, 8 o'clock.*

Address by A. J. Wurtz: "Practical Demonstrations of Protecting Lines from Lightning."

THURSDAY, FEBRUARY 21st.

*Morning Session, 10 o'clock.*

Paper by Dr. Louis Bell: "The Monocyclic System;" discussion, A. E. Kennelly, L. B. Stillwell, J. F. Kelly.

Report of committee on rules for safe wiring. William J. Hammer, chairman.

Topic: "Underwriters' Rules vs. National Electric Light Association Rules;" discussion, William Brophy, C. H. J. Woodbury, J. J. Burleigh, A. W. Field.

*Afternoon Session, 2:30 o'clock.*

Executive session.

Report of secretary and treasurer.

Executive committee.

Election of officers.

## A New York Removal.

The New York Electric Equipment company, of which S. Bergmann is president, announces the removal of its principal offices and salesroom to the new building at Nos. 572 to 578 First avenue, corner of Thirty-third street, New York. This building has contained the company's factory for some time. The general offices are on the second floor and are handsomely fitted up and well adapted for their purpose. The office at 59 Duane street will be retained as a branch salesroom and supply depot for the convenience of near-by customers. The company is rapidly extending its business and by bringing the executive, selling, construction and manufacturing departments under one roof it will be able to meet the increasing demands promptly and well. The company does all kinds of construction work and manufactures fixtures and supplies.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, February 9.—The aftermath of the Brooklyn strike of electric railway employes still engages the attention of the public. Mayor Schieren has vetoed the resolution of the Brooklyn aldermen revoking the charters of the three offending companies, and United States Commissioner Morle has dismissed the case against President Benjamin Norton of the Atlantic avenue road for carrying United States mail signs on the cars of his road which did not actually contain United States mail. In a long opinion the commissioner decided that the contract the Atlantic Avenue company had with the government required the placing of the signs where they were, and furthermore, that there was no intention on the part of Mr. Norton to place signs on any other cars than those running on the mail route. Therefore the law was not violated. President Norton, who was under arrest, was accordingly discharged. In Albany the Assembly committee on ways and means has voted to grant the request for a special committee to investigate the Brooklyn trolley strike, but has curtailed the expenses. The entire cost of the investigation is not to exceed $6,000 and that is to be divided among counsel, one stenographer and a messenger. The committee is to report by the 15th of March. The resolution was introduced by Mr. Friday. The criminal courts have taken cognizance of the matter, for yesterday the February grand jury in the Court of Sessions brought in twelve indictments against strikers and others who obstructed and interfered with the trolley cars and committed acts of violence during the strike. All pleaded not guilty.

The report of the State Board of Mediation and Arbitration on the strike was presented to the Legislature yesterday. The following extracts are of especial interest:

The primary cause of this Brooklyn strike and of all kindred strikes is to be found in the fact that the Legislature, in creating railroad corporations and vesting in them the public function of transporting persons and property of the people, has neglected to make necessary provisions for a stable and efficient service of operating forces upon the lines to subserve the end for which they were given breath of life and clothed with the state's power of eminent domain.

Any remedial legislation to be effective should have prevention for its objective point. The interruption of operation of a railroad in its service to the people for which its corporate owner was created, by reason of a controversy or dispute between the company and the operating forces, or strike of the latter, should be made impossible. The measure recommended by this board is one that would bind alike in mutual obligations both employer and employe, and in outline is as follows:

1. Declare the service of railroad corporations created by the state a public service.

2. Entrance into such service to be by agreement for a definite period, upon satisfactory examination as to mental and physical qualifications.

3. Resignation or dismissal from such service for ordinary cause to be permitted, to be stated in writing and filed with some designated authority, and to take effect after the lapse of a reasonable and fixed period, with proviso for summary resignation or dismissal for extraordinary cause, to be stated and filed in like manner.

4. Wages to be established at the time of entry, and changed only by mutual agreement or decision by arbitration of a board chosen by the company and employes, or by a state board, or through the action of both, the latter serving as an appellate body. Other differences that may arise to be settled in like manner.

5. Promotions to be made upon a system that may be devised and agreed upon by both parties, with the aid of a state board, if necessary.

6. Any combination of two or more persons to embarrass or prevent the operation of a railroad in the service of the people a misdemeanor; and any obstruction of or violence toward a railroad serving the public, endangering the safety of life and property, a felony, with punishment of adequate severity.

7. Establishment of a beneficiary fund for the relief of employes disabled by sickness or accident and for the relief of their families in case of death, as is done upon the lines of a number of railroad corporations in other states.

8. Membership in a labor union shall not be used as a bar against the employment of competent workmen by a railroad corporation created by the state.

All to the end of a discharge of mutual obligation of railroad corporations and employes, the enjoyment of mutual benefits, and the securement of a permanent and satisfactory service to the people, who have a right to it and a right to use every power necessary to obtain it.

It is confidently believed that a law enacted on the lines of the measures above suggested would insure relief and justice to all.

A point of very great importance in the operation of railroads, and especially of electric street railways in the congested streets of cities, is that of sight and hearing in motormen and conductors. The trolley roads have been in operation in Brooklyn between two and three years, and during that period more than 600 accidents have been reported, and it would probably be conservative to add 150 to that number. The number of people killed up to the first of the year 1895 is stated at 91; and the State Railroad Commission is reported as stating the number killed during 1894 alone at 45. It is believed that many of these accidents and fatalities are directly traceable to imperfect vision in motormen. That the managers of trolley roads are sensible of this fact is evidenced by the action several months ago of President Beckley of the Rochester electric street railway, which is conceded to be one of the best managed and most efficient of this class of railroads in the United States, in ordering an examination of its motormen and conductors as to sight and hearing by Dr. Wheelock Rider, an eminent oculist and aurist of Rochester, and making provision for such examination of all applicants for places before employing them in the future. It is suggested that aside from other legislation touching the operation of railroads, this one point of faculties of seeing and hearing in the operating forces, as the positions where seeing and hearing are essential, ought to be covered by requirement of statute for examination by a competent oculist and aurist before applicants are taken into the railroad service. Information has been received that men dismissed from service of the Rochester road on account of defective vision and hearing found employment on the Brooklyn roads without question.

Judge Gaynor has written a letter to the State Board of Arbitration, in answer to a request, stating that his idea of the cause of the strike was that the companies brought it on by their greed in endeavoring to pay dividends on stock watered far beyond the value of the property, instead of allowing the men reasonable wages. President Norton emphatically denies this charge for the Atlantic Avenue company.

The Rapid Transit Commission, at Tuesday's meeting, refused to indorse the report of the board of experts, abstracted in last week's WESTERN ELECTRICIAN, and practically decided to go ahead on the original plan. These resolutions, offered by Mr. Low, were adopted:

*Resolved*, That counsel be instructed to submit at the next meeting of the commission a resolution in form for final adoption, confirming the routes already adopted on July 17, 1894.

*Resolved*, That this resolution shall call for immediate construction on the west side as far as One Hundred and Eighty-fifth street and for extension to the city limits within a period hereafter to be determined upon.

*Resolved*, That this resolution shall call for immediate construction on the east side as far as Forty-second street, and for construction to Mott Haven and the city limits within periods hereafter to be determined upon.

*Resolved*, That this resolution shall make provision for future construction of a line proposed by the board of experts running from the northern boundary of Central Park through private property near Sixth avenue to the Harlem river.

W. F. O.

## Northwestern Notations.

MINNEAPOLIS, February 8.—D. S. Stewart has secured a 20-year franchise for an electric light and power system in Clintonville, Wis.

The electric street railway company in Marshalltown, Ia., is about to extend its line to the Soldiers' Home and is waiting for the right of way.

The General Electric company has sued O. H. Simonds and R. S. Munger for $13,458, due on notes given by the Fond du Lac Light, Power & Railway company and endorsed by them, in the District Court in Duluth, Minn.

The Minneapolis Trust company is taking soundings of the Kettle river in Sandstone, Minn., for a dam for electric lighting and other purposes.

Local capitalists of Iowa Falls, Ia., are considering the advisability of establishing an electric light plant, since the company which was granted the franchise had to relinquish it.

It is rumored that a new telephone company will be formed in Minneapolis backed by the famous "Bonanza" J. W. Mackay. J. F. R. Foss is given as interested in the deal, but, when seen, said he was not ready to give out any statement in regard to the matter.

The Winona General Electric company's plant and the street car system have changed hands. Manager A. H. Hill has resigned and has been succeeded by John F. Gay.

E. S. Shephards of Rhinelander, Wis., has invented and patented an electric railroad to run on an elevated track, of wood, the cars being cigar-shaped and running on pneumatic wheels. They are expected to make 100 miles per hour.

The Dubuque Street Railway company has asked a perpetual charter for a line from Couler Creek to Sageville and for a half mile on the Sageville road. It proposes to form an artificial lake, lay out a park, to be brilliantly illuminated with arc lights, and altogether expend about $100,000 in improvements.

The Bismarck, N. D., council has granted E. A. Hughes an electric light franchise over the mayor's veto.

H. B. Moore, appointed receiver for the Great Western Manufacturing company of Duluth, Minn., by the District Court of that place, has been allowed certain rights by Receiver Fowle, appointed by the United States court in Chicago, the latter being in possession. The former suspected that the goods of the company were disappearing and put detectives on the case, resulting in the arrest of Andrew Miles and J. G. Kennedy, custodians of the company's interests, William Burgess of the Burgess Electric company, and Roderick Pomeroy, a clerk of that company, charged

with grand larceny. The missing property was found in the custody of the Burgess Electric company, which claims to have bought it from Miles and Kennedy. Receiver Moore is quoted as saying that the men thought they could realize quicker and to more advantage on the company's property than the receiver could. There was about $800 worth of insulated wire taken.

The Minneapolis Board of Trade will move in favor of a mutual telephone company on the Stockholm plan.

The Stillwater Electric Street Railway company of Stillwater, Minn., has constructed a trestle work to be used as an approach to the Oak Park bridge, and is running cars over it to South Stillwater. This gives a through car system for the first time since the disastrous floods of last May.

Weyauwega, Wis., voted in favor of granting an electric light franchise overwhelmingly at a special election.

The New Ulm, Minn., Electric Light company is considering changing its system from the incandescent to the arc light.

A local company, with $15,000 capital stock, has been organized in Iowa Falls, Ia., to put in an electric light plant, and work will be begun at once.

Public meetings have been held in Stevens' Point, Grand Rapids, Centralia, Marshfield, Wausau and Merrill, Wis., and committees appointed to wait on the Wisconsin Telephone company with a demand for cheaper and better service. If the demand is refused they agree to establish an independent system to be operated by the several committees. G. J. Jackson of Stevens' Point has given the matter considerable study and thinks it feasible.

The Rainier Power & Railway company of Seattle, Wash., with its franchise, tracks and equipment, has been sold at auction under an order of the United States Circuit Court. The property was bid in by Angus Mackintosh and Frederick Bausman for $15,500 cash.

Claussen & Bonwell of St. Paul secured a contract for putting in an electric light plant at Wells, Minn., for $6,936, including the engine. It is to be completed by April 15th.

It is rumored that the Twin City Rapid Transit company has given up the idea of tunneling the Selby avenue hill in St. Paul, changing the cable to electric and extending to connect with Minneapolis, but will instead extend the Grand avenue line in St. Paul to Marshall avenue by way of Cleveland or some neighboring street, over the Marshall avenue bridge to Lake street in Minneapolis, and into Minneapolis on the Minnehaha avenue line. M.

## PERSONAL.

Edward R. Grier of Grier Brothers, Chicago, has recovered from a severe attack of the grippe.

August P. Munning, lately with the Central Electric company, Chicago, is now connected with the Carpenter Enamel Rheostat company, Hoboken, N. J.

At the reorganization of the Clonbrock Steam Boiler company of Brooklyn, N. Y., on January 16th, the company elected S. V. Morrin as secretary, and in doing so recognized the merit of close application to business. Mr. Morrin started with this concern at the foot of the ladder, learning the various branches of its business until this important position was given him. His large circle of acquaintances in the electrical and iron trades will wish him continued success.

The Standard Underground Cable company has just completed arrangements with James R. Wiley to represent it in the West, with headquarters in the Rookery building, Chicago. Mr. Wiley is well known in electrical circles, having been connected with electrical enterprises for many years, including eight years in the Metropolitan Telephone & Telegraph company as superintendent of private lines. He is a brother of George L. Wiley, who has represented the Standard Underground Cable company in New York and the East for the last ten years. J. R. Wiley assumes the management of the western sales department. He is a western man, and his family are Chicagoans. He will be welcomed by the electrical fraternity of the West and it is hoped that he will have continued prosperity in his new position.

## NEW INCORPORATIONS.

General Electric Railroad company, Chicago; capital stock, $5,000,000; Daniel M. Simmons, Chicago.

Marseilles Telephone company, Marseilles, Ill.; capital stock, $2,000; to operate a telephone plant; H. R. Adams, Marseilles, Ill.

McLean Armature company, Chicago; capital stock, $15,000; to engage in general electric manufacturing; James McLean, Chicago.

Clintonville Electric Light & Power company, Clintonville, Wis.; capital stock, $8,000; to operate an electric light and power plant.

Saginaw & Bay City Railway company, Saginaw, Mich.; capital stock, $500,000; to construct and operate street railway lines in Saginaw.

Commercial Heat & Power company, Chicago; capital stock $2,000,000; to operate heat, light and power plants; Daniel V. Harkin, Chicago.

## ELECTRIC LIGHTING.

At the regular meeting of the Common Council of Portage, Wis., the council concurred in the resolution of the Board of aldermen of Manitowoc asking for legislation to enable cities and towns to own and operate electric light plants, and directed that Senator Conger and Assemblyman Mohr be so notified.

John McElhany has organized an electric light company at Neosho, Mo., with a capital stock of $10,000.

A project for the erection of a municipal lighting plant is exciting considerable discussion in Richmond, Va.

Pierce & Richardson of Chicago have been retained to prepare specifications for an electric lighting plant for the city of Owensboro, Ky.

During the coming summer the Grand Island, Neb., Light & Power company proposes to increase the capacity of its plant in order to enable it to sell current for electric heating. The company will be one of the first in the country to make an active effort to secure this class of business.

The municipal authorities of Guipuzcoa, Spain, have recently decided upon the establishment of a central station for the electric lighting of the town. The plant is to consist of two 70 horse power engines, one dynamo giving 300 amperes at 125 volts, and one giving 180 amperes at 170 volts, together with a battery of 62 accumulators.

An injunction has been filed in the Circuit Court for Garrett county restraining Dr. J. Lee McComas, who was appointed receiver of the Oakland, Md., Electric Light & Power company by an order of court of January 25th, from taking charge of the effects of the corporation or in any way interfering until the exceptions which were filed to the sale under the mortgage were heard and decided by the court.

The following news comes from Ottumwa, Iowa, and is dated February 9th: There are neither arc nor incandescent lights burning in the city to-night, which is due to a peculiar cause. The Des Moines river is very low and fish by the millions are drawn into the pumps at the water power house, clogging them up. Wagonloads of the fish have been taken out the last few days, but to-day they became so numerous as to clog up the pumps. The water works system has been so badly crippled from the same cause that a fire to-night would have everything its own way.

It was given out on February 8th that a consolidation had been effected of the several electrical companies in Toledo, O., comprising the Toledo Electric company, the Western Electric company, the Toledo Consolidated Street Railway company and the Toledo Electric Street Railway company. The capital stock of the new corporation is placed at $5,000,000, and prominent among its promoters are said to be W. E. Hale and N. B. Ream of Chicago. Several New York capitalists, too, are interested in the company, which as yet has not been given a name.

The Citizens' Electric Light & Power company, Appleton, Wis., commenced operations on February 15th, furnishing light and power to about 150 consumers. The building is of brick 40 by 60 feet, boiler house 30 by 40 feet and there is a brick stack 150 feet high. The equipment consists of one 175 horse power Atlas compound condensing engine, two 150 horse power Atlas boilers, one 60 kilowatt Westinghouse alternator of low frequency, one 60 kilowatt Crocker-Wheeler power generator, one Smith-Vaile feed pump, one Gould feed pump operated by a two horse power Crocker-Wheeler motor and one Locke damper regulator. This plant is considered one of the best arranged and equipped in the state, every piece of machinery being of strictly high grade. The officers of the company are: President, M. H. Croswell; secretary and treasurer; D. H. Pierce; superintendent, John A. Peterson.

## ELECTRIC RAILWAYS.

The electric railway connecting Canisteo with Hornellsville, N. Y., has proved so great a financial success that a rival line is to be built.

The Queen City electric street railway of Marion, Ind., is to be sold on a decree of foreclosure obtained by the Metropolitan Trust company of New York. The sale is set for March 6th.

"Sound the loud timbrel o'er Egypt's dark sea; the people are in it, and all are in glee," is the way the *Journal* of Corning, N.Y., heads its announcement of the mayor's signing of the franchise for a local street railway.

An interesting rumor in Niagara Falls is to the effect that the contract has been let for the construction of that part of the Niagara Falls & Buffalo electric railway between Niagara Falls and Tonawanda, which will connect Buffalo and the Falls. The right of way was secured some time ago.

The Macon, Ga., Consolidated street railway has been sold. Tucker & Anthony, bankers of Boston, have purchased the plant from the General Electric company. There is $300,000 of bonds and $500,000 of stock. Mr. Tucker will be the treasurer of the company. Some time ago $500,000 of bonds of the railroad was issued, but only $300,000 was floated. The remaining $200,000 has been held in reserve for improvements, etc. Stock to the amount of $500,000 has been issued.

## MISCELLANEOUS.

Cleveland now has an electric street car mail service.

A large portion of the mails between Haywards and Oakland, Cal., are now carried on the Oakland, San Leandro and Haywards electric railway.

The St. Louis Electric Club is undergoing some radical changes and it is believed that the club will soon be in better shape to be a benefit to its members than ever before.

A plan is on foot to electrically utilize the power of the Chattahoochee river for transmission to Atlanta for industrial use. The dam and power house are to be located at Bull Sluice Shoals or the Devil's Race Course, and the transmission will be about 12 miles in length.

## TRADE NEWS.

A. H. Reece has been appointed agent for the Southwestern states by the Fort Wayne Electric corporation, and has opened an office in the Turner building, St. Louis, as headquarters.

Stanley Greene, western manager of the Fuel Economizer company of Mattewan, N. Y., reports having sold the Crystal Plate Glass company of St. Louis three economizers aggregating 2,500 horse power.

The Safety Insulated Wire & Cable company, New York, through its St. Louis agent, Lieut. E. J. Spencer, has closed a contract with the West Chicago Street Railway company for its second order for underground feeder cable.

Grier Bros., "the Bryant Electric company's men in the West," are getting out a unique souvenir for the electric light convention at Cleveland. It is a copyrighted pamphlet entitled "Stories That You Have Told or Heard Before." The Bryant company has a reputation for creating new things, and there is no doubt that its souvenir will "go like hot cakes." It will be distributed free at the convention or mailed to any address on receipt of two cents.

The Phœnix Glass company announces in a circular issued February 5th, that its main factory, located in Monaca, Beaver county, Pa., was destroyed by fire February 3d, but its factory No. 2 is unharmed and working to its full capacity. The company has leased a large and well equipped factory, which, in connection with its factory No. 2, enables it to fill all orders with but little temporary delay. Within two or three weeks the company hopes to be in full and complete working order, capable of promptly filling all orders.

The Metropolitan Electric company of Chicago was recently gratified by the receipt of a letter from a customer which read as follows: "The bill of goods you shipped me January 9th just received, and to my great astonishment I find the same to be the very first bill of electrical goods received in eight years just as ordered. You did not make a single mistake and the goods came up in good shape. Only one 32 candle power lamp broken in the entire lot. This is an extraordinary circumstance and contrary to my previous experience with any electrical concern." The shipment contained parts of nearly everything in the company's catalogue. When it is considered that the goods traveled over 2,000 miles to reach the customer, the Metropolitan company may well be proud of the undertaking. The feat is said to be unparalleled in the history of the electrical supply business.

## BUSINESS.

The Ginocchio Electric company of Dallas, Texas, has completed arrangements to act as southwestern agent for the Royal Electric company of Peoria, Ill.

W. R. Jennings, St. Louis, Mo., is doing a fair business in electrical supplies. His trade is steadily increasing, and he is receiving orders from many eastern states in addition to those from the Southwest.

M. Philip Long, Marshfield, Mo., is carrying a large stock of electrical supplies and is prepared to fill orders promptly. He has a number of excellent specialties as well as an exhaustive stock of bells, batteries, miniature incandescent lamps, small dynamos and motors and electric light supplies in general.

The Shultz Belting company, St. Louis, has secured the contract for belting for the Ottumwa, Iowa, electric light plant. The contract calls for one 36-inch 125 foot belt, as well as many smaller belts. The Shultz company has just made a shipment of 5,000 feet of belting to London, England, and another large shipment for the city of Monterey, Mexico, is under way.

William H. Bryan, the well-known electrical engineer of St. Louis, Mo., has just returned from Paducah, Ky., where he was called to make a complete test of the city lighting plant. Mr. Bryan found the plant in good shape. It was installed by the Consolidated Engineering company of St. Louis. Its present capacity is 115 2,000 candle power arc lamps. Standard Electric company's machines are in use with a Hamilton-Corliss engine.

The American Electrical Manufacturing company of St. Louis has just issued a circular announcing the completion of its new plant by which it is enabled to double its capacity. In 1890 the company began the manufacture of incandescent lamps, turning out 150 daily. At the present time the output is over 3,000 lamps daily, and still the company is unable to keep up with its orders. The success of the company is merited and it is hoped that it will continue.

The Electric Appliance company, Chicago, has just completed its catalogue of electric railway supplies, and will be pleased to furnish copies with special trade discounts on application. In preparing this catalogue the Electric Appliance company has made it consist wholly of electric railway supplies, not considering it necessary to pad it out with material which comes regularly under the head of electric light supplies. This line of electric railway material will also be included in the new issue of this company's general catalogue, which, it is promised, will be a most complete catalogue of general supplies.

During January Warren Webster & Co. of Camden, N. J., sold many of their vacuum feedwater heaters and purifiers. In many cases this firm receives the price of the heaters in monthly installments, consisting of the saving of fuel to the purchaser, until the whole is paid in this manner. Recent purchasers were: Glen Manufacturing company, Berlin, N. H.; F. R. Walker & Son, Warren, Mass.; Sayles & Jenks, Warren, Mass.; Beaver Tin Plate company, New Lisbon, O.; the Johnson company, Lorain, O.; Hurlbut Paper Manufacturing company, South Lee, Mass.; es-

tate of C. H. McCormick, Chicago, Ill.; M. Guggenheim's Sons, New York; Midvale Steel company, Nicetown, Philadelphia, Pa.; J. H. Horne & Sons company, Lawrence, Mass.

Owen Ford, St. Louis, well known in electrical circles through his connection with many of the largest installations of the General Electric company, is now located in the Security building. Mr. Ford has met with a large measure of success since opening an office for himself and has made several noteworthy installations. Among these is one recently completed at O'Fallon, Ill., an electric lighting and water works plant, at a cost of $18,000. This plant is regarded as a standard of excellence by the surrounding country. The same engineer has installed twelve plants during the last year in the South and West and Mexico. Mr. Ford formerly was manager of the railway, lighting and power business of the General Electric company at Denver, Colo., where he was located for four years. Mr. Ford has designed and installed over a hundred plants throughout the country, among them being some of the most important power transmission, mining, railway and lighting plants in the West.

The Wallace Electric company of 307 Dearborn street, Chicago, has just closed an arrangement with the Whittingham Electric Car Heating company of Baltimore for handling the latter's electric car heater in the West. This heater shows a radical departure from former types of electric heaters. It is developed on the idea of steam radiation from pipes. Each heater is composed of eight wrought-iron pipes running the full length of the car, four on either side, fitted in suitable castings and attached to the riser of the seat. Each pipe contains a coil of German silver wire enclosed within a heat-conducting, insulating tube. The tube and wire are placed inside the wrought-iron pipe, and both pipe and tube are packed by machinery with chemically pure silica. This construction surrounds the wire with the best possible heat-conducting medium, at the same time perfectly insulating it from the wrought-iron radiating jacket. The advantages claimed are great durability at any temperature, greatly increased radiating area, even distribution of heat throughout the car, reserve capacity and safety. In reference to consumption of current, which is one of the principal points to electric railway companies, the agent says that it can furnish two variations of heat—that is, half and full temperature—taking respectively three and six amperes. Six amperes is considered ample for severe weather, but with this system arrangement can be made to utilize any amount of current that railway companies will be willing to expend in heat and to adapt the heater to all conditions of weather. The Wallace company has one of these heaters installed in its office as an exhibit.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued February 5, 1895.*

533,427. Automatic Telephone Switch. Henry D. Bayne, Brooklyn, N. Y. Application filed May 31, 1894.

This device combines a sliding bar carrying a contact or contacts, a bracket having one jaw pivoted and in engagement with the bar, a spring acting on the same and a receiver for inserting between the bracket jaws.

533,434. Rosette for Electric Lighting. Elisha W. Buffinton, Fall River, Mass. Application filed October 6, 1894.

In this rosette the principal features are the cup comprising the central or main portion and oppositely grooved walls, the clamp secured at a point between its ends to the main portion by a single screw, the outer ends of the clamps being grooved at binding screws, whose heads overlap the grooves, whereby the electric wire is held therein, and the lamp cord clamped between the protuberances on the inner ends of the clamps and the recesses on the upper surface of the main portion of the rosette.

533,445. Electric Dental Motor Apparatus. Francis N. Denison, Toronto, Ont. Application filed May 26, 1894.

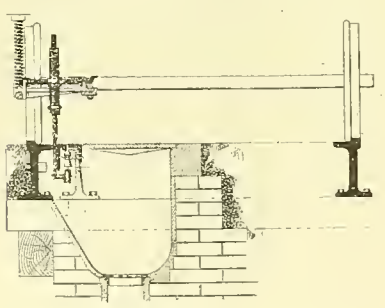
In a dental outfit is claimed the combination with the dental table pivoted and swung in proximity to the chair of an electric motor in a chamber under the central portion of the table between the drawers, and having the rigid spindle of the dental engine deriving motion from the motor, journaled in suitable hearings in the inner partition and side of the table, and having the flexible shaft of the dental engine extending outwardly from the end of the rigid spindle.

533,447. Electric Railway. John G. Douty, Williamsport, Pa. Application filed May 17, 1894.

The arrangement shown in the accompanying cut includes the combination with a car and a trolley wire of a tubular arm connected to the car, a vertically movable trolley arm passing through the tubular arm, a trolley wheel carried by the trolley arm, a collar on the trolley arm adapted to engage a shoulder on the tubular arm to limit the movement of the trolley arm in one direction, and a spring in the tubular arm, the spring bearing at one end against the latter and at the other end against the collar to maintain the trolley arm at one end of its vertical movement and the wheel in line with the trolley wire.

533,459. Electrically Lighted Buoy. Ira W. Henry, New York, N. Y. Application filed May 29, 1893.

The cut shows a buoy, having mounted thereon an electric lamp or lamps, and a water-proof transformer for delivering to the lamp or lamps a low potential current from an alternating circuit, the leads to the circuit being housed in a groove or recess formed in the buoy and provided with a water-proof cover.



NO. 533,447.

533,490. Electric Fire Alarm and Police Signal Box. George E. Paynter and William H. Thompson, Richmond, Va. Application filed May 4, 1894.

The last claim follows: In a signal box the combination with a signal transmitting mechanism of a jointed locking lever, a releasing lever, an angular lever having on one arm a lug adapted to lie beneath the releasing lever, an armature on the other arm, an electro-magnet and a spring projected retracting bar having a conoidal enlargement to act when said bar is pushed in by the key upon a heel on the angular lever, the latter having a rearwardly bent extremity overlying the jointed locking lever.

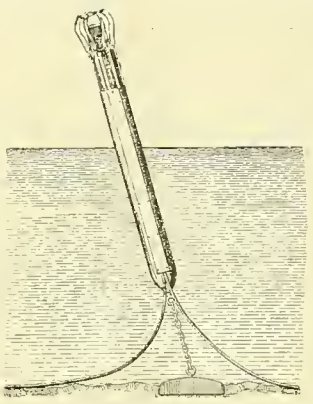
533,502. Method of and Means for Testing Incandescent Lamps. Frank S. Smith, Pittsburg, and James A. Vandegrift, Allegheny, Pa. Application filed July 9, 1894.

The illustration shows a means for testing lamp bulbs while in process of exhaustion, leads in circuit with the filaments of the lamps, a conductor in proximity to the lamps, and means for producing high tension oscillatory or alternating currents, one end of the high tension producer being connected to either of the leads and the other to the conductor.

533,583. Brush for Dynamo-electric Machines. Joseph W. Dickey, New York, N. Y. Application filed December 8, 1894.

The claim follows: In a dynamo brush composed of woven wire cloth or mesh, the combination with main blank, cut angularly to the length of the roll or piece of a second shorter piece of wire cloth similarly cut and placed over the main blank, with its angular ends in reverse position to those of the main blank, and wound up and pressed to form and forming a dynamo brush of suitable shape.

533,596. Apparatus for Refining Metals by Electrolysis. Henry A. House, Bridgeport, Conn. Application filed May 2, 1894.



NO. 533,459.

In an electrolytic apparatus the claim is made for the combination with a rotating cathode, partially immersed in the solution, of a scraper for removing the film of metal from the surface of the cathode above the solution as the cathode revolves, and means for insulating that part of the cathode with which the scraper engages.

533,598. Running Gear for Electric Cars. Charles A. Jackson, Reading, Mass. Application filed September 15, 1893.

There is the combination of the axle, having a ring affixed thereto, a wheel having a recess to receive one-half of said ring, and a clutch-block having a recess to receive the other half of the ring and a flange bolted to the wheel.

533,607. Insulated Conductor. Henry G. O'Neill, Boston, Mass. Application filed March 22, 1894.

A covering for resistances consisting of two coats, the inner coat being composed of a mixture of silicate of magnesia and silicate of soda in solution, and the outer coat consisting of a mixture of lime albumen dilute and lactic acid.

533,610. Conduit Electric Railway. Alfred Rosenholz, San Francisco, Cal. Application filed May 22, 1894.

In a conduit electric railway the arrangement is described of a slotted tube or tunnel, arms or levers fulcrumed to the car and extending through the slot into the tunnel, and having their lower ends extended in the line of the travel, and inclined upwardly, a conductor or conductors stretched between these levers and forming communication through them with a motor carried upon the car, the arms or levers being extended above their fulcrum points, and having their upper free ends engaged by an elastic connection, whereby the tension of the conductor or conductors is automatically maintained, main conductors extending along the line of the track with branches extending from them at intervals into the conduit, and switch mechanisms adapted to form contact with the conducting wires carried by the car, whereby the current is transmitted from the main conductor to the car and motor while such contact is complete.

533,619. Telephone Arm Rest and Receiver Holder. William Steubing, Cincinnati, O. Application filed October 30, 1894.

Following is the claim: In a telephone support, the combination with a telephone and its receiving tube, of a base having perforated arms, of a rod moving therein and bent near its upper end, of a spring holding said rod in place, of a curved and forked support for the receiver attached to the upper end of the rod, of a round and notched bar held vertical by the arms of the base, of an elbow-rest at the top of an arm, of a sleeve adjustable on the vertical bar, and with which the arm is integral, and of a pawl pivoted in the socket and holding it in place on the bar.

533,627. Conduit Electric Railway. William H. Baker, Pawtucket, R. I. Application filed May 18, 1894.

Among the claims for the system is the following: In a conduit electric railway system, a trolley comprising a roller equipped carriage for traversing lines of conductors laid at different elevations in the conduit, conductor plates for extending through the conduit slot and insulated from each other, one of said plates extending downward beyond the other, suitable connections between said plates and the carriage respectively, and an armor incasing the conductor plates and having a pendent portion, said armor being cut away at the place of connection of the upper carriage with its conductor plate, and in its pendent portion back of the said carriage to expose the insulation.

533,631. Subway for Electric Railways. Frank E. Button, Rochester, N. Y. Application filed June 6, 1894.

The last claim describes the combination with a subway provided with a longitudinal groove or slot, and an electric conductor supported within the subway at one side of the groove or slot, of the supporting frame of a vehicle, a trolley wheel movable along the conductor within the subway, a support for the trolley wheel consisting of an upper section composed of a division fixed to said supporting frame, and a second division reciprocally movable along the former division and provided with an internal chamber and a movable plate for permitting entrance to said chamber, and a lower section having one end flexibly connected to the second division of the former section and its opposite end guided in the groove or slot, and provided with an upturned extremity carrying the trolley wheel, means for reciprocating the movable division of the former section of said support, a spring for elevating the lower section and forcing the trolley wheel against the conductor, a fuse arranged within the chamber of the movable division of the upper section of said support, and the opposite sections of a conductor extending from the trolley wheel along said support and connected to the fuse.

533,698. Safety Connection for Electric Conductors. Ralph E. Bates, Brooklyn, N. Y. Application filed June 20, 1894.

A hanger for electrical conductors, comprising a housing and two plates, said housing having transverse bolts, and the plates provided at their forward ends with vertical slots or kerfs adapted to engage the forward bolts and a horizontal slot or kerf in their inner ends, engaging the inner bolts of the housing, the forward ends of the plates connected to the electric conductor.

533,729. Telephonic or Analogous Electrode. Thomas McCoubray, New York, N. Y. Application filed August 9, 1894.

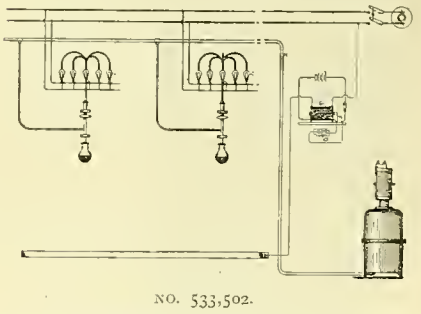
The method of preparing a carbon powder from the residuum of petroleum distillation consists in crushing or grinding the material into a powder-like form, then passing the powder through a sieve of given mesh and again separating the finer particles from the coarser, and finally carbonizing the particles retained in the second sieve.

533,772. Trolley for Underground Conduits. Charles M. Yost, Washington, D. C. Application filed November 3, 1894.

The combination with the base plate and the posts extended there through to swivel, of the trolley arm mounted in the upper ends thereof for pivotal movement, the intermeshing gears on the lower ends of the posts, means for turning one of the gears, and depressible spring supports for the said arms, is described.

533,785. Telephone Exchange. Morgan Brooks, Minneapolis, Minn. Application filed October 17, 1894.

A subscriber's circuit, with a permanent coil included therein, a movable second subscriber's circuit, and a second coil connected therewith and adapted to be placed within the field of said permanent coil, whereby electrical energy is induced upon the second line or circuit, are combined in this arrangement.



NO. 533,502.

533,795. Electric Broiler or Toaster. Levi T. Edwards, Haverford, Pa. Application filed March 2, 1894.

The device consists of a frame, a spring-actuated bar beyond the same, a grid contained within the space bounded by the frame and consisting of a wire carried backward and forth in a zig-zag course and insulated from the frame, means for rigidly connecting one side of the grid to one of the bars of the frame, and means for rigidly connecting the other side of the grid to the spring bar.

533,836. Conduit System. Charles M. Yost, Washington, D. C. Application filed November 3, 1894.

The combination is claimed of the main conductor, alternately arranged, fixedly mounted conductor bars, having an independent connection with the main conductor and arranged with their ends overlapping, and a separate plate for each bar by which it is secured in proper position with relation to the slot

533,853. Cover for Electric Light Globes. Hans Johansen, Chicago, Ill. Application filed June 30, 1893.

In this arrangement is claimed the combination with the cover of an electric light globe, of a nut mounted thereon to rotate about a vertical axis, a threaded horizontal rod working in said nut, and a second nut working upon the free end portion of said rod and provided with a rigid hook open upon the side toward the rod and adapted to engage the rod of a lamp frame, whereby the cover may be secured to a lamp rod upon any side of the nut first mentioned and at any moderate distance therefrom.

Western Electrician.

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## The Niagara Power Plant as It is To-day.

By Frank C. Perkins.

The power house for the great electrical transmission plant at Niagara Falls is practically completed, and the offices and engineers' rooms are about ready to be occupied. The main part of the power house is now as large as necessary for operating the first three turbines and alternators of 5,000 horse power each, or a total development of 15,000 horse power. The illustration, Fig. 2, shows the power house at the right as viewed from the south. All that will be necessary to increase the capacity of the plant will be to extend the power house toward the river, installing the necessary turbines after the wheel-pit has been prepared.

The interior view on this page, Fig. 1, was taken from that end of the power house nearest the river and shows at the right the completed foundation for the switchboard and the supports for the railing which will surround it. This view also shows the governors or regulators, the various cast-iron bases of the alternators bolted to their stone foundations, the electric crane in the background, the oil filtering pumps, cylinders and tank near the center of the building at the left, and finally the bolts which are to hold the foundation plates of the rotary transformers, which will be located over the subway, just in the foreground, next to the switchboard foundation. The slabs of slate shown on the switchboard foundation are to be laid to form the floor of the gallery or platform surrounding the switchboard.

FIG. 1. THE NIAGARA POWER PLANT AS IT IS TO-DAY.—INTERIOR VIEW OF POWER HOUSE.

### GENERATING APPARATUS.

The first of the 5,000 horse power alternators is now being erected at the power house. It will occupy the position nearest the office, directly over the first turbine. The stone foundation, showing bolts for fastening down the cast-iron base of the generator, may be seen in the foreground of Fig. 4. Two circular cast-iron bases mounted upon the stone foundations are shown in Fig. 1. These bases are ready to receive the stationary armatures of alternators Nos. 2 and 3. These armatures are bolted to vertical cast-iron cylinders, which are fastened to the cast-iron base plates. The alternators, it is said, are constructed mechanically very nearly as designed by Prof. George Forbes, but the electrical work and details of winding are believed to have been considerably modified by the engineers of the Westinghouse Electric & Manufacturing company. The wrought-steel ring upon which is bolted the inwardly projecting cast-iron magnet pole pieces forms a massive flywheel field magnet and is attached to a vertical shaft by a large steel spider. The shaft supporting the rotating flywheel field magnet has its bearings supported by the cylindrical frame on which the stationary armature rests. Mica is used for insulating the armature windings, which consist of copper bars placed in the holes of the armature core. Two independent circuits are to conduct the currents from the alternators to the switchboard and transformer house. These circuits consist of cables to be carried in conduits in the cement floor of the power house to the switchboard, and are to be supported by brackets in the subways leading to the transformer house beyond the conductor bridge. The switchboard and foundation stand directly over the subway, which runs the full length of the power house. The alternaors, which are 13½ feet high, each generate two alternating currents differing in phase from each other by 90 degrees. The frequency is 25 periods per second. The current supplied to each circuit is designed to be 775 amperes at a potential of 2,250 volts. The field coils consist of bent copper bars, which are to receive direct current from rotary transformers by means of brushes and copper rings fixed to the shaft which supports the field magnets. The speed of the revolving field magnets will be 250 revolutions per minute, and the turbine is said to be so designed that the maximum speed possible will be less than 500 revolutions per minute.

The regulating apparatus presents many interesting features. The three regulators for governing the speed of the three alternators are in process of erection, and the governor shown, in Fig. 4, is about finished, although the balls and most delicate parts have not been put into place and will not be connected until the more heavy parts of the alternators have been assembled. Each alternator has its own regulator located near it, as seen in Fig. 1, and is connected to it beneath the cement floor of the power house. The regulator is connected to the gates of the turbines by a system of levers which is very delicately balanced; the total power necessary to move the series in order to open and close the gates is only about four pounds. This regulator controls the speed of the generator to a nicety by means of the delicately balanced levers. It is said to have done very good service in other electrical installations, and was designed to control the speed to within one-half of one per cent. at a normal rate of working and within about three per cent. if the load of the turbine is increased or diminished suddenly by one-quarter load, or 1,250 horse power. This is a very remarkable result for regulators for water power, and will be watched with interest in practice. The governors were designed by Faesch & Piccard of Geneva, Switzerland, who are also the designers of the turbines installed.

The completed foundation for the switchboard is shown in Fig. 1. The switches are all to be mounted within the foundation and operated by compressed air from levers on the platform or gallery which surrounds the switchboard proper. There will be mounted on the switchboard the various indicators, lamps, ammeters, voltmeters and other measuring instruments which will require watching by the engineers in charge. The switchboard is mounted on an iron and brick foundation framework in the form of a room which is 58 feet long, 13 feet wide and 8 feet high. The foundation is built of white enameled brick, and the side nearest the dynamos, shown in the illustration, gives a beautiful appearance, being a smooth, white, unbroken surface. The opposite side near the wall of the power house next to the inlet canal, has ten doors of white pine with a large number of small, square, heavy, plate-glass

windows. The doors open into the room under the foundation, in which are mounted the heavy main switches and connections to the various cables. It has been stated by the engineers that these switches are to be operated by a compressed air mechanism similar to the Westinghouse air brake apparatus, the air compressor being operated by

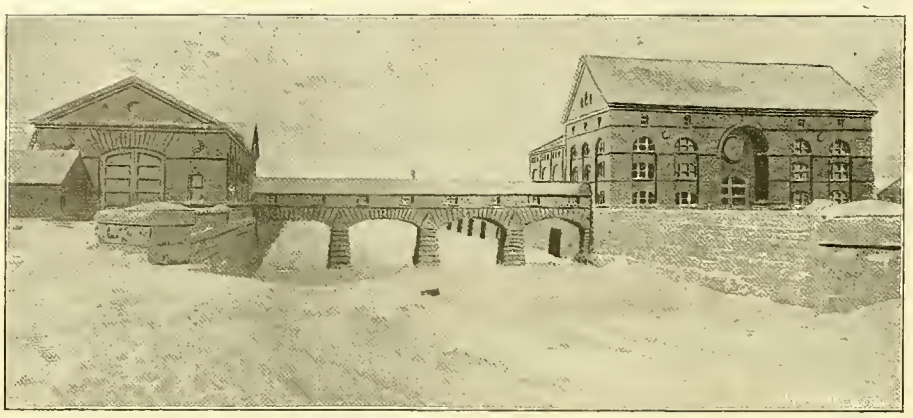


FIG. 2. THE NIAGARA POWER PLANT AS IT IS TO-DAY.—POWER HOUSE, CONDUCTOR BRIDGE AND TRANSFORMER HOUSE.

water power in the wheel-pit below. The switchboard stands directly over the subway, making it easy to arrange the connections to the alternators, transformer house cables, resistance conductors and rotary transformer wires. The gallery surrounding the switchboard proper has a slate floor, and a handrail extends around it. A metallic stairway leads to this switchboard gallery from the power house floor. It has been stated that the only foreign instruments to be used will be some wattmeters. The voltmeters, ammeters and other measuring instruments, together with switches and other switchboard apparatus, are to be furnished by the Weston Instrument company of Newark, N. J., and the Westinghouse Electric & Manufacturing company of Pittsburg.

It is very interesting to note the provision for the necessary resistance for a plant of such magnitude. It is of considerable importance that the resistance be placed near the switchboard and near the generators and still be out of the way and easy to be reached with the various conductors. The resistance pit is being constructed beneath the floor of the power house and directly in front of the switchboard and foundation. The pit is about 6 feet deep, 18 feet long and 12 feet wide, and is walled in with brick. It opens into the subway beneath the switchboard foundation through an archway, and the conductors leading to it may be easily laid to the switchboard and alternators.

The conductor bridge, as seen in Fig. 2, connects the power house with the transformer house. It is a covered stone structure supported by stone piers whose foundations are on the bed of the inlet canal. The conductors are to be supported on brackets in the subways in the power house and transformer house, and the cables connecting the dynamos and switchboard to the transformers will be carried over the conductor bridge.

The transformer house, shown at the left in Fig. 2, is a fine stone building and has but recently been finished. In it will be installed the necessary step-up transformers for transmission of power to a distance. It has been so constructed that it can be easily extended toward the river to hold all the transformers necessary for the total 100,000 horse power. At present the interior of the transformer house has not been finished; it shelters a couple of cars containing cables and parts of the alternators. The field magnet coils and casting for the top of the alternator occupy one car, the cables furnished by the General Electric company for use in the transmission taking the other.

The current from the generators is said to be a two-phase current, and four conductors will be necessary to convey it in two circuits away from the alternators to the switchboard and transformers. At the transformer house the current will be changed from two-phase to three-phase by means of transformers, and instead of using four wires for the transmission line, three wires only will be necessary, making a great saving in copper. Six wires will probably be used, however, for increasing the carrying capacity of the transmission line.

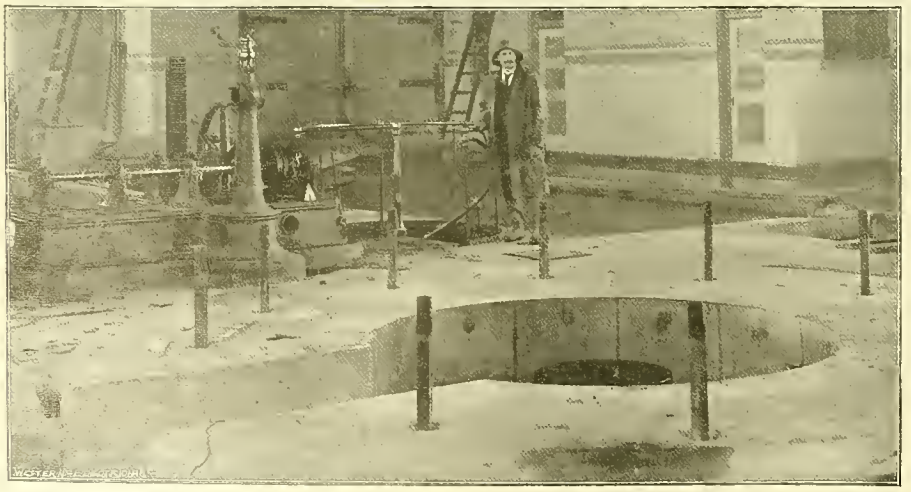


FIG. 4 THE NIAGARA POWER PLANT AS IT IS TO-DAY.—TURBINE REGULATOR AND DYNAMO FOUNDATION BOLTS OVER WHEEL-PIT.

PRESENT LIGHTING AND POWER PLANT.

The lighting and power plant now used for the operation of the various motors and for lighting the power house is located in a small building near the inlet canal and Niagara river, and the current is conducted to the power house by pole line construction.

The boiler is installed in the pumping station of the city water works and steam is piped into the adjoining building to supply a compound Westinghouse engine. This engine develops about 100 horse power and is directly connected to a Westinghouse 220 volt direct current generator of 100 horse power.

The rotary transformer plant will replace this outfit when the former is operating satisfactorily, and the older plant will be used in case of emergency.

ROTARY TRANSFORMERS.

The direct current for exciting the field magnets of the generators, as well as that necessary for lighting the wheel pit and power house and operating the electric motors of the elevator, crane and gate gearing, will in time be supplied by rotary transformers located at the farther end of the power house near the end of the switchboard and directly over the subway. The bolts for securing the foundation plates of these rotary transformers may be seen in the foreground of Fig. 1, near the end of the switchboard. These motor-generators were designed by the Westinghouse company and are of the six-pole type, each machine delivering 200 kilowatts at a potential of 220 volts. Four stationary transformers will be placed in the subway beyond the motor-generators, and two of the stationary transformers will be utilized while the others are held in reserve. The exciting current delivered by these rotary transformers will be conducted through the subway and switchboard to the alternators by cables laid in conduits leading to the bases of the generators, the conduits being laid in the cement floor of the power house. From the alternator's base the exciting current conductors will run through the upright iron columns which support the gallery or platform of the generator to the brushes of the alternator magnets.

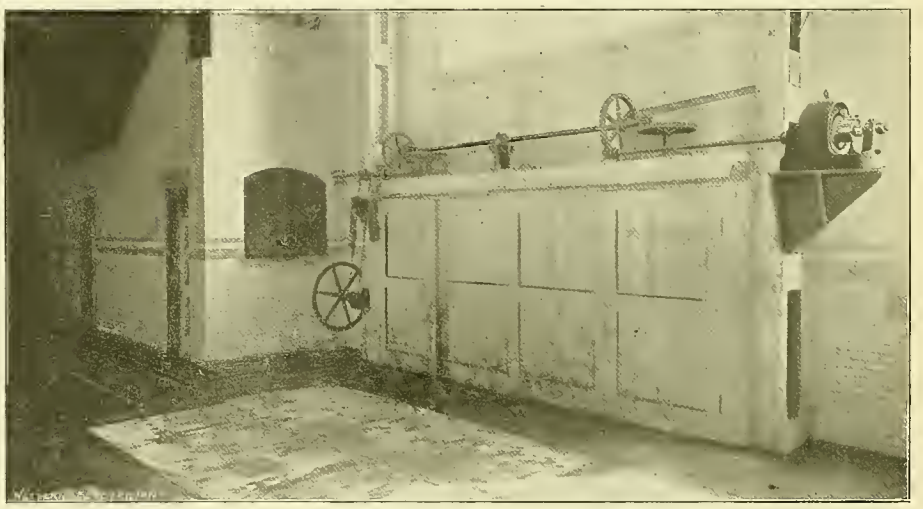


FIG. 3. THE NIAGARA POWER PLANT AS IT IS TO-DAY.—ELECTRIC MOTOR AND GEARING FOR OPERATING INLET GATES.

SPECIAL FEATURES.

An electric traveling crane is and has been in use for a considerable length of time in assembling the various heavy parts of the turbines, shafting, etc., and lowering the same into their positions in the wheel-pit. It is now coming into use for assembling the parts of the large 5,000 horse power alternators. It was furnished by William Sellers & Co. of Philadelphia, Pa., and is operated by a Bilberg motor. The current is supplied from the temporary plant. The crane may be seen in the background of Fig. 1.

The circular rail and opening seen near the governor in Fig. 4 is the entrance to a winding stairway leading to the elevator landing. At this landing one takes the electric elevator to visit the various galleries and sub-galleries in the wheel-pit. It is used for carrying the tools and workmen up and down the shaft, where they are busy finishing and scraping the various shaft bearings. The elevator was designed and constructed by Otis Bros. & Co. and is operated by a 220 volt direct current motor. The marble switchboard for the elevator and the hoisting apparatus and motor are temporarily inclosed in two small rooms built in the power house to keep the machinery away from the moisture which rises from the wheel pit below.

The gates which are opened to allow the water to pass from the inlet canal outside the power house to the large pipes which lead to the turbines are operated by electric power. Fig. 3 shows the gearing and electric motor, which operate the first gates leading to turbine No. 1. The electric motor is mounted on a shelf supported by iron brackets. It is an eight kilowatt direct current Westinghouse machine and is operated at 220 volts potential. Two of these motors are already in place, but have not been,

as yet, connected, electrically or mechanically. The current for operating these motors will be supplied from the temporary plant at first, and finally from the rotary transformers. The visitors' gallery may be seen in both Figs. 3 and 4. It is near the main entrance of the power house and directly over the doors leading to the offices of the company.

The lighting of the various galleries and sub-galleries in the wheel pit is interesting, from the fact that the greatest care was necessary in the wiring and conduit work, on account of the excessive moisture encountered. Water is dripping continuously from the framework on the various galliers from the floor of the power house to the turbines at the bottom. The construction work for lighting the wheel pit was done by the Western Electric company. The current is supplied from the same source as that of the electric elevator, electric crane and electric gate motors. There are four galleries in the wheel-pit and three sub-galleries. Each gallery is now provided with four permanent incandescent lamps supported by four curved iron pipe standards. The conductors are carried through iron conduits lined with insulating material. Each lamp is enclosed in a separate hermetically sealed globe, and the sockets are of rubber carefully arranged to exclude all moisture. There are iron junction boxes on each gallery making the connections to the risers running to the bottom of the wheel-pit.

The lubricating and cooling apparatus for the bearings present many novel and instructive features, but description of them must be reserved for a future article.

## Buckeye Electric Company.

The Buckeye Electric company was incorporated in the spring of 1890 under Ohio laws, with a capital of $100,000. Its beginnings were modest, the original factory built soon after the incorporation being but a small frame structure only 50 feet square and two stories in height. In this it was proposed to manufacture 300 lamps per day; but in the spring and summer of 1891 the company found that, owing to the adoption of a new and improved filament obtained from abroad, the demand for its product was very largely increased, and the erection of a new factory was decided upon. A substantial brick building, about 40 by 100 feet and three stories high, with a wing 60 by 80 feet and one story in height for boiler, engine and dynamo room was built, and the output increased to 2,500 lamps daily. But the growing demand for the new lamp was still beyond the supply, and a still further and larger structure was finished in September, 1894.

The company has suffered in common with others from litigation. During 1893 the works were closed by injunction obtained on motion of the General Electric company, but after six months an application for a dissolution of the injunction in the United States Court of the Northern District of Ohio was successful, and since that time the Buckeye Electric company has successfully resisted all attacks upon it or its customers. The present output of the plant is nearly six thousand daily. The lamp is recognized as a leader by the trade, and as being of uniformly high quality in material and workmanship, and the business is large and satisfactory, increasing steadily month by month as the lamp becomes more widely known.

The directors of the company, in addition to the president, vice-president and treasurer, portraits and sketches of whom appear herewith, are: Joseph Colwell, vice-president of the Commercial National Bank; C. A. Grasselli, president of the Grasselli Chemical company; D. Z. Norton, of Ogleby, Norton & Co.; Daniel Bailey, secretary of the Grasselli Chemical company; Julius King, president of the King Optical company. These gentlemen are all men of wealth and high standing in Cleveland.

J. Potter, president of the Buckeye Electric company, is a native of the state of Ohio. He was graduated with honors from Princeton College in 1877, and later received the degree of M. A. from the same institution. He became identified with the electrical industry in the fall of 1881, when he made an engagement with the Brush Electric company to take charge of its business in Japan, China and other oriental countries. After several months of practical preparation in the Cleveland factories and in Mr. Brush's laboratory, he sailed from San Francisco for Japan in April, 1882. Although several English and French manufacturers had endeavored to get a foothold in the Orient, Mr. Potter was, in fact, the pioneer of the electrical industry in that part of the world. He made his residence in Yokohama, Japan, and within a year had built up a large and lucrative business. He made extensive contracts with the Japanese government for lighting docks, arsenals, warships, etc., and established the first central station electric lighting plants in Japan and China.

Mr. Potter's operations in oriental countries resulted in handsome profits to himself and his company, and as a result of the ability for affairs which he displayed, he was, in 1884, recalled to Cleveland to take the offices of treasurer and director of the Brush Electric company. He returned via India, Egypt and Europe thus completing the circuit of the globe. He was an incorporator of the Swan Lamp Manufacturing company, and of the Short Electric Railway company, and became vice-president of the former and president of the latter. Until 1893 he took a prominent part in the management of the affairs of these and subordinate companies, and especially administered their finances. After the formation of the General Electric company in New York, Mr. Potter disposed of his interests in the enterprises with which he had been identified and retired from the management. In January, 1894, he acquired large holdings of the stock of the Buckeye Electric company, and became its president. He is also interested as a stockholder in these banks has been remarkably successful, their combined deposits amounting to more than $3,000,000. Mr. Stafford is also the head of the insurance firm of O. M. Stafford, Goss & Co., which does the largest fire insurance business in Cleveland and vicinity. He became interested in the Buckeye Electric company upon its organization, and has always been one of its largest stockholders. He is one of the most prominent, active and successful men of Cleveland.

Charles H. Rockwell, secretary and treasurer of the Buckeye Electric company, was born at Tarrytown, on the Hudson, a city that is rich in the historical lore of the Revolutionary War, and not far from the spot where the celebrated Major Andre was captured. His parents were George and Sarah (Tunis) Rockwell. His great-

O. M. Stafford. Arnold Spiller. J. Potter. Chas. H. Rockwell. J. H. Cooke.

BUCKEYE ELECTRIC COMPANY.

Cleveland banking institutions and manufacturing companies, being a director in several. He is a member of the Chamber of Commerce, the Union and Country clubs of Cleveland, the American Academy for the Advancement of Science, the University Club of New York, and president of the Cleveland Alumni association of Princeton University.

Oliver M. Stafford, vice president of the company, was born in Cleveland, and received his education at the Cleveland Institute. At the age of twenty years he entered the Commercial National Bank of Cleveland, and occupied various positions of responsibility in its service for a period of eleven years. In 1884 he organized the Broadway Savings & Loan company, a combined savings and commercial banking institution in one of the populous outlying centers of Cleveland, and later, in 1887, he organized the Woodland Avenue Savings & Loan company, a similar institution. His management of grandfather was a lieutenant in the army of General Washington. At an early age, on September 17, 1862, Mr. Rockwell enlisted in the One Hundred and Second New York Volunteer Infantry, and served until the close of the war. He was mustered out as first-lieutenant in November, 1865, having participated in many of the more important battles, among which were Chancellorsville, Gettysburg, Lookout Mountain, Resacca and the campaign of General Sherman to Atlanta. After the close of the war he engaged in business in New York city, being connected with the Swiftsure express line of steamers on the Hudson river, and afterward with the New York Steam company for many years. In 1885 Mr. Rockwell came West, locating in Cleveland, where he organized the Western Mineral Wool company, with which he has ever since been connected, and in which he still holds the office of vice-president and general

manager. In the spring of 1890 he became interested in electrical work, and was one of the promoters and organizers of the Buckeye Electric company. Mr. Rockwell gave much time and attention to the new venture, and for the first three years was the active head and manager of its affairs. The growth of the enterprise has been rapid, though the beginning was very modest; yet the success of the company is now assured, the business representing an invested capital of $300,000. Mr. Rockwell is a member of the Cleveland Chamber of Commerce, the Masonic fraternity, the Electric club, and other organizations, but his principal interest is in, and his time is devoted to, the Buckeye company, its advancement and continued success.

Arnold Spiller, the superintendent of the Buckeye Electric company, although educated as an analytical chemist, has been connected with the incandescent lamp industry for ten years. Between the years 1879 and 1884 he devoted his time to the study of chemistry and kindred sciences in the laboratories of Kings College, London, City and Guilds of London Institute and the Polytechnicum, Zurich. In the year 1885 he joined the staff of the Brush Electric Engineering company, London, as experimental chemist to the incandescent lamp department, and two years later was appointed superintendent of the department, which position he held until the closing of the English factory in 1889 through ligitation with the local Edison interests. He then went out as expert to the Brush company's Vienna factory, managed by the firm of Kremenezkui, Mayer & Co., where he introduced several improved processes that were so successful in England. Early in the year 1891 Mr. Spiller came to this country to establish at the works of the Buckeye Electric company the special filament process, with which that company is particularly identified, and a few months later he was appointed to the position of superintendent of the works. He is a fellow of the Institute of Chemistry of Great Britain, and a member of several other scientific and technical societies.

One of the best known men connected with the Buckeye company, although not a member of the executive staff, is Joseph H. Cooke, who occupies the important position of Chicago representative of the company. Mr. Cooke is a native of the Buckeye state and was born at Circleville, Ohio, September 10, 1851. For a number of years he was connected with the P., C. & St. L. division of the Pennsylvania Railroad company, with headquarters at Richmond, Indiana. In that city he served as city treasurer for three terms of two years each. His connection with the incandescent lamp business dates back to May 1, 1890. For two years he served as secretary and treasurer of the Sunbeam Incandescent Lamp company of Chicago. On May 1, 1892, he joined the Buckeye Electric company, being given charge of the states of Illinois, Indiana, Iowa and Wisconsin, with headquarters at Chicago. His patience, perseverance and faith in the Buckeye lamp have resulted in the establishing of the largest individual lamp trade in the city of Chicago.

The Cuyahoga, Ohio, Suburban Railway company has filed a mortgage deed to the Savings & Trust company to secure the issue of $50,000 worth of bonds. Bedford, Chagrin Falls, Chardon, Burton and Kinsman will all be connected by this system, and the richest farming territory in the state will be opened up by this projected system

## Elliott-Lincoln Electric Company.

One of the younger concerns that have done much to give the city of Cleveland prominence as an electrical center is the Elliott-Lincoln Electric company, an outgrowth of the Elliott Electric company which was formed three years ago and which has already established for itself an excellent reputation among builders of high-class dynamos and motors. Starting in a modest way a little over three years ago, the only work attempted was repairing. The shop occupied by the concern at this time was 20 feet by 30 feet, but it was soon found to be too small, and quarters three or four times the size had to be secured. In September, 1892, the name of the company was changed to the Elliott-Lincoln company, and the business was pushed with greater energy. During 1893, in spite of the hard times, the company's quarters became too cramped; and in March, 1894, it removed to the present commodious quarters, 1120–1130 Payne avenue. Here the company has ample room for the present business, with provision for future increase. The shop at present has three rooms; the center one comprises the machine shop, and at one end the winding department is located. This room is 125 feet long, and an idea of the distribution of the machines can be had from the accompanying cut. On one side of the main shop there is a room of almost equal size, at present used as a storeroom, and a wing of the same size, west of the one shown in the cut, is occupied by a brass foundry. The testing room is back of the one shown in the cut. An engine of 150 horse power drives the machinery.

ELLIOTT-LINCOLN ELECTRIC COMPANY.

With the development of the business new lines were taken up gradually, and soon the company found itself in position to undertake the construction of a complete line of dynamos, power generators and motors. Of late the machinery manufactured by the company has been principally standard dynamos and motors for lighting and power purposes. The company has recently changed its type from four-pole machines with two coils to a four-pole machine with four coils. This was done to improve the ventilation. With the change in type an additional stability and neater appearance was gained. Considerable experimental work has been done by the experts of this company, and very satisfactory results have been obtained. At the present time the company is engaged in perfecting an alternator of novel construction. The armature is stationary and is located outside the field. These machines are to be made in two types, one of 15,000 alternations per minute or 125 periods per second, and the other of 7,200 alternations per minute or 60 periods per second. The machine is so constructed that a powerful current of air blows through the field coils on the revolving field and out through the armature. The armature core is so put up that each lamina forming the armature core is separated from its neighbor by an air space equal to its own thickness, over one-half its surface. This gives the best possible ventilation, and in addition to the strong draft of air from within insures perfectly cool operation. The armature coils, it is claimed, are arranged so that it is possible to have a 110 volt current direct from the machine without transformers, a 220 volt three-wire system, a 550 volt five-wire system, and a 1,100 volt transformer system, all operating from one machine at the same time.

The officers of the company at present are as follows: President, J. C. Lincoln; vice-president, S. K. Elliott; general manager and treasurer, J. E. Crawford; secretary, W. A. Crawford.

## Brush Electric Company.

A sketch of Cleveland would not be complete without reference to the Brush Electric company, and any attempt to give an idea of the electrical interests of that city must necessarily deal largely with the history of that corporation and the men who have so successfully conducted the business. The Brush company has occupied the same position in the arc lighting field as the Edison company in incandescent lighting. Every student of electrical literature is familiar with the valuable work of Brush and his assistants in the development of arc lighting. Many of the older members of the company have retired or joined other enterprises, but their places have been filled by men of ability and the interests of the concern have not suffered. As will be seen by reference to the accompanying group, showing the executive staff of the company as at present constituted, the business is in the hands of bright, intelligent, clean-cut men. The chief of the executive staff is S. M. Hamill, who holds the position of second vice-president and general manager of the company.

Mr. Hamill was born in Lawrenceville, N. J., where he attended school until entering Princeton in the class of 1880. He was graduated with the degree of A. B., and subsequently that of A. M. was conferred upon him. After leaving college he taught for three years in the celebrated Lawrenceville school, and during the latter portion of the time studied law. Opportunities in the railroad world offering more remunerative prospects, he secured a position on the Chicago, Burlington & Quincy railroad, where he remained for three years in various positions connected with the freight, traffic and accounting departments. In 1886 he had charge of the C., B. & Q. grain elevators in Peoria, Ill. When he located in Cleveland he secured the position of assistant secretary of the Brush Electric company. He is now second vice-president and general manager of the Brush Electric company and president of the Swan Lamp Manufacturing company, as well as an officer and director in a number of other corporations.

L. H. Rogers, assistant general manager, began his business career in Kansas City in 1884 as a manufacturer of lead pipe and metals. He started the first lead press west of the Mississippi river and continued in the business until 1887, when he became president of the New York Copper Manufacturing company. This company had headquarters in New York and was organized to manufacture articles by electro-deposition. The storage battery as manufactured by the Electric Accumulator company offered a more attractive field to Mr. Rogers and he became interested in that company. The Brush company secured his services early in 1889. He had charge of the Boston office, through which the business for New England was done. During the years 1891 and 1892 he was the general agent for the Thomson-Houston and General Electric companies for the territory of Northeastern New England. In the spring of 1893 he accepted the position of assistant general manager of the Brush Electric company. Mr. Rogers is noted for his energy and ability as a salesman and also for honest and conscientious devotion to all his duties.

Addison H. Hough, secretary of the company, has gained practically all of his business experience in the Brush company. In 1890 Mr. Hough graduated from Yale University and at once entered the employ of the Brush Electric company, first taking a six months' course in the factory. He then entered the accounting department and held several positions until March, 1892, when he was appointed assistant treasurer. In that position he had charge of books of account and collections and retained this position until March, 1894, when he was elected secretary and purchasing agent. Mr. Hough is a very pleasant and genial officer of the company, and his career thus far indicates a promising future.

A. D. Dorman, manager of the sales department, like many others in electrical fields, is an old telegrapher. Mr. Dorman was employed as telegraph operator and stenographer for four years previous to 1888, at which time he entered the employment of the Brush company in the same capacity. In the latter part of 1888 he went to the New York office of the Brush company as chief clerk, and for two years had general charge of the office work. Then for two years had charge of the New York office. Early in 1893 he returned to Cleveland as manager of the order department and was subsequently made manager of the sales department. Mr. Dorman has general charge of all correspondence of the Brush company and the companies connected with it and the employment of the office force, but devotes his time almost exclusively to looking after the sales of the company. He, and those associated with him are hard and conscientious workers.

C. W. Phipps, superintendent, began his career in the works of the Cleveland Machine Screw company as an ap-

prentice. He worked in the several departments, learning the trade of mechanical engineer, from 1874 to 1879. Then he entered the shops of the Telegraph Supply company, predecessor of the Brush Electric company, and has since been connected with the Brush company. In that time he has filled numerous positions of trust in various parts of the world. He spent the year 1882 as superintendent of dynamo construction in London for the European Brush factory. From 1883 to 1885 he was constructing engineer in Japan and China. He returned to Cleveland in 1885, and traveled as erecting engineer and superintendent of the southern engineering force till 1887, at which time he was appointed superintendent of construction for the general eastern territory, with headquarters in New York. He retained this position until the latter part of 1890, when he was appointed assistant superintendent of the factory. He succeeded to the position of superintendent of the factory early in 1893, and has since been in charge. Mr. Phipps is one of the old timers, and his experience is of great value to his company.

T. E. Adams.
L. H. Rogers.
I. R. Prentiss.
A. H. Hough.
S. M. Hamill.
A. D. Dorman.
R. C. Foster.
C. W. Phipps.
C. N. Black.

BRUSH ELECTRIC COMPANY.

Charles N. Black, assistant superintendent, was graduated from Princeton University in 1888, with the degree of B. A. He pursued a two years' post-graduate course in electrical engineering under Professor Brackett. In 1890 he found a position in the shops of the Brush Electric company and for two years secured an excellent practical training in various departments. At one time he was at the head of the draughting room and again in charge of the testing room. After serving as superintendent of construction for the Short Electric Railway company, he returned to the Brush company as assistant superintendent and electrician, which position he now occupies. During the last eighteen months Mr. Black has devoted a large proportion of his time to the designing and development of the large Brush arc dynamos, and in connection therewith has been in frequent consultation with Mr. Brush. His contact and work with two such men of genius and ability as Professor Brackett and Mr. Brush have been of great value to him and have made him one of the leading young men of his profession.

Unlike most of his associates, T. E. Adams was born on a New York state farm, but the machinery used upon the

farm, as well as the machinery of some shops and mills nearby, were objects of interest in his early years. At seventeen he started to improve his education at Oberlin college, but becoming interested in a sewing machine school, he abandoned his studies and for four years sewing machines engaged his attention. Agricultural machine shops, wood-working machinery and steam engines occupied the time until 1876, when, obtaining several patents on a small device for farm use, it was profitably introduced and patents sold. In 1878, having married in Cleveland, and his wife wishing to reside there, he entered the service of the Britton Iron & Steel company, with which he remained two years. The introduction of an electric light plant into these mills first called his attention to the great field of electric lighting, at that time just opening. On January 1, 1882, he entered the employ of the Brush company and did expert work until 1884. For five years he was foreman of the testing department. Later he was absent from the shop on street railroad work, which occupied his attention until 1891. From 1891 to 1895 arc lamps and general foreman work kept him busy. During these years Mr. Adams has invented many things he never attempted to patent, and patented more than a score of devices, some of which have gone into general use. That he is a busy man is shown by the fact that he has not had a week's vacation from business since entering the employment of the Britton Iron & Steel company in 1889.

The next subject, I. R. Prentiss, reversed the usual order, beginning in the central station and later joining the factory forces. In 1880 Mr. Prentiss secured a position with the Brush Electric Light & Power company of Cleveland, the local company operating the Brush system. He remained with this concern for two years and then entered the employment of the Brush company. For four years he was continuously in this company's employment, most of the time in various departments of the shops. About this time he went to New York and spent two years in the large local Brush station of that city. Later he spent considerable time with the Manhattan and Harlem companies in New York city, and in 1889 returned to the Brush company at Cleveland, and since that time has been traveling in various capacities for that company. Mr. Prentiss is well posted electrically, as well as being a clever business man.

Roy C. Foster commenced business in 1884 in the auditor's office of the Valley Railway company, remaining in this position until 1890, and accepting a position with the Cleveland, Lorain & Wheeling Railway company. In 1891 he entered the employment of the Brush Electric company. The following year he was made chief clerk, and in 1894 was given charge of the accounting department, which position he now occupies.

## National Electric Light Association.

This week's meeting of the National Electric Light association at Cleveland will mark an important point in the history of the organization. An unusually attractive programme has been prepared, with the view of inducing the members to pay more attention to the meetings than they have in former conventions. The committee on arrangements announced some time ago that the social features would be made subordinate to the business of the convention. But there is no reason to think that the social features will be forgotten. The electrical people of Cleveland have on a former occasion shown great hospitality, and the visitors may anticipate a pleasant sojourn in the Forest City.

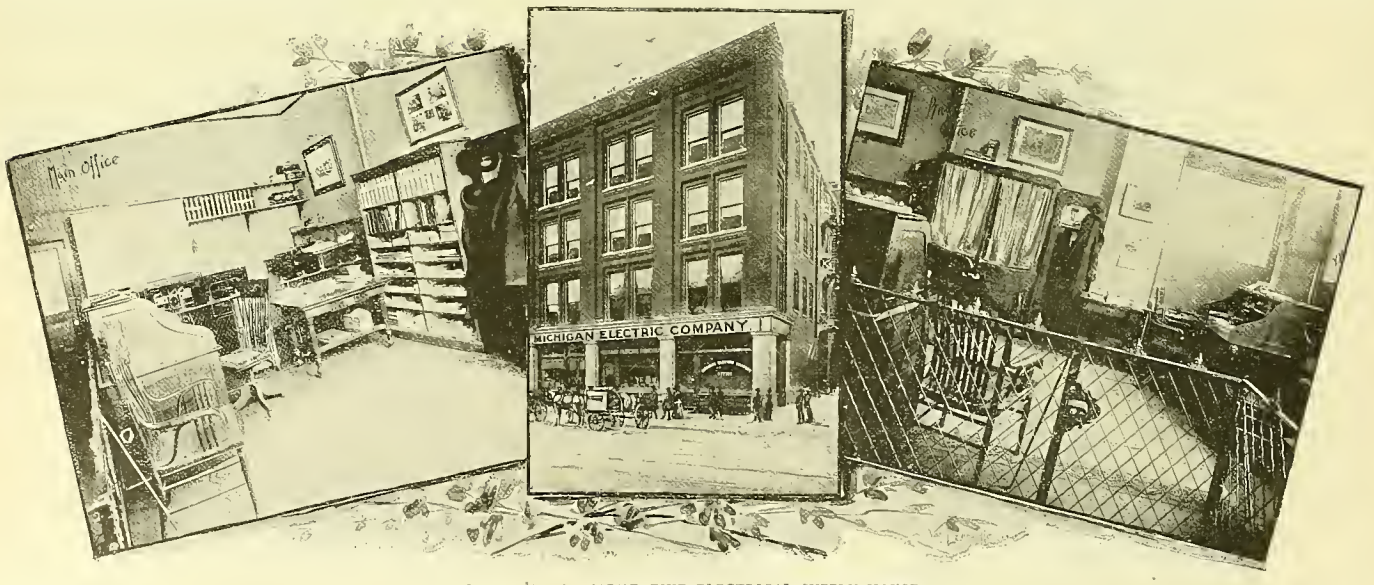
The programme of the convention and all the arrangements for the convenience of delegates and visitors have been published—the complete list of papers and topics having been presented in the last issue.

## Michigan's Representative Electrical Supply House.

During the earlier years of the development of electrical industries the business of furnishing electrical supplies was small and only able to support a few houses, the principal ones of which were naturally located in the large trade centers, such as New York and Chicago, but with the rapid development of the last few years the necessities and demands of many sections of the country have led to the opening of new houses located convenient to these sections, and the size, character and appointments of many of these are such as would be a credit to any of the older lines of trade.

JOSEPH E. LOCKWOOD.

Among these new houses is that of the Michigan Electric company of Detroit. This company was incorporated about two years ago, and since that time its business has grown rapidly, requiring frequent additions to room and stock, until to-day its headquarters, which is here illustrated for the first time, is a credit to the electrical business. The success of this company has undoubtedly been due largely to its active and capable management, consisting of Joseph E. Lockwood, president, and George A. Mansfield, treasurer, a brief outline of whose connection with the electrical business is here given.




MICHIGAN'S REPRESENTATIVE ELECTRICAL SUPPLY HOUSE.

President Lockwood was one of the pioneers in the introduction of electric lighting, having entered the employment of the United States Electric Lighting company in January, 1880, soon after which time he perfected the first carbon filaments used in Maxim incandescent lamps; then installed the first incandescent electric light service in New York city at the Equitable building and vicinity; next introduced the Maxim incandescent and Weston arc systems in Europe, and in 1881 represented the United States company at the first International Electrical Exposition, which was held in Paris. He afterward installed and put into operation a factory in Barcelona, Spain, for the manufacture of the Maxim incandescent lamps and also introduced the incandescent electric light in Holland by installing the Maxim system in the gas works of DeBruyn & Zonen in Amsterdam. After his return to America in 1882, he represented the United States company at several expositions in this country, including those held at Cincinnati, Louisville and Charleston. In 1887 he severed his connection with the United States company and located in Detroit, where he at first was general manager of the Thomson-Houston Electric Light company and later of the Brush Electric Light company of the same city. This latter position he held until 1890, when he entered the electric railway field in the service of the Detroit Electrical Works, of which company he was elected secretary a year later; and he held that position until the organization of the Michigan Electric company. Since 1887 he has been a regular attendant at the conventions of the National Electric Light association, and since 1891 of the American Street Railway associations, and to the members of both associations his face is a familiar and welcome one.

Treasurer Mansfield is a graduate of the Michigan Military academy and afterward attended the University of Michigan. Since the organization of the Michigan Electric company he has been an indefatigable worker in its interests, and to-day he has a wide circle of friends in the electrical field.

In addition to the general lines of electrical supplies this company handles Simplex wires and cables, Siemens & Halske apparatus, Buckeye incandescent lamps, General incandescent arc lamps, Carpenter enamel rheostats, Automatic Switch company's motor starters, C-S flush switches and appliances, Colvin telephones, canvas jacket flexible conduit, Pern porcelain goods and the Walker Manufacturing company's railway apparatus. It owns and manufactures the complete line of overhead material and specialties for electric railways known as "Michigan," and it is the general selling agent for the lighting dynamos and stationary motors manufactured by the Detroit Electrical Works.

Although this company has only been organized about two years, it has made for itself during that time a reputation and standing equal to many older companies, and to-day with its excellent location, ample space and stock and energetic management, it bids fair to make other companies look sharp to keep the lead.

## Power Plant for the Baltimore Tunnel.

Probably no electric plant, or, it might be said, electric experiment on a large scale, has attracted more attention than the Baltimore & Ohio railroad tunnel plant in Baltimore, which will decide beyond dispute the question as to whether electric traction is adaptable to steam railways as substitute for steam locomotives, and also whether electricity is the best motive power for rapid transit in tunnel plants.

The Belt Line road, as it is termed, is but a short cut connecting the main tracks of the Baltimore & Ohio railroad at two points, and its object is to avoid a long curve about the city. This is calculated to save from twenty minutes to half an hour in the running time between New York and Washington, and besides it will enable the Baltimore & Ohio Railroad company to place one station near the present Union Station of the Pennsylvania railroad and a second one in the very heart of the business center of the city. The Belt Line road is about seven miles long. It begins near Bayview, to the east of the city, runs several miles through deep cuts along the northern edge of the city until it swerves around to the Jones Falls embankment, west of Oak street; it crosses the valley of this stream, the tracks of the Pennsylvania railroad and the Baltimore & Lehigh railroad on a large bridge, and a short distance be-

yond this it enters the tunnel, which follows Howard street through the city to the present Camden station. The tunnel is 7,430 feet, a little less than a mile and a half, long, and it cost the Baltimore & Ohio Railroad company between $7,000,000 and $8,000,000.

The motive power is furnished from one station located near the end of the tunnel. This power house is equipped throughout by the General Electric company, which is making the test of electric traction at its own expense, and if the departure proves in every way successful the Baltimore & Ohio Railroad company will purchase the plant complete from it.

In addition to the traction plant an electric lighting plant is found here which will supply about 2,000 incandescent lamps, which are placed throughout the tunnel. As there there will be no smoke in the tunnel it is intended to paint its interior white; and when it is illuminated by the electric lights it will not be necessary to light the lamps in the cars of passing trains, as the passengers will find it almost as brilliant inside the tunnel as outside in the daylight. The generators will be driven by Armington & Sims engines, and the steam will be furnished from improved Root water-tube boilers.

The boiler room of this plant is most interesting, and includes the most modern appliances. Twelve Root boilers are arranged in six batteries, three batteries on each side of the room. Each of the two flues, which run along the opposite walls, back of the boilers, carry the heated gases to economizers, which rob the gases of their heat and by this means raise the temperature of the feed water. The gases then pass into a fan of the Sturtevant pressure pattern, which expels them through a short stack into the air. This fan establishes an induced draft, causing the air to pass rapidly through the grate bars and coal, thus promoting combustion more or less rapid, according to the speed of the fan, which is regulated by the demand for steam on the plant. A coal and ash handling device, made by the C. W. Hunt company, carries the coal direct to each of the boilers, where it is needed, and it also carries the ashes away from the ashpits.

As the General Electric company is relying entirely upon the success of this plant for the sale of it to the Baltimore & Ohio Railroad company, it was naturally obliged to exercise the greatest care in the selection of all the appliances, and to illustrate this point, in the case of the boilers, it may be stated that the General company did not place its order with the manufacturers until after it had thoroughly tested the boilers in two of its plants in Lynn, Mass., which are equipped with this make of boilers.

## Convention Announcements.

The Abendroth & Root company will be represented at the convention by P. M. McLaren, and those of the electrical fraternity desirous of becoming better acquainted with the merit of the Root boiler for electrical power stations will find him ready at all times to aid them in the matter.

The National Conduit Manufacturing company will be represented at Cleveland by J. P. McQuaide and H. F. Tate. The latter gentleman has been appointed manager of the western business, with headquarters at 542 Rookery, Chicago, and his many friends will no doubt take occasion to congratulate him at the convention. The company's headquarters during the meeting will be at the Hollenden.

The General Electric company at the Cleveland convention will have headquarters at the banquet room of the Hollenden, and it will be represented by the following named gentleman: From Schenectady, S. D. Greene, J. R. Lovejoy, E. W. Rice, Jr., W. L. R. Emmet, F. O. Blackwell, H. C. Wirt; Boston, F. M. Kimball, C. D. Haskins, H. A. Harthen; Cincinnati, W. F. Hays; New York, T. Beran; Nashville, H. H. Corson; Chicago, B. E. Sunny, Dr. L. Bell, F. N. Boyer; St. Louis, G. F. Rosenthal; Harrison, N. J., A. D. Page and Wilson S. Howell. The exhibit will be located at the Canal street station of the Cleveland Illuminating company, and will consist first of a working demonstration of the new monocyclic system. It will include a 230 volt four-pole fifty kilowatt 575 revolution direct current motor of the latest type, which will be run by current taken from the Cleveland company's circuits. Belted to this motor will be a monocyclic eight pole sixty kilowatt 900 revolution sixty cycle generator, the current from which will operate a fifteen kilowatt induction motor making 900 revolutions per minute. This will be belted to a four pole nine kilowatt 850 revolution direct current dynamo furnishing current to a load of incandescent lamps and Thomson '93 incandescent arc lamps. The current for the induction motor, at 1,040 volts primary, will be taken from the

GEORGE A. MANSFIELD.

monocyclic generator to two of the General Electric recently designed type G 60 cycle transformers of 7½ kilowatts capacity each, and will thence be brought to the motor. In addition, the monocyclic generator will have as a load a 1,000 watt and a 15,000 watt type G transformer, with the secondaries connected to a suitable lamp load. To the 1,040 volt primary circuit, taken from the generators of the Illuminating company, will be connected a twenty kilowatt 125 cycle transformer; a three-wire secondary will run from this and furnish current to 104 volt lamps. In the primary circuit a station primary Thomson recording wattmeter will be connected. The secondaries will be loaded to their capacity with incandescent lamps, Thomson '93 alternating arc focusing lamps, Thomson induction fan motors, etc. The current on the secondaries will be measured by Thomson three-wire and two-wire meters. Current from the 1,040 volt circuit will also be taken for an exhibit of the General Electric alternating street system, consisting of fifty series lamps of 3½ amperes, the sockets of each being provided with the automatic paper cut-out. The working exhibit will be further augmented by a twelve-inch hand controlled searchlight, which will probably be operated on some nearby roof. The appliance exhibit will consist principally of samples of the latest devices put out by the General Electric company. These will comprise cut-outs, switches, insulators, etc., showing the excellence of the porcelain of its own manufacture; a full sample board of the new punched clip switches, showing, among others, those devised for 500 volt circuits; samples of the new key and keyless sockets. Altogether the exhibit which the General Electric company will make will not only be comprehensive, but will prove of more than ordinary interest to all those anxious to keep themselves thoroughly posted on the latest and most approved appliances, as well as the most recent developments in electrical practice.

MICHIGAN'S REPRESENTATIVE ELECTRICAL SUPPLY HOUSE.

A school of practical telegraphy for young women has been opened at Comayagua, Honduras. It is under the direction of Senorita Margarita Alcerro.

## Elwell-Parker Electric Company of America.

One of the latest acquisitions to the electrical enterprises of Cleveland is the establishment of the factory of the Elwell-Parker Electric company of America in the Forest City. This company was organized a little over a year ago with Cleveland capital and by Cleveland men, all of them being manufacturers themselves. They purchased the American patents, rights and franchises from the English Elwell-Parker company, called the Electric Construction company of London and Wolverhampton, England, and are now in a position, as a result, to place upon this market all the various types of the celebrated Ellwell-Parker dynamos, motors, and apparatus used in conjunction therewith.

The Elwell-Parker machines have been in use since 1881 in all parts of Great Britain, on the continent of Europe, in South Africa, India, Australia and other countries, where the largest and most important installations are, in very many cases, composed of Elwell-Parker machinery. The American capitalists examined the plants equipped by this company for the Liverpool Overhead railway, the Manchester corporation, the London Metropolitan Electric Supply company, the London General Postoffice, the Oxford Electric company, Oxford, England, and the Liverpool Electric Supply company, all of which are very large and very highly efficient generating and distributing plants, and are looked upon in England as models. They found the Liverpool Overhead Railway company's electric generating and traction plant unequaled in efficiency and all-round reliability. Elwell-Parker generators are now doing the majority of all the electrolytic work in Great Britain. The Elwell-Parker system of long-distance transmission and distribution by direct currents is the only one that is in successful operation in a considerable number of places.

The American company manufactures electric generators, motors, transformers, automatic switches and other apparatus for all the industrial applications of electricity, and especially the heavy electric machinery for all electric power and lighting purposes, including long-distance transmission and distribution by both alternating and direct currents. It will make a specialty of the manufacture of generators for railway and similar purposes, of any power required, and generators and gearless motors for heavy electric railway work.

The officers are at present as follows: President, F. C Phillips; vice-president, E. B. Phillips; secretary and treasurer, Alex. E. Brown; superintendent, E. S. W. Moore. Of the officers of the company it may be said that F. C. Phillips has had a large and varied experience in every branch of electrical engineering abroad, and especially in England. Superintendent Moore has had a similar experience, but confined to Great Britain, while E. B. Phillips has had 14 years' experience of the electrical industries in this country. A. E. Brown is the inventor and manufacturer of the world-famed Brown hoisting and conveying machines that have revolutionized the handling of large quantities of ore, coal, pig iron and other like raw materials.

Regarding the proposed electric railway between Milwaukee and Chicago, it is stated that the road will be completed from Chicago to Waukegan not later than August 1st. The Wabash avenue loop in Chicago has occupied the attention of the Chicago projectors of the new line for the last four months, so that but little work was done in that time. As yet there is nothing positive as to the extension of the road from Waukegan to Milwaukee.

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CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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THE headquarters of the WESTERN ELECTRICIAN during the Cleveland convention are Parlor 130, The Hollenden.

AN English contemporary calls attention to several ridiculous announcements in the "Notes and Queries" column of *Echo*. Among these is the assertion that the use of bicycles in Toledo, Ohio, has depreciated the value of electric street railway plants in that city £500,000 during the past two years.

DESPITE unfavorable legal decisions in patent cases and active competition in all parts of the country, the Bell company has thus far succeeded in holding its securities among the most desirable in the country. At the recent sale of 3,368 shares of stock not taken by the stockholders under the recent order of new treasury stock the average price received was 189.9 The price of Bell telephone stock, at the Stock Exchange, was stimulated by the auction sale and sold as high as 192, with 193 bid, 195 asked at the closing. Investors seem to be undisturbed in their faith in Bell stock.

MANY central station men throughout the country are interested in electric railways, and no doubt some of them will find their way to Cleveland this week. It is equally probable that they will take occasion to inquire into the policy and methods employed in operating the Cleveland trolley system, but it is to be hoped that none of them will adopt the plan by which the local company evaded the vestibuled motor car act passed by the Ohio Legislature. The appearance of the cars which have been tinkered up to conform to the law ought to deter others from following this example. They afford very little protection to the motorman and are so offensive to the eye that a protest from the public would be justified.

DELEGATES and visitors in attendance at the Cleveland convention of the National Electric Light association this week will find much to interest them aside from the proceedings, although it is to be hoped that they will give their undivided attention to the work of the organization during the hours appointed for the meetings. There is much to admire in and about the beautiful city, its drives and historic spots, and there is no doubt that visitors will be afforded every opportunity to enjoy these pleasing attractions. But there are many points of special interest, aside from these, that will engage the attention of electrical workers. The home of Brush and the scene of his early experiments in arc lighting, which were of such incalculable value to the industry, must of necessity appeal to all who are engaged in electrical pursuits. To the practical mind there is a great object lesson contained in the progress and expansion of the electrical interests of the city. When one stops to consider the magnitude of the industry to day, the enormous capital invested and the advances that have been made in applications to every branch of industrial activity, it seems incredible that all this should have been accomplished in such a short space of time. From an infant industry of little importance it has grown in a few years to one of mammoth proportions. Central station managers will find in the great factories of Cleveland an object lesson in what constitutes the best practice in electrical engineering to-day. This, too, will be supplemented by a display in connection with the convention of the various types of machines and fixtures of outside concerns, all contributing to make up a complete exhibition of standard apparatus, and in striking contrast to the crude machines and devices that formed the stock in trade of the pioneers of the industry. Aside from the value of the meetings, the papers and discussions, it will be readily seen that those who attend the Cleveland convention will have ample facilities for gaining information and experience that will more than repay them for the expense and time devoted to the trip.

THE disastrous fire in the Stadt theater in Milwaukee, while primarily due, no doubt, to improper electrical construction, has likewise thrown a heavy load of responsibility on the underwriters' inspectors. It will be remembered by those who read the recent account published in this journal that the fire was due to a short-circuit on wiring for a temporary electric lighting outfit arranged to give added brilliancy to a charity ball. A chandelier supporting a lamp design was decorated with a quantity of some gauzy stuff, and the fire was due to melted fuse metal dropping on this material, or some such cause, at a preliminary test. Of course the electrical contractor should have taken proper precaution in anticipation of the possible blowing of a fuse strip—assuming the fuse metal theory to be the correct one—especially in view of the dangerous proximity of highly inflammable material; but what of the duty of the insurance inspectors? It appears that the extra lighting system was inspected by the representatives of the board of underwriters but a short time before the fire, and passed. What are electrical insurance inspectors for, anyway? Is it to sit in their offices and compile long lists of alleged "electrical fires," of which they gain their first knowledge after the damage is done, or is it to go out and make careful and intelligent survey of new or remodeled electrical construction, whether temporary or permanent? To express this critical inquiry concisely: Does the inspector inspect? Such a fire as that in the Stadt theater strongly inclines one to the belief that he does not. The insurance companies had to pay a loss of about $60,000, and they will receive but scant sympathy.

Of course it will not do for the electrical contractor to excuse botchwork on the plea that the inspector should have discovered it. It is no extenuation of the original fault that a second man failed to discover it, although, as we have pointed out in previous consideration of this important subject, the original fault can be traced to the owner as often as to the contractor. If the consumer deliberately elect to pay a price for his electrical work and material that is insufficient to insure good construction, as shown by the figures of reputable concerns, he can undoubtedly secure a contractor to serve his end, but he must himself assume the major responsibility for whatever result ensues from his short-sighted economy. But all this has nothing to do with the electrical inspector. He must be competent; he must be fair; he must be thorough; he must take nothing for granted. Such an inspector, by applying himself to the practical rather than the theoretical, can do much for the real good of the electrical industry by fairly and faithfully discharging his duty to his employers, the underwriters.

MR. PERKINS' article on the present condition of the great electrical generating plant at Niagara Falls, presented in this issue, bristles with interesting information. The installation is impressive in its magnitude and highly instructive in the original treatment of the problems presented. Withal it possesses a peculiar interest and significance, in that it diverts into the channels of industry a portion—a very slight portion—of the stupendous power of the world's greatest cataract. The experiment—for we are not yet emboldened to call it more—is of much importance to the industrial development of the world, for if the transmission shall prove practicable and economical to the distance claimed, the transformation and distribution of water powers by electrical means will receive a notable impetus in America and Europe.

To read of a capacity of 15,000 horse power, generated by the largest dynamos in the world; of alternators with moving parts revolving in a horizontal plane and excited by current made through the application of the current of the big machine itself; of a large stone building merely for transformers and of a conductor bridge connecting it and the power house: of a switchboard, or rather a switchroom, containing switches that are to be operated by compressed air from an upper gallery; of a space merely for resistance of 1,296 cubic feet; of an electric elevator in the wheel-pit, and the varied minor electrical features—to read of these things is to gain an insight into the size and remarkably interesting character of the plant.

It will be at least several months before the whole plant is in operation and a longer period must elapse before current is transmitted to any distance, so that final judgment on the Niagara Falls scheme must be deferred for some time to come. In the meantime the electrical public will eagerly await news of the successive steps in the completion and operation of the equipment.

IN view of the action of the strikers petitioning the city and state governments to revoke the franchises of the Brooklyn street railway companies, it will not be untimely to recall a case in Indianapolis in which the question of the life of a franchise was involved. In the latter case it was claimed that the term for which the franchise had been granted had expired, but the company contested the claim and announced its intention of carrying the case to the United States Supreme Court if necessary. Ex President Harrison, who is considered one of the most conservative and best equipped lawyers in the country, made the argument for the company, and the position which he took at that time has since been commended by other legal authorities. In this argument street car lines were placed upon the same basis as railroad lines, and their right to operate, it was contended, was of equal authority. By refusing to sell or lease or grant a right of way, a county or a people could prevent a railroad company from passing over its territory unless the state saw fit to come in on the plea of public necessity and condemn the lands, but when the road was once established there was no power by which it could be forced to abandon its property or sell it to a competitor. So with a city. It might say upon what terms a street railway might enter upon its streets, so far as those terms related to the regulation of traffic, but when once occupation was had it became absolute and perpetual. Regarding the rights of the public, it was said that it was proposed by the city to bring to a sudden termination a convenience upon which many of the people depended entirely for transportation to and from their places of business; that, if the street car service were discontinued, these people could not live where they do, for they could not reach their places of business promptly. The street cars were a public convenience, and not designed merely to put money into the city treasury. The public has a right in them, and the idea that the system could be broken up, the public put to inconvenience and traffic on the streets stopped at the mere whim of the city, as a corporate body, was pronounced monstrous. Another point in the argument was the question of the measure of compensation and by whom it was to be fixed if the company was forced to give up its property. The theory, said Mr. Harrison, was that it could be fixed by some judicial process, but he wanted to call attention to the fact that there is no provision whatever in the law of Indiana for fixing a value upon the property. And this demonstrated beyond doubt that the Legislature regarded such franchises as perpetual, for no provision existed by which property values could be reached when franchises ceased to exist. The question is one of vital interest to holders of franchises, and should the contention of the Indianapolis company be sustained upon final hearing, it would add greatly to the value of such holdings.

## FIFTY-TWO PAGES.

### The "Western Electrician" Takes a Long Leap Ahead in Advertising Patronage.

Despite the hard times, despite the unfair attacks of an envious rival, the WESTERN ELECTRICIAN has this week the pleasure of bearing to its thousands of readers generally, and to the gentlemen attending the Cleveland convention of the National Electric Light association in particular, the business announcements contained in the 52 advertising pages of this issue. This beats the best previous record of the blue-covered paper—made at the St. Louis convention in 1893—by ten pages, and marks the top-notch in the advertising progress of this journal. Naturally we feel pleased at this overtopping evidence of the value to advertisers of the western electrical journal, and we are disposed to receive congratulations. We are quite well, thank you; and we hope you are the same.

We desire to call attention to the character of this advertising. It is good, clean, legitimate business. There are no "fakes," "dummies" or donations in it. From cover to cover, the advertising department of the paper is crisp, clean-cut and *bona fide*. Not only that, but we may state that six pages of advertising were proffered and declined. Four of these were tendered by two supply houses at a losing rate, and in the case of the remaining two pages the compensation would have been contingent on a favorable decision in the Bate Refrigerator case. The WESTERN ELECTRICIAN does not gamble on uncertainties; neither does it accept business at nominal rates. There is no fictitious advertising in this issue—no favorites or unjust discrimination.

We ask our friends to note, also, that the 52 large pages of the WESTERN ELECTRICIAN are equivalent to from 70 to 90 pages of the small eastern papers—70 pages of the size of the larger one and 90 of the smaller. The superior advantages of the larger pages to advertisers need not be recounted here.

We are glad to note in this great increase of business a promise of reviving trade; and we are pleased to observe also the keen appreciation of the journal that reaches the consumers of the central and western states. It will be noted that the *Electrical World's* piteous appeal to advertisers to discontinue business relations with the WESTERN ELECTRICIAN has had a boomerang effect. The *World* sends out its circulars giving advertisers a few pointers; it tells them to withdraw their patronage from the WESTERN ELECTRICIAN —and the advertising in this journal jumps up ten pages above the best record previously recorded! What a commentary on the efficacy of slander, misrepresentation and distorted figures as weapons in business warfare! The *World* should retire to some quiet nook and take communion with itself as to the wisdom of its ways.

We thank our friends for their generous patronage. Their confidence has not been misplaced, as the issue will be circulated as no other number of a technical journal has been.

### City and South London Railway.

Following is an abstract of the semi-annual report of the directors of the City & South London Railway company for the six months ended December 31, 1894, presented on February 1st.

The receipts from all sources for the past half-year have amounted to £24,252 13s. 4d., and the cost of working has been £14,762 6s. 2d., leaving a profit of £9,490 7s. 2d. Inclusive of the balance brought forward from June 30th last, the net revenue account shows an aggregate total of £10,919 8s. 10d. After making provision for the debenture and debenture stock interest, a balance remains available for dividend of £6,771 12s. 10d. Out of this sum your directors recommend that the full dividend of 5 per cent. per annum be paid on the preference shares, and that a dividend at the rate of 1¼ per cent. per annum be paid upon the consolidated ordinary stock, leaving a balance of £950 7s. 8d. to be carried forward to the next account.

During the past half-year there has been a very satisfactory and steady growth of the traffic during all the hours of the day, but especially between 8 A. M. and 10 A. M. in the trains bringing passengers to the city. The trains between these hours have been considerably overcrowded, and as the small accommodation at the King William street station prevents any increase in the number of the trains run, a further advance in the fares during those hours has been made. This has had the effect of diminishing the overcrowding of the trains without seriously reducing the receipts.

The substitution of motors on the train itself in the place of the present separate locomotives was found to be a more difficult operation than was at first expected, owing to the small size to the tunnels and the sharp curves near the entrance of the King William street station. After various experiments, these difficulties have at last been overcome, and a new motor car train has been satisfactorily completed, and has been approved by the Board of Trade. As this alteration will give an increased carrying capacity to the trains, it is proposed to proceed with the conversion of the existing stock as rapidly as the exigencies of the traffic will allow. By means of these motor trains there is every reason to expect that the increased traffic which may be anticipated during the present year will be able to be dealt with. But beyond that time there will be no means available for providing for any further increase that may arise, though from the steady growth of the traffic in the past, such increase may be confidently expected.

FIG. 2. STREET RAILWAY AND POWER GENERATOR.

The directors, therefore, feel that the time has arrived when some steps should be taken to carry into effect the powers granted by the Act of 1893 for the extension to Islington. They would recommend that the line should in the first instance be extended to Finsbury-pavement only, the estimated cost of which is £280,000. The first steps to be taken in connection with this operation will be the acquisition of the sites for the stations at the south side of London Bridge, the Bank, and Finsbury-pavement, and as these negotiations are likely to occupy a very considerable time, your directors recommend that they be authorized to proceed with the purchase of these sites at once, leaving the question of the time for carrying out the works and the most advantageous mode of raising the capital, to be discussed at a future meeting. This extension, when completed, would enable more than double the number of trains to be run, and a considerable increase in the accommodation of each train to be provided. The introduction of motor car trains will necessitate further siding accommodation at Stockwell, which it is proposed to proceed with it at an early date.

A table accompanying this report shows that 24,155,972 passengers have been carried since the opening of the line, exclusive of those holding season tickets, and that the receipts, including season tickets, have been £175,335 13s. There has been a gradual increase in the patronage of the road, as is showo by the fact that in the first six months of operation ended June 30, 1891, 2,412,343 passengers were carried while in the last six months there were 3,275,649.

### Street Railway and Power Generator.

The accompanying cut, Fig. 1, shows the new street railway and power generator which has recently been brought out by the Commercial Electric company of Indianapolis, Ind. This new machine possesses all the excellent qualities of the company's bipolar type, together with the advantages of the slow speed multipolar form and many unique features of construction which facilitate repairs and reduce the attention required to a minimum. The magnet frames are of cast steel, and all parts of the magnetic circuit are so proportioned that the requisite field is obtained with the smallest possible expenditure of energy, thus making a most efficient machine both under light and heavy loads. The armature, Fig. 2, is of the smooth core, Gramme ring type, and will operate under wide variations of load without sparking at the brushes. It does away with eddy currents in the pole pieces. Each armature coil is entirely independent of the others and if one is damaged it can be removed and replaced without disturbing the others. Coils of the 110 and 220 volt generators are wound separately on forms and then assembled on the armature core. These coils can be furnished complete ready to be placed on the armature, and thus repairs are readily made. Both armature and commutator are thoroughly ventilated, and the fields have a large radiating surface, so that the heat is readily dissipated. The maximum temperature of any part of the machine after a continuous run is less than 40 degrees Centigrade above the air. The regulation is practically perfect, as constant potential machines will vary less than 2 per cent. from no load to full load. These machines have self-oiling, self-aligning bearings of the spherical type, with bronze linings, and the oil reservoirs are of large capacity. The commutator has a great number of segments and a large bearing surface, so that the currents are collected with scarcely any heating of either commutator or brushes.

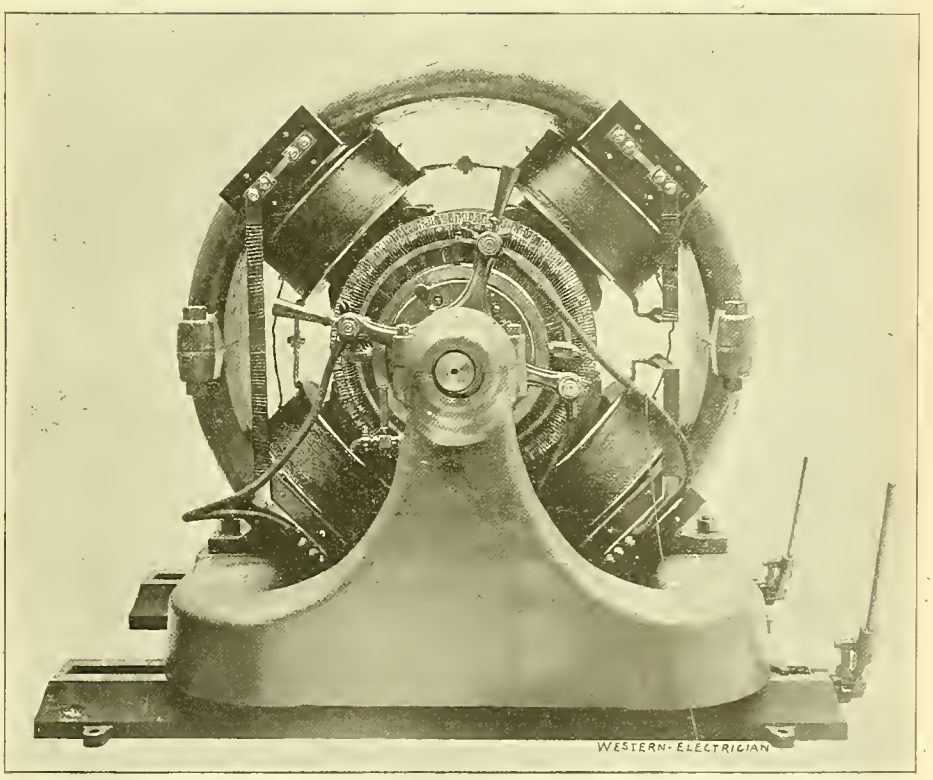


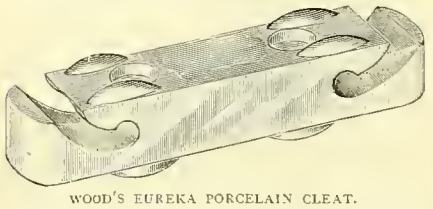

FIG. 1. STREET RAILWAY AND POWER GENERATOR.

The segments have a great depth, and the commutator may be turned down many times before it will have to be renewed. These generators are furnished for either lighting or power and are particularly adapted for street railway work on account of their ability to withstand heavy temporary overloads and their freedom from sparking under wide variations of load peculiar to this service. They may be either belt driven or arranged for direct connection to any standard make of engine. These machines have been on the market but a short time, but the warm praises and hearty recommendation from those who have used them are resulting in a steadily increasing demand, which is taxing the capacity of the company's works to the utmost.

## The Handling of Coal and Ashes at the Third District Station of the Edison Electric Illuminating Company, Brooklyn.

The problem of handling coal and ashes is one of great interest to engineers designing or in charge of power plants. It is also a problem that admits of solution in such a manner that a great saving may be made in the operating expenses

In electric lighting and power stations it is required to convey the coal from the receiving point to the furnaces, remove the ashes to some receptacle from which they can easily be taken away, and to accomplish this at the lowest possible cost per ton. In many cases this is not a simple



WOOD'S EUREKA PORCELAIN CLEAT.

engineering problem, but is so affected by the environment as to make it complex and difficult. The C. W. Hunt company, New York city, has been prominently identified with the developing of coal handling machinery, and installed the apparatus for that purpose in use at the Third District station of the Brooklyn Electric Illuminating company at Pearl and Gwinnett streets in that city.

This station is situated at some distance from the coal wharves and the coal is delivered in wagons. It was necessary to take the coal from the wagons, carry it to the furnaces, and also to remove and dispose of the ashes. The arrangement of the machinery installed for this purpose is shown in Figs. 1 and 2.

The coal is carried from the hopper underneath the sidewalk to the coal tanks above the boilers by a conveyor, which upon its return passes underneath the ashpit of the furnaces and carries the ashes to a bin, from which they can be drawn at will for removal. The conveyor consists of a series of gravity buckets pivoted in a double chain, and the whole system is carried on self-lubricating wheels. The buckets are so pivoted in the double chain that the force of gravity keeps them always in an upright position whether full or empty, and no matter how tortuous the track over which they are drawn.

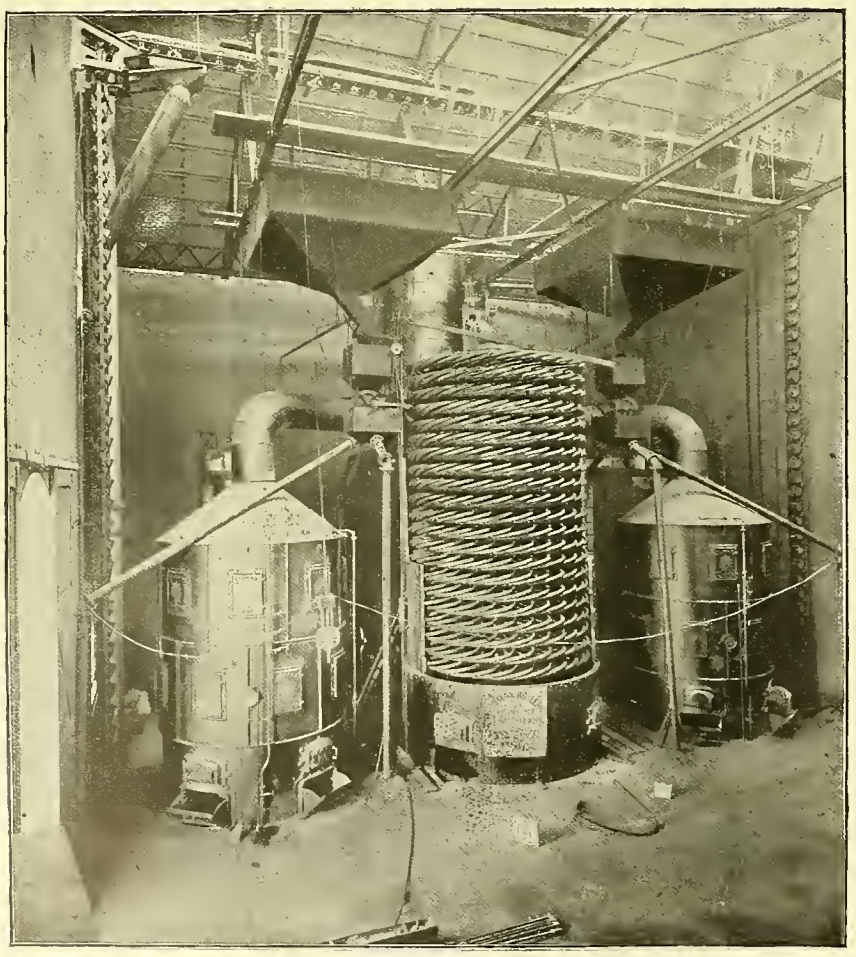


FIG. 1. THE HANDLING OF COAL AND ASHES AT THE THIRD DISTRICT STATION OF THE EDISON ELECTRIC ILLUMINATING COMPANY, BROOKLYN.—VIEW IN BOILER ROOM.

The conveyor possesses several features that are peculiarly desirable for this work. The material is caried to its destination by a single conveyor in a horizontal, vertical or angular direction, all of these positions being utilized in this station. The change in the direction of the conveyor is made by running around curves instead of over sprocket wheels, and the whole machine is noiseless in itsoperation. The chain is driven by pawls instead of by sprocket wheels, avoiding entirely the destructive wear heretofore inherent in conveyors, especially as the material does not come in contact with any working part of the conveyor to cause wear. The conveyor is moved slowly, the capacity being obtained by the size of the buckets and not by the speed of the chain.

In this station the necessity for a special method of filling the buckets under the sidewalk will be apparent when it is considered that the buckets swing freely on pivots, and might oscillate to a harmful extent or might be loaded on one side and remain at an angle during the trip. The loading is accomplished by a continuous filler, and so perfectly that it would not occur to an observer that there was any liability of swinging or uneven loading. The filler guides the coal into the buckets, filling each one as it passes. The power for driving the conveyor is located at the top line, and is furnished by a 10 horse power electric motor. The operating switches are placed below on the boiler room floor for convenience in starting and stopping the machinery. At this station when receiving coal at its full capacity, the power required to operate the conveyor is 4½ horse power, measured at the switch. The coal is drawn from the storage bins above the boilers into weighing hoppers, from which it is spouted to the floor of the boiler room at such distance as to be easily shoveled directly into the furnaces.

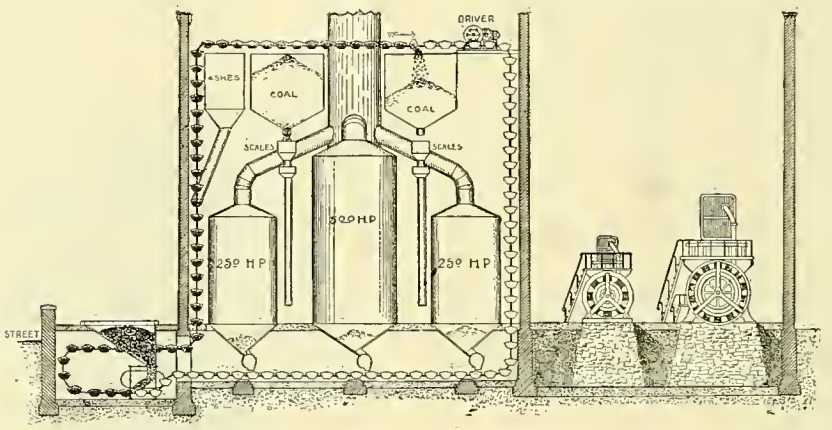



FIG. 2. THE HANDLING OF COAL AND ASHES AT THE THIRD DISTRICT STATION OF THE EDISON ELECTRIC ILLUMINATING COMPANY, BROOKLYN.—SECTION OF COAL HANDLING MACHINERY.

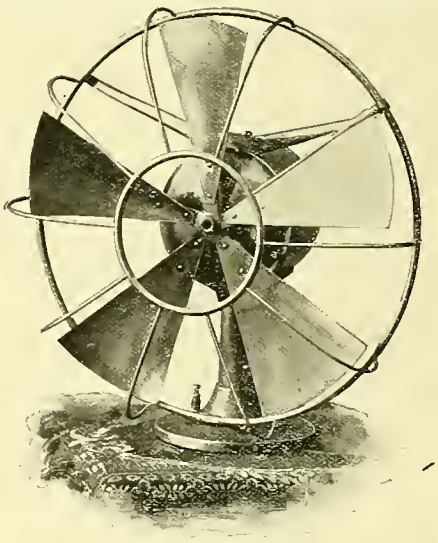
Handling ashes, either wet or dry, has heretofore been considered one of the most difficult objects to accomplish, and one of the most destructive to machinery, but in this station the work is accomplished completely by the use of a special filler, one of which is placed under each boiler and is always ready for service. It is said to be as easy to handle the ashes as the coal.

## Wood's Eureka Porcelain Cleat.

M. M. Wood, Chicago, well known as an inventor and manufacturer, seems to be well supplied with new ideas. His latest has taken the form of Wood's eureka porcelain cleat, as shown in cut; and it seems to embody the features necessary to make it indispensable to wiremen. The idea of having the slot parallel with the wire, so that the wire can be pulled tight before placing it in the cleat, is believed to be a new one and do doubt will be appreciated by those using the device.

## Davis Electric Fan.

The alternating fan motor outfit illustrated in the accompanying cut is manufactured by the W. J. Davis Electric



DAVIS ELECTRIC FAN.

company of Pittsfield, Mass., and combines many points of excellence developed by the company in the three years' experience it has had in this branch of the business. It is practically noiseless and runs at a speed of about 900 revolutions per minute. There are many admirable features of construction embodied in this outfit and in practice, it is said, it has demonstrated the practical value of the inventor's idea. The company claims that the arrangement of parts makes it impossible for the bearings to get out of line and prevent heating and gumming of the shaft. Bearings are ample, and the arrangement for oiling is one of the special features of this motor. A large supply of lubricant is carried in a chamber and fed to the shaft by a ring arrangement. The position of this chamber makes it almost impossible for any oil to run out and be thrown off by the fan blades. The parts are all simple, compact and easily accessible.

## Creaghead Arc Lamp Pulley.

The arc lamp pulley shown in the accompanying cuts is a convenient device for supporting arc lamps over trolley wires, or over streets on which there is considerable travel. Fig. 1 represents the pulley itself and Fig. 2 shows the operation with lamp attached. The latter represents an arc lamp supported from the pulley on the side of the street. When the trimmer pulls down on the rope next to the pole on the right-hand side, he hauls the supporting pulley toward the center of the street, with the lamp, and at the same time

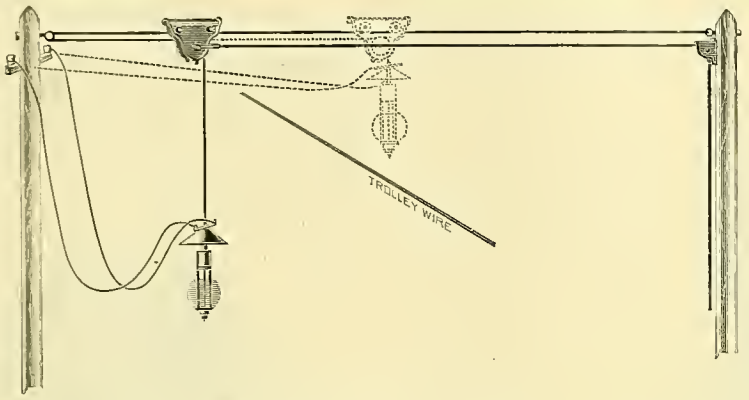



FIG. 2. CREAGHEAD ARC LAMP PULLEY.

the arc lamp is lifted up to the position shown by the dotted lines in the cut. In lowering the lamp, the pulley moves to the side of the street and the lamp drops down to the side of the street of its own weight. The operating rope is attached to a loop on this pulley and passes to the pole pulley, as shown in the right-hand side of the cut, and down to the trimmer. The rope that is fastened to the lamp passes up from the lamp over the large pulley wheel of the pulley and then to the eyebolt in the pole on the left, where it

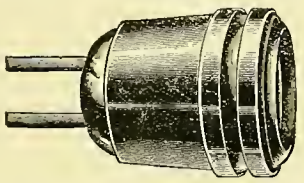


FIG. 1. SOME NEW DEVICES IN ELECTRIC LIGHTING.

is made fast. The span wire or cable is such as is used in suspension of arc lamps ordinarily. This span wire is fastened into the eyebolts on the pole at each end. The supporting pulley is mounted on this span wire so that it will roll back and forth on the small grooved wheels in the upper part of the case. This pulley is light in weight, neat in appearance and is very serviceable. It is manufactured by the Creaghead Engineering company, Cincinnati, O.

## Some New Devices for Electric Lighting.

The Fiberite company, manufacturer of the Medbery insulation, has recently gotten out some new devices in the

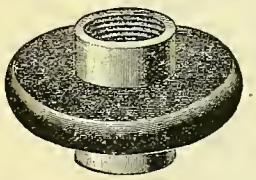


FIG. 2. SOME NEW DEVICES IN ELECTRIC LIGHTING.

shape of keyless lamp sockets, as shown in Fig. 1, made to fit all types of lamps, for use in mines, breweries, factories, tanneries, and other places where there are gases and vapors destructive to metal sockets. These are made upon a new principle. They are entirely moisture-proof and are not subject to corrosion by acids or gases, and are

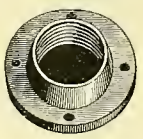
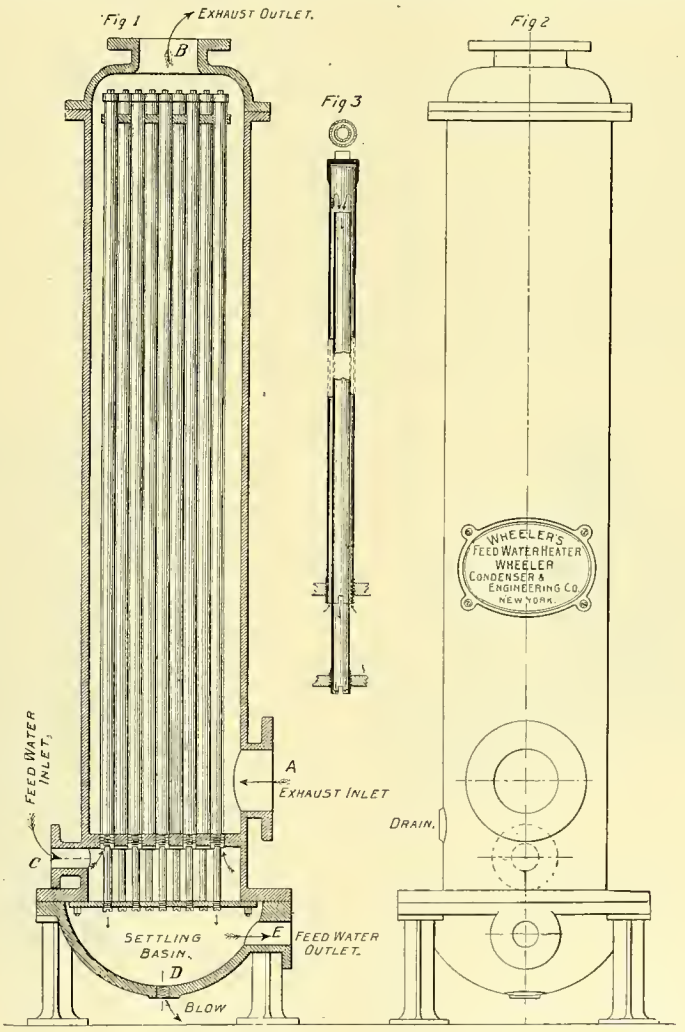


FIG. 3. SOME NEW DEVICES IN ELECTRIC LIGHTING.

very popular where they are known. The company is also offering a wall socket, Fig. 2, for use in street cars, and in other places for ornamental purposes, where brass is not available. Fig. 3 shows a new type of insulating joint for gas chandeliers, which is stronger and better than those heretofore presented. These goods are all offered at prices that will enable their speedy introduction. The high character of the Medbery insulation is a sufficient guarantee of the quality of these goods, and this company is leading all others in its efforts to introduce new and desirable articles for public use. The Mason Electric company of Chicago is the western agent of the Medbery insulation and will be pleased to furnish samples and prices on any of their goods.

## The Wheeler Feed Water Heater.

The success attending the introduction and practical operation of the Wheeler double tube system for surface condensers has induced the Wheeler Condenser & Engineering company, 39 and 41 Cortlandt street, New York, to apply the same principle and similar construction in the design of the Wheeler feed water heater, as shown in the accompanying cut. This heater is adapted for stationary or marine steam engines, either condensing or non-condensing, and is built in sizes ranging from 50 to 2,000 horse power. The cut shows the vertical style of heater. When there is not sufficient head room for this style, or if for any other reason




THE WHEELER FEED WATER HEATER.

it is deemed advisable to place in a horizontal position, the heater is built on the horizontal plan and placed between two sections of the exhaust pipe. As shown by the sectional view, the exhaust steam from the engine enters through nozzle *A*, fills the heating chamber, completely enveloping the exposed surface of the large tubes, and then passes out at the upper nozzle *B*. There is, therefore, little or no impediment to the exhaust steam as it passes through the heater. The feed water enters at nozzle *C* and passes upward through the annular spaces between the larger and smaller tubes, and returns downward through the smaller tubes to the bottom or settling chamber *D*, and finally out through the discharge nozzle *E*. This insures the most perfect circulation and prevents undue pressure on the feed pumps, while the feed water, being subdivided into many small streams, absorbs all the heat possible from the exhaust steam. The discharge nozzle *E* is placed high enough in the settling chamber, so that the sediment caught in the latter can not be disturbed by the current of the feed water as it flows out. At the bottom of the settling chamber is pro-

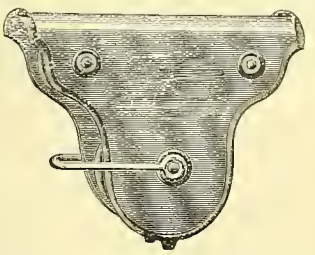


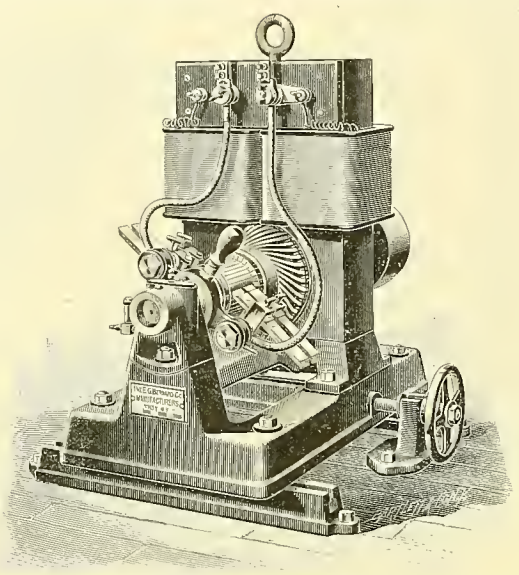
FIG. 1. CREAGHEAD ARC LAMP PULLEY.

vided a cock for blowing off the sediment. A drain cock is also provided in the lower part of the heating chamber for draining off the condensed steam. The shell of the heater is made of cast-iron or steel plate as preferred. Particular attention is called to the manner in which the tubes are secured. Both the larger and the smaller tubes are provided with thickened ends with screw threads. These tubes are securely screwed into their respective heads, and perfectly tight joints can, therefore, be guaranteed. The upper ends of the tubes being free, ample provision is thus obtained for expansion and contraction. The tubes are of seamless brass or copper carefully tinned inside and outside. They can be removed for cleaning or repairs by unskilled labor. These tubes are tested to 500 pounds pressure per square inch. Fig. 3 shows in section the details of both the inside and outside tubes, and the method of fastening them to their respective tube heads, as described. To remove the tubes for repairs or cleaning they are simply unscrewed by means of a screwdriver tool inserted in the slot cut for the purpose at the end of each tube.

## Adams Dynamo.

The accompanying cut represents the improved Adams dynamo and motor, which the E. G. Bernard company of Troy, N. Y., has been making for some time. While the company has not aimed at bringing out any new style or type of machine, it has, it is claimed, greatly improved on the standard type in a number of details.

One of the principal features is making the magnetic field out of wrought-iron forged in one piece, thus doing away with any joints in the magnetic field and decreasing the number of parts, which, from an engineering point of view, is of considerable importance, beside making an extremely simple, compact machine of high efficiency. The Bernard company is the only maker in America of this type, although a number of prominent manufacturers in Europe adopted it some years ago. It has the least number of parts of any machine at present on the market.



ADAMS DYNAMO.

The insulation is of mica throughout. The mechanical details are of the latest, such as self-oiling bearings, self-centering phosphor bronze journal boxes, automatic brush holders and positive belt-adjusting rails. The commutator is made of tempered copper insulated with the best quality of India mica. The dynamos are compound wound and absolutely automatic under all conditions of load. All parts of the machines are interchangeable and any parts proving defective in one year will be replaced free of charge.

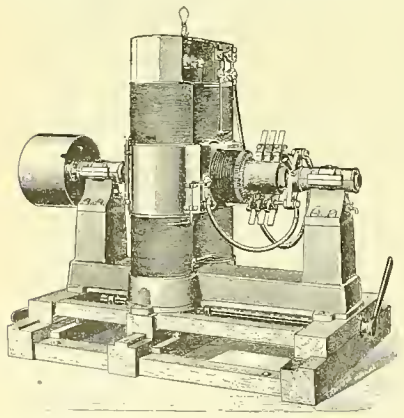
The Bernard company is just issuing an attractive price-list and collective testimonial sheet. The introduction of the latter reads as follows: "We, the undersigned, hereby certify that we have the system of electric lighting and power, as installed by E. G. Bernard, in our factories and buildings, for the period of time set opposite our names, and time thus far has proved all of his assertions and guarantees to be true, the dynamos, etc., having given us perfect satisfaction; and we recommend this system to those desiring similar apparatus. Dated February 15th." Then follow the signatures of over 100 customers.

## Cleveland Snap Switch.

The Cleveland snap switch is well known. The Bryant Electric company purchased the patents several years ago, and has now 10, 20 and 30 ampere Cleveland snap switches especially adapted for 500 volt circuits. The cut represents one form of the switch about one-half actual size.

## New Hundred Light Machine.

In the accompanying cut is illustrated a new hundred lighter, manufactured by the Onondaga Dynamo company of Syracuse, N. Y. The frame consists of a cast-iron base with the supports for the boxes cast in one piece. The field magnets are of the best forged wrought-iron. The pole pieces are soft cast-iron shrunk on the center of the forged iron magnet cores. The magnets are bolted to the cast-iron base and furnished with a cap piece, the whole forming a very powerful magnet of the double horse-shoe type. The armature is of the drum type, built up of disks of a special iron, thoroughly insulated with paper and mica. The commutator being a vital part, special attention has been given it. The bars are of hard tempered copper insulated with carefully selected mica, and assembled by experienced workmen; they are extra deep and long, so formed and arranged that the available portion includes nearly the whole depth. The headquarters of the western department of the company is in the Monadnock building, Chicago. Leslie W. Collins is the manager of this branch.



NEW HUNDRED LIGHT MACHINE.

## Electric Freight Transportation in Des Moines.

The Electric Railway company of Des Moines, Iowa, has secured an ordinance for eight years permitting it to carry freight. The conditions are interesting:

Freight may be carried on the Belt Line and Sebastopol Line connected by tracks on Front street; Second, from Commercial to Locust street, being used by the Belt Line until a right of way on Front street can be maintained; Locust and East Third to the power house.

The freight trains shall consist of one motor car and two other cars.

Five per cent. of the gross receipts of the company for carrying mail, express and freight shall be paid to the city of Des Moines.

No steam motors shall be used, but electricity only.

All damages or claims for damages arising from the improvement shall be satisfied by the company.

No freight train of more than one car may be run on West Second street between 6 A. M. and 6 P. M., and no train can stop on street crossings or stand on the streets.

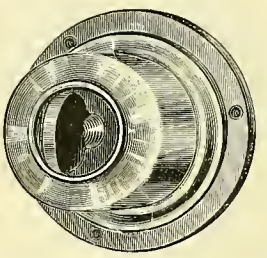
The carrying of freight is always subject to regulation by the city.

The charge for carrying freight within the city limits shall not exceed $3 per car for any single haul.

The company must file a receipt of the city for all demands against the city caused by removal of tracks for construction of sewer on Eleventh and Twelfth streets.

## Station Output Thomson Recording Wattmeter.

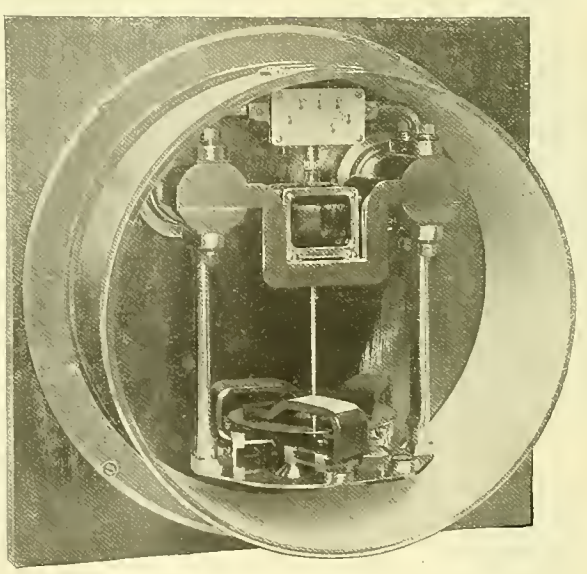
To furnish a mathematically correct instrument to measure the full output of a station and at the same time automatically to record the result, the meter department of the General Electric company has devised a new recording wattmeter known as form "G," which is a development of the Thomson recording wattmeter. It is a series instrument and takes the whole current through its field, thus eliminating errors, it is claimed, which might arise were a high capacity shunt employed. The field of the meter consists of a one-half turn made of a solid copper forging of high conductivity, in the form of a wide winged yoke having the wings of sufficient arm to permit the insertion of the supporting studs. Within the "U" shaped part of this yoke revolves the armature actuating the dial mechanism. The shaft of the armature is as in the other meters, prolonged, and carries a copper disk which revolves between the jaws of three magnets set at the bottom of the meter. The resistance in series with the armature is external to the meter. It is installed at the back of the switchboard and is there out of the way. The meter is mounted directly on the switchboard, and is supported entirely by the heavy studs which pass through the material of the board and are secured by heavy nuts to the connections behind. The studs thus form the mechanical support and the electrical connections.



CLEVELAND SNAP SWITCH.

The cover of the instrument is of bevelled plate glass set in a burnished brass flange and rim fitting snugly against the board, and is provided with a felt packing to exclude dust. All the metal parts of the instrument are brightly polished, and impart to it a very handsome appearance. These meters are intended for connection with each machine or each feeder, or a single large meter may be connected for recording the total output of an entire power or lighting station. They are manufactured in capacities of 2,500, 3,750, 5,000, 6,250 and 7,500 amperes, the first, third and last being considered the standard sizes and for pressures of 100 and 500 volts. The 100 volt instruments have been designed for use on the three-wire system, one meter being placed on each side of the line. The 500 volt meters are for use on railway systems or in a stationary power plants.

In addition to the meters described, an arc station watt-

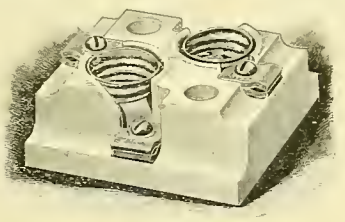


STATION OUTPUT THOMSON RECORDING WATTMETER.

meter for measuring the total output of an arc machine has also been devised. In this instrument the principles of the Thomson recording wattmeter have been retained, modifications being introduced to adapt it for use in connection with constant current circuits of high potential. The rheostat used with this arc station meter is a separate piece of apparatus to be installed in front or behind the board. It is designed for use under extremely high pressures, especial care being given to the insulation, and is mounted on a marble base. The arc station meters are made in four sizes: 35 lights, 6.8 amperes; 35 lights, 10 amperes; 50 lights, 6.8 amperes; 50 lights, 10 amperes.

## New Lighting Appliances.

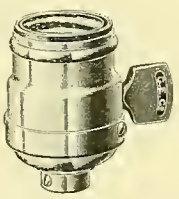
The General Electric company has placed on the market a new cut-out and a new socket, embodying improvements of an important nature. The former, a double-pole single or double cross-over branch plug cut-out, is so constructed as to facilitate its attachment to the wires already placed, while holding the wires well apart where they cross. It is a very compact device, of the well-known plug fuse type, the fuse being held in a brass-covered screw plug, which is inserted in the female screw shell secured to the porcelain.



NEW LIGHTING APPLIANCES—CUT OUT.

Replacement of the fuse entails no further labor than is involved in the unscrewing of the fuseless plug and the insertion of a perfect one, and it is this feature which makes the plug cut-out so valuable, especially in residences and places where fuses have to be cared for by unskilled persons.

The lamp socket is smaller than the Edison type. The entire base is formed of one porcelain piece of conical shape, and ridged perpendicularly so that there is no danger of short-circuit between the working parts. The key may be turned in either direction. The central connection for the lamp base is a well tempered contact spring against

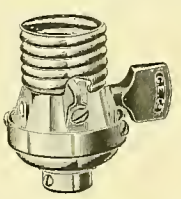


NEW LIGHTING APPLIANCES—LAMP SOCKET.

which the lamp is screwed and a good contact made, while the spring serves to prevent the lamp from working loose. The wires are connected as directly as possible, needless joints being avoided. The insulating collar between the screw shell and outside shell is firmly locked in place and extends one-sixteenth of an inch beyond the shell.

## The Gilgit Telegraph Line.

Among the difficulties to be encountered when telegraph lines have to be constructed at high altitudes is first of all the cold, says the *Indian Engineer*. The variation of the



NEW LIGHTING APPLIANCES—LAMP SOCKET, INSIDE.

length of wire in a span owing to change of temperature has the effect of varying the strain, and unless precautions are taken the wire will merely break from the excessive strain due to contraction. It must, therefore, be erected at a tension not greater than one-sixth of its breaking strain, so as to allow an ample margin.

The next thing is snow, which affects a telegraph line in several ways. If the alignment be not judiciously chosen, the whole line, posts, wire and all, may be completely buried under the snow. Although dry snow is a bad conductor, and it is possible to send signals through a wire buried in it for a considerable distance, when the snow begins to melt the conditions change and the signals fail. Under any circumstances, it is an objectionable state of affairs, and one that has to be provided against. To this intent the site for each pole has to be carefully selected in order to avoid places where snow is likely to accumulate; where this is impracticable, especially long poles must be made use of.

On the Gilgit line two high passes have to be crossed—the Rajdiangan, 11,600 feet, and the Burzil, 13,500 feet On the summit of the former snow sometimes lies to a depth of 10 to 14 feet, and on the latter 16 to 18 feet, and the poles used are 30 feet long. The poles need to be very strong, for the pressure of the snow upon them when planted on a slope is often very great. The use of stays or struts has to be avoided as much as possible, for experience has shown them to be a source of danger from the pressure exerted upon them by accumulation of snow. Moreover, when the ground is frozen hard, the post is so firmly fixed that, provided it is strong enough, they are not wanted, especially when there is only one wire to be supported.

Another danger from snow is due to the fact that under certain conditions of the atmosphere it is deposited on the wire, forming a rope of snow several inches in diameter, until the line is broken down by the sheer weight of snow. Dry snow does not adhere; but when there is a change from rain to snow, or from a mild and moist to a cold and dry condition of the atmosphere, then it does. This is exemplified by the experience of last winter, when it was found that on the Rajdiangan Pass, which is affected by the moisture rising from the Woolar Lake, the snow formed on the wire, causing a break in one place; while on the Burzil Pass, which though much higher enjoys a dry climate, the snow did not adhere, and there was no breakdown.

The danger from wind pressure on a wire thickly coated with snow is greater than from the mere weight of snow. The effect of a high wind on a rope of snow is most disastrous, especially on a line carrying several wires. To guard against this danger on the Rajdiangan Pass, a solid homogeneous steel wire of the greatest strength manufactured has been put up over the most exposed section, supported on strong deodar poles, planted at short distances apart.

All these difficulties, and more, have had to be overcome on the Gilgit line.

With the best and most carefully constructed line, perfect immunity from damage in the winter can hardly be hoped for, and every possible provision for promptly restoring communication when an interruption occurs has to be made. To this end offices of observation are being maintained at Guraisand Minimarg, which, with those at Bandipur and Astor, command the two dangerous passes. In the winter there is absolutely no local labor procurable, and it is necessary to retain permanently sufficient men to form a strong party for interruption duty when required. Every man has to be fully rationed and supplied with warm clothes. Two Europeans are stationed at each office, and everything has been done that will help to render their services efficient, and their solitary life, during the months they are cut off by the closing of the passes, as bearable as possible. Each office has been supplied with different patterns of snow shoes, which it is confidently expected will prove of great value, when once the men become practised in their use.

H. S. Olphert is the telegraph officer who has been engaged in the construction of the Gilgit line, and it remains to be seen from the results of the coming winter whether his labors, and the care and forethought bestowed upon the work by the Telegraph Department, will be justified, and a reliable service maintained with this, the most outlying portion of Her Majesty's Indian dominions.

## Hotel Proprietor Objects to the Engines

A Reading, Pa., dispatch of February 3d says: There is a possibility of this city's electric service being temporarily interfered with under unusual circumstances. William B. and George W. Gabel, landlords of the Exchange Hotel, last evening filed a bill in equity asking for an injunction to restrain the Metropolitan Electric company from operating its four large engines in the plant adjoining the hotel. These engines constitute the motive power for the dynamos that furnish the electricity for the trolley cars of the Reading Traction company (excepting the East Reading and Stony Creek branches) and for the city electric lights. Judge Ermentrout, in chambers, directed that the bill be filed and notice given to the company that application would be made in open court for a preliminary injunction. If an injunction should be granted and the machinery stopped, the street electric lights and those in business and other places, where there are no private electric plants, would not burn, and the trolley cars would cease to run. Messrs. Gabel set forth that the engines make a loud noise and cause the doors, furniture and beds to sway and rock like a cradle, rendering sleep impossible and causing the occupants sick headache and other ailments; that some members of the plaintiff's families are ill most of the time owing to the "nuisance;" that half the boarders have already left and the others say they will leave if the annoyance continues; that transient customers are driven away, and that if the company is not restrained from operating the engines the hotel will have to be abandoned.

The bill introduced in the Illinois Legislature by Mr. Cody of Cook regulating telephone charges, provides: The rate for telephones in cities of 1,000,000 inhabitants and over shall not exceed $78 per annum; in cities of 500,000 and less than 1,000,000, not to exceed $66 per annum; in cities of 100,000 and less than 500,000, not to exceed $48 per annum; and all cities less than 100,000, not to exceed $36 per annum. If the charge or price fixed shall not be deemed remunerative upon the capital invested, the company may file sworn statements to this effect, and an investigation be made and the rate established so as to pay the capital invested 10 per cent. The penalty for violation is a fine of not less than $100 nor more than $500 for each offense. The fine is to be apportioned equally between the state and the county in which the offense is committed. The person aggrieved may recover in a civil action for damages.

# CORRESPONDENCE.

## New England News.

BOSTON, February 14.—The Edison Electric Illuminating company of Brockton, Mass., will probably soon transfer nearly all of its stock to capitalists in this city. At the present time the majority of the stock is owned by Dr. Wallace C. Keith, Fred P. Richmond, Fred B. Howard and Horace Richmond of Brockton. The deal will cancel all of their interests in the corporation as well as the stock of several others. Practically the Boston buyers will own the plant if the deal is consummated. The purchasers are well known Boston capitalists with other large electric holdings, but until the deal goes through they do not wish to have their names made public.

A petition was received in the House of Representatives the other day from L. D. James and others for an act to incorporate the Western Hampshire Street Railway company, to operate in Williamsburg, Goshen, Chesterfield, Worthington and Cummington in Hampshire county in the western part of the state. The capital stock is not to exceed $150,000 and the company asks authorization to transact the business of a common carrier of goods and merchandise.

For several weeks negotiations have been in progress for the absorption of the Haverhill & Amesbury and Newburyport & Amesbury electric railroads by the Lowell Street Railway company. Officials of both roads are very reticent at present and refuse to state whether any definite plan of consolidation has been arrived at. The Newburyport & Amesbury, one of the roads in the deal, is one of the oldest local lines in the state, having been chartered by the Massachusetts Legislature in 1864. It was built from Newburyport to Amesbury in 1872, and used as a horse railroad up to five years ago, when it was equipped with electricity. The company owning it has since added a branch road to Newbury. The Haverhill & Amesbury has about 18 miles of track, covering Haverhill, Merrimac, Amesbury, Newburyport, Salisbury and Salisbury Beach and Seabrook.

The most important electric railway scheme which has ever been contemplated in New England is soon to come before the Legislature of New Hampshire, when a bill asking a charter for the incorporation of the Merrimac Valley & St. Lawrence electric railroad will come up for action. Hon. Thomas Sanders of Haverhill, Mass., the president of the company, has been in Concord, N. H., within a few days in the interest of the scheme, and, while he appreciates the antagonism of the big lines of steam railroads to the scheme of permitting an electric rival to gain a foothold in the state, he is confident of the prospect of realizing success ultimately. The Boston & Maine and Concord & Montreal steam railroad companies, which have been fighting each other for years, have joined in recognition of the common enemy and will undoubtedly bring all their combined influence to secure the defeat of the scheme before the Legislature. If the scheme, as now outlined, is carried out, the Merrimac Valley & St. Lawrence electric railroad will start at Haverhill, Mass., pass through Nashua, Manchester, Concord and the White Mountains in New Hampshire and terminate at Quebec. The plan of the prosposed route is to reach Nashua by a westerly course of 20 miles from Haverhill. Thence it is to follow the east bank of the Merrimac river through Manchester and intermediate towns, continuing northward through Concord on the opposite side of the river, Franklin, Bristol, Plymouth, up the valley of the Pemigewasset to the Profile House, and through the mountains, via Jefferson and Milan, to the Connecticut lakes. After reaching this point, the northern New Hampshire boundary, the route will run for nearly 100 miles through the Province of Quebec to a terminus on the North Atlantic docks in South Quebec. From Lake Winnepisseogee, one of the most popular and beautiful summer resorts in the White Mountains, to Lake St. Francis in the province of Quebec, or for nearly half the length of the proposed line, a country of hills and mountains will be traversed, the grades of which, it is claimed, can be easily and safely overcome by the electric cars.

A new method by which passengers may notify conductors when it is desired to bring a car to a stop is being tried on the West End road in this city. On one of its suburban lines a car has been equipped with a series of push buttons attached to the framework of the windows. By touching one of these the passenger sets a gong in motion over the conductor's head on the rear platform, which is a notification that he wishes to leave the car. So far the scheme has worked entirely satisfactorily. In a few weeks there will be about 300 of the cars supplied with the electric buttons, and before long it is likely all the cars will be similarly equipped.

The blizzard and cold spell which prevailed for several days last week in New England caused the electric rail-

roads in the cities outside of Boston no end of inconvenience and did considerable damage. Almost all of the roadt were tied up for 24 hours and a number of them did no get to working for even a longer time. In Boston the West End road was not seriously inconvenienced and no great pecuniary loss was suffered by this system.

The city of Providence, R. I., was in darkness on the night of February 8th, and for several succeeding nights. The heaviest loss through the storm fell upon the Narragansett Electric Lighting company, which has a contract to light all the principal streets on both sides of the river. The terrific wind on the morning of February 8th drove a great tidal wave up the bay and river. Without any warning the employes in the electric light station on Dyer street found a flood pouring in upon them which quickly filled the boiler house and put out the fires under the big double battery and then rushed into the engine room where it filled the wheel-pits and stopped the engines. Before the engineer and his assistants could procure aid the monster belts, costing $10,000, were under water and the plant was crippled. The Union Railroad company's electric plant is near that of the Narragansett company, but fortunately it stands higher from the river bank and the flood was kept out.

The Campbell Electric Supply company, 104 High street, this city, has made an assignment to close up the business, to R. A. Stewart, treasurer of the company.

The Leicester Electric company has been attached by the General Electric company on account of a claim for $5,000 secured by mortgage. The plant will be sold by foreclosure on March 15th.

Last Saturday was Bell Telephone day in Boston and a red letter day at that. R. L. Day & Co. supervised an auction sale of 3,368 shares of American Bell Telephone company stock not taken by the stockholders under the recent offer of new treasury stock. The stock was offered in 50 share lots or the whole at the buyer's option, payable and deliverable in 50 share certificates on Tuesday. The auction room was overcrowded and early bidding was spirited. Starting at 185, the bids were 186, 187, 188, 189, 190 and 191, at which 767 shares were knocked down to to Moors & Cabot Then followed a sale of 100 shares at 190¼ to Hornblower & Weeks, 50 shares at 190 to J. Pickering & Moseley, 100 shares at 190⅛ to E. N. Foss, 503 shares at 189¼ to Moors & Cabot and the balance of 1,748 shares at 189¼ to H. C. Wainwright & Co., who represented a pool of investment orders from several different houses. The average price received was 189.9. The same number of shares sold to stockholders at par would have realized $336,800, a difference of $302,153, the total received at the auction being $638,953 25. This difference of over $300,000 is less the commission of 25 cents per share for selling. The price of Bell Telephone stock at the stock exchange was stimulated by the auction sale and sold as high as 192, with 193 bid, 195 asked at the closing.

The New England Telephone & Telegraph company has petitioned for a permanent injunction against the Brattleboro, Vt., Gas Light company, controlling the electric light plant in Brattleboro, to restrain it from operating wires that interfere with the operations of the telephone plant. The telephone service has been worthless at night because of the induction.

A new self-adjusting electric car fender, invented by James O. Brown of Boston, has been put in practical operation on a car on the Boston and Quincy line, and it is announced that it will soon be placed upon all cars in Quincy. The mechanism is very simple. When an electric car is in motion, the scoop or fender is drawn back and up under the car out of the way. Whenever the motorman applies the brake, whether in case of impending accident or not, the scoop is automatically run down and ahead of the front platform, ready to pick up any object lying upon the track. The rubber fingers, revolving inwardly, fixed to the edge of the scoop, prevent bruising and insure a sure landing in the net. The fender also serves as an indicator as to the amount of slack which the motorman allows his brake chain when running through a crowded street. It is self adjusting to uneven surfaces. No extra attention has to be paid to the fender when the motorman changes the ends of the car to run the other way. The spring which released the fender from the ground when the brake is loose is so attached to a lever that it transmits the power to the brake-shoes, which enables the brake handle to have more power. The power it takes from the ground to rotate the front roll tends to stop the car. The railroad commissioners of this state have this to say of the merits of Mr. Brown's invention: "The Foster & Brown car fender is different in type from any of the others, consisting of a cylinder with rubber fingers projecting therefrom. The fender is brought to the ground by the operation of the brake handle, and the cylinder is caused to revolve by two wheels which run along the ground, one on each side of the track. This fender gave unexpectedly favorable results in our tests."

The Massachusetts Agricultural College at Amherst now lights its own buildings by electricity, having just finished putting in one of the best private electrical plants in the state. J. C. E.

## St. Louis, Mo.

St. Louis, February 15.—Many efforts have been made to consolidate all the street railways of St. Louis into one company or management. So far the state laws have always stood in the way of this movement. Capitalization is limited to $10,000,000; corporations are not permitted to consolidate, and the stock of one corporation cannot be owned or held in trust by another. Three bills have been introduced in the upper house of the state Legislature to amend the statutes so as to permit of a capitalization up to $50,000,000, and to permit the consolidation of corporations, and also the ownership of stock in other coporations. The idea is to vest the ownership of all street car lines in St. Louis in one corporation. The new company will probably be entitled the St. Louis Traction company, with a capital stock of $20,000,000. Not long ago a committee of appraisement was authorized to determine an approximate valuation of the several lines. The result is given herewith:

| Railways. | Capital stock. | Bonded debt. | Miles of track (single) |
|---|---|---|---|
| Cass Ave. & F. G. | $ 2,500,000 | $ 1,600,000 | 30 |
| Citizens' | 2,000,000 | 2,000,000 | 21 |
| Fourth & Arsenal | 150,000 | 500,000 | 6 |
| Jefferson Avenue | 112,000 | 100,000 | 5 |
| Lindell Ry. Co. | 2,500,000 | 3,000,000 | 70 |
| Missouri Ry. Co. | 2,400,000 | 500,000 | 28 |
| People's Cable Co. | 300,000 | 1,000,000 | 10 |
| St. L. R. R. Co. | 2,000,000 | 2,000,000 | 20 |
| St. L. & S. | 2,500,000 | 2,300,000 | 18 |
| Southern Ry. common. | 800,000 | 500,000 | 8 |
| Southern Ry. pref. | 700,000 | 500,000 | 8 |
| Union Depot Ry. | 3,000,000 | 3,000,000 | 67 |
| Totals | $13,962,000 | $16,050,000 | 283 |

It is estimated that the consolidation will effect a saving of $100,000 per year in salaries alone. The public will be benefited by the transfer privilege, which will no doubt be used to as great an extent as possible.

A bill has been introduced into the state Senate requiring all electrical wires except trolley wires in cities of over 200,000 inhabitants to be placed underground. Three members of the St. Louis Subway commission have gone to Jefferson City to appear before the joint committee of the House and Senate to look after the interests of the St. Louis subway scheme.

A bill has also been introduced to fix telephone rates in cities of 75,000 to 200,000 inhabitants at $45 per year; in cities of 25,000 to 75,000 inhabitants at $30 per year, and in cities of 3,000 to 25,000 inhabitants at $25 per year, and in no city more than $60 per year.

A bill is now before the City Council authorizing the construction and operation of a street railway belt line. Almost the entire line will be made up of existing lines, as follows: The Peoples' Railway from Seventeenth and Chouteau avenue over Chouteau avenue and Fourth street to Washington avenue, thence over the Lindell avenue railway on Washington avenue west to Eighteenth street and thence south over the track of the Union Depot and Lindell railway companies on Eighteenth street to Chouteau avenue again. A short piece of single track on Chouteau avenue from Seventeenth to St. Ange will be required to complete the necessary double-track arrangements. The object of the new line is to accommodate down-town traffic and also to establish a transfer system from the belt line to all intersecting lines. Every road in the city excepting the Jefferson avenue line will be crossed by the new belt line. Charles Green, president of the Peoples' Railway company, is the promoter of this new scheme.

Another ordinance is pending before the City Council providing for the use of fenders for street cars. The managers of the several street car companies have been in conference with the committee on railroads with a view to amending the bill so as to conform to the practical requirements of street car service.

The Citizens' railway, formerly a cable road, has been changed to electric power and is now in successful operation throughout its entire length from Fourth street to the city limits, and also the Fair Ground branch on Grand avenue. R. J. H.

## PERSONAL.

H. F. Taite has been appointed manager of the western department of the National Conduit Manufacturing company, with headquarters at 542 Rookery, Chicago.

## ELECTRIC LIGHTING.

The electric lighting companies of Cincinnati, Ohio, have adopted the meter basis on motor as well as lighting circuits.

An electrically lighted racetrack will be operated in Kansas City soon. Robert J. Holmes has leased the Exposition Driving Park for $4,000, and is negotiating for the purchase of an electric light plant with which to illuminate the track for racing at night.

The Jefferson City Light, Heat & Power company, Jefferson City, Mo., has decided to add to the present electrical equipment one 1,000 light machine to furnish current for power and light. After the additional equipment is put in the company will furnish current day and night.

## ELECTRIC RAILWAYS.

The Detroit Railway company has contracted with the Cambria Iron company of Johnstown, Pa., for rails, bolts and fish plates for about forty-five miles of track. The price agreed upon is $170,000. The contract for all special work, such as curves, switches and crossings, has been given to the Cleveland Frog & Crossing company, the price being $48,600. Both contracts stipulate that deliveries shall begin in April and shall continue as rapidly as materials are required.

A safety trolley car fender is at last reported to have been of actual service. A Rochester, N. Y., paper tells the incident as follows: Eddie Horton, aged seven years, who lives with his parents at the corner of Tremont street and Caledonia avenue, was riding a sled down a hill and across Caledonia avenue. On one trip he had reached the center of the street when an electric car approached at a high rate of speed. There was a collision and when the car was stopped Eddie was perched on the life guard crying lustily. There was a deep cut in his forehead, his face was lacerated and one of his arms was sprained. He was taken home, where he is rapidly recovering from his injuries.

The promoters of the proposed electric railway from Albany, N. Y., to Castleton via Greenbush, have secured the right of way for their proposed line. The railway will be for the accommodation of passengers and local freight between these places, and the fare is fixed at 10 cents from Albany to Castleton and 5 cents to Greenbush. The power house will probably be located near the Genet school house in East Greenbush, as there is a plentiful supply of pure water close at hand. The managers of the Albany and Greenbush bridge are ready to co-operate and fix a liberal rate for crossing that structure as soon as all arrangements have been made to construct the railway. It is the intention to operate five passenger and two freight cars on the proposed railway. The main or Castleton cars will leave Albany every hour and the Greenbush cars every 20 minutes.

Articles of incorporation of the Frankfort & Utica Street Railway company have been filed in the office of the secretary of state at Albany, N. Y. The length of the proposed road is seven miles, its termini being the intersection of Main and Litchfield streets in Frankfort, and the westerly line of the county of Herkimer, connecting with the Bleecker Street & Utica Park railway. The capital stock of the company is $70,000 divided into 700 shares of $100 each. Ten per cent. of the amount of the capital stock has been paid in. It is the intention to build, equip and operate an electric railway between Frankfort and Utica. The eastern terminus of the proposed new road is the western terminus of the proposed electric road from Herkimer through Mohawk, Ilion and Frankfort, and with that road and the Bleecker Street road will form a line from Genesee street in Utica to Main street in Herkimer.

## TELEGRAPH.

The French government has ordered from the cable manufacturing establishment of A. Grammont in Pont-de-Chérui a deep sea cable of a length of 550 kilometers to be laid between Mozambique, on the east coast of Africa, and Madsungo, in Madagascar. The cable is expected to be ready for delivery next month.

The new telegraph line from Buffalo to Clearmont, Wyo., connecting with the Western Union line at the latter place, was completed on December 28th. The re-establishment of Buffalo's telegraphic communication was celebrated by a parade with a band of music. This line is especially important to stock-growers of that section of Wyoming in enabling them to catch a good market for their shipments, and at one time the Buffalo telegraph line saved many lives.

The Western Union Telegraph company's central cable office recently published a bulletin received from Port Darwin, Australia, reporting serious interruption to the Government telegraphs of that country and great difficulties encountered in the work of restoration owing to floods. All Australian telegrams were accepted subject to delay. The telegraphs in the Transvaal were also interrupted, and messages for that part of Africa were likely to meet with some delay. The Eastern Telegraph company reported that there were no prospects for the restoration of the Australian land lines at present. The country is still under flood. The Commercial Cable company announced that messages from Shanghai take about five and three-quarter hours in transit, and from Yokohama about six and one-quarter.

## TELEPHONE.

It is charged that large blocks of the stock of the Mutual Automatic Telephone company of Philadelphia have been issued to politicians and councilmen of that city to secure franchises. The matter is under investigation.

The Central Union Telephone company has reduced the telephone charges in Decatur, Ill., 50 per cent. for all service. This course has been taken, it is said, to crush the Harrison Telephone company, which has 600 instruments in use at a rental of $26 each a year.

The report of the sub-companies of the Erie Telegraph & Telephone company for three months ended December 31,

1894, shows: Gross income, $270,337.03: gross expenses (including dividends paid), $262,128.18; surplus, $8,208.85; proportion of dividends received by the Erie Telegraph & Telephone company, $61,587.50; dividend No. 45, $48,000; surplus, $13,587.50; total surplus for the three months, $21,796.35.

The directors of the Duluth Telephone company have elected officers for the ensuing year as follows: Arthur G. Fuller, president; Col. C. H. Graves, secretary; A. W. Taussig, treasurer, and Edward Lomasney, manager. Mr. Lomasney, since coming to Duluth, has had charge of the local system, and now by vote of the directors succeeds to the position as general manager, formerly held by Mr. Van Brunt, who has retired from the company.

The annual report of the Wisconsin Telephone company shows that the value of the real estate owned by the company amounts to $130,825.15, an increase of $97.90 over a year ago. The length of wire in the state controlled by the company is 13,494 miles, and the number of instruments in use is 7,000. The gross earnings of the company for the year ended December 31, 1894, were $421,213.73. The gross earnings of the company for the year ended December 31, 1893, amounted to $414,756.18.

## POWER TRANSMISSION.

The Clear Creek Gold Mining & Water Power company has been organized by New York, Philadelphia and Colorado capitalists to wrest from the bed of Clear Creek, for thirteen miles above Golden, Colo., the vast accumulation of gold supposed to have been deposited there through the ages, and to supply electrical power for the running of all sorts of machinery. Henry Levis of Philadelphia is the president and representative of the eastern capitalists. The Denver men are Scott J. Anthony, vice-president; E. W. Rollins, treasurer; Dr. W. G. Smith, secretary, and J. M. Downing and H. J. Mayham, who, with those named and Mr. Keene of Philadelphia, constitute the board of directors. The company contemplates supplying power to run the street cars and all sorts of plants in Denver by generating electricity many miles away.

## MISCELLANEOUS.

At a recent election of officers of the Jenney Electric Motor company, Indianapolis, Ind., the following named gentlemen were elected: C. D. Jenney, president and general manager; A. A. Barnes, vice-president; E. W. Jenney, secretary and treasurer.

## TRADE NEWS.

The Jenney Electric Motor company, Indianapolis, Ind., has contracted for the erection of a new factory, which it hopes to have completed within 60 days.

The sales of the Triumph Electric company, Cincinnati, O., have averaged about one machine per day for the last three weeks, and orders are still coming in. The advantages which this company claims for its machines are becoming better known each day, and in practice their superiority is fully demonstrated.

The new 17 circuit switchboard installed by J. Grant High & Co. of Philadelphia for Eben Harding & Co. of that city, is said to be one of the finest placed in that city for a long time. It was at this place that the first Edison apparatus was put in Philadelphia, and the plant has been long pointed out as a model electric lighting equipment.

The Abendroth & Root Manufacturing company, 28 Cliff street, New York, is the sole maker of the Root improved water-tube boiler so generally employed in electric lighting and street railway power stations. It has branch offices in the Perin building, Cincinnati, O., Monadnock building, Chicago, Ill., Security building, St. Louis, Mo., and at No. 8 Oliver street, Boston, Mass.

Nicholas & Barr, 28 West Washington street, Chicago, are placing on the market the Gate City soldering furnace for which they claim many points of excellence, including economy of fuel, simplicity of construction, a burner that cannot be clogged up and fixed pump. This furnace can be used in strong winds on roofs, and is especially adapted for electricians', plumbers', tinners', cornicemakers' and roofers' use. It is particularly well adapted for conduit, electric light and telephone work.

The Electric Appliance company, Chicago, has just published and distributed a copy of the rules and regulations of the National Board of Fire Underwriters in neat and convenient form for ready reference. Inasmuch as these regulations are now required in all the large cities and a majority of the smaller ones, it is very necessary that every one in the electrical business should be familiar with them. The Electric Appliance company has a number of extra copies and will be pleased to send them on application.

The Shawhan-Thresher Electric company of Dayton, O., has just completed an installation for the United Brethren Publishing company of that city for furnishing light and power. The installation is complete in every detail, the iron-clad type of machine being used throughout. Two 30 kilowatt generators comprise the generating plant, while eight motors are distributed throughout the various departments. The company some time ago made an installation for the King Powder company, comprising the transmission of 1,200 horse power, the generators being of the direct connected type of 200 kilowatt capacity and fifteen motors varying from 20 to 80 horse power.

## BUSINESS.

The American Carbon company of Dayton, O., is finding it difficult to keep up with the rush of orders which have continually found their way to the office. The excellent line of carbon specialties which this concern handles has become known all over the United States, and has never failed to give perfect satisfaction.

The Automatic Switch company of Baltimore has received a flattering testimonial from H. B. Beckman of Newburg, N. Y., in which he says that the automatic non-reversible motor starter, supplied by this company, has been in constant use since last May, in large store-houses operating a large elevator, and it has given perfect satisfaction. It is simple, strong and durable, and thoroughly reliable.

The Diamond Electric Manufacturing company, Peoria, Ill., reports an excellent business for the last six months. The company has received orders from its well-known wattmeters and tranformers from all over the country. In fact it has done such a tremendous business that its present facilities are entirely inadequate to the demand, and it is now negotiating for a new factory which it hopes to occupy within a few months.

The Royal Electric company of Peoria, Ill., reports the following sales of alternators and their capacity in transformers, last month: Columbus, Neb., 1,250 lights; Roanoke, Ill., 500 lights; El Paso, Ill., 1,250 lights; Morton, Ill., 650 lights; Cambridge, Ill., 650 lights; Grand Haven, Mich., 1,000 lights; Raymond, N. H., 500 lights; Havana Cuba, 500 lights; Los Angeles, Cal., 500 lights; Warsaw, Ill., 1,000 lights; Iowa Falls, Ia., 1,250 lights. The company also reports a steady increase of transformer sales.

With a record of ten years of use, the P. & B. insulating products have become familiar to every electrician in this country and are becoming well known abroad. The Standard Paint company of New York, with Chicago office at 186 and 188 Fifth avenue, which manufactures these compounds, publishes many hearty endorsements of its material, bearing date from 1888 to 1894. It is remarked that P. & B. compounds are highly recommended by the boards of fire underwriters in the leading American cities, for coating mouldings to be placed in damp places, making cut-out boxes water-proof and practically fire-proof.

Ed. Wertheim, 207 and 209 Lake street, Chicago, sole agent for the Union Carbon Works, Kronach, Germany, having succeeded in making these carbons known to advantage, is now carrying a full stock of soft cored and solid carbons for immediate deliveries. The Union carbons have been tested by the Armour Institute in Chicago. The test was conducted by Prof. W. M. Stine, who, after comparing them with other carbons, pronounced the "Union carbon" to have the longest life and "to be the only make that gave a really satisfactory arc in an alternating current lamp." These carbons have been tested by a large number of electric companies in this country and all pronounce them to be first-class in every respect. Some of the companies are already using them extensively, and the prospects of increasing the sales of Union carbons in this country are bright.

Friends of M. M. Wood will be interested to know that he has started in business for himself. It will be remembered that Mr. Wood was for a number of years district engineer for the Edison company on the Pacific Coast, and was also connected with the Ansonia Electric company and recently with the Wallace Electric company, Chicago. His excellent work in the far West, as well as with his Chicago connections, is too well known to need comment here. The Wood specialties are now thoroughly familiar to everyone in this country interested in the purchase of high class electrical supplies. Mr. Wood's office will be at 1536 Monadnock Block, Chicago. His laboratory is at Berwin, Ill., and the development and manufacture of his high-class electric lighting and railway supplies is busily occupying a number of skilled workmen. Those interested in the latest novelties in this line should write for catalogue and other descriptive matter covering Mr. Wood's work.

"Exhaust Steam Utilized to Effect Economy or Increase of Power—and How" is the title of a 128 page book just issued by Warren Webster & Co. of Camden, N. J. The little volume, as its sub-title indicates, is an illustrated catalogue of the Webster vacuum feed-water heater and purifier, and the merits of this widely-known device are attractively set forth. Views are given of the main office and works, with a description and cuts of the vacuum heater. The introduction contains this statement: "The Webster vacuum feed-water heater and purifier in its latest construction and modifications of design adapted for special requirements, represents the greatest economy for use with exhaust steam. Enjoying a reputation for acknowledged superiority during the past six years, in which time have been installed over 400,000 horse power, we desire to thank our patrons of the past for their many favors and to meet those to whom the subject is as yet an investigation. In presenting this, our latest revised and illustrated catalogue, it is with the hope that the facts presented will carry conviction to an investigating temperament and the difference in principle for the results intended be self-explanatory, effecting for the greatest range of service the highest excellence in every detail throughout. Opportunities for economy are frequently sacrificed by inefficient apparatus adopted upon the basis of price lists and discounts." A large number of pages is devoted to testimonial letters.

The Fellowship Club's unique St. Valentine's banquet at Kinsley's, Chicago, was an opportunity for pleasing electrical decorative work that redounded greatly to the credit of the Chicago Edison company. Purchasing Agent Charles Holmes of the Edison company was in charge of all the decorative electrical work at this banquet, and working in conjunction with the electrician, A. T. Brown of Kinsley's, it may be said that the beautiful electrical effects played a most important part in that enjoyable affair. The banquet was spread for 125 covers on five tables. Each table was in the shape of a heart, three of them being fifteen feet and two ten feet long, and of proportional width. Without attempting to detail the strikingly handsome furnishings outside of the electrical fittings, it may be said that in the middle of each of the three large tables was something which looked like a bed of red flowers in the shape of a heart about four feet long. These center pieces consisted each of a mass of ruby electric lights. When illuminated the effect of the three table decorations was most striking and peculiar, and particularly so from the fact that the glow from the ruby lights of the center pieces predominated over the few other lights in the central chandelier and elsewhere in the room. The most striking feature of the decorations, however, was the fan at the head of the room. This piece, it will be remembered, was exhibited at the General Electric company's display at the World's Fair. It had been shipped to Chicago for this occasion, and the company went so far as to have a special expert, Charles W. Moffett, Jr., come on from New York to install and operate the fan. Its peculiar feature was the opening and closed effect, secured by the cutting in and out of lights placed so as to represent the ribs or sticks of the fan. Without a doubt the Chicago Edison company handled the electrical work of this banquet in a most creditable and thorough manner.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued February 12, 1895.*

533,861. Electric Locomotive. Eben M. Boynton, West Newbury, Mass. Application filed April 9, 1894.

Among the claims allowed is that of the combination with the car body of a frame fastened to it near one end, having guide wheels engaging with an upper guide rail, a driving wheel having removable web plates fastened to hubs revolving loose on a shaft in the frame, armature and field magnet elements between the web plates, and one element fastened to the wheel tire and the other element to the shaft, and means for fastening the shaft to the motor frame or allowing it to rotate.

533,869. Conduit System for Electric Railways. Frederick S. Davenport, Jerseyville, Ill. Application filed October 26, 1894.

It is claimed for the arrangement illustrated that there is the combination with a feed wire and traveling contact bar of an underground conduit having for one of its sides one of the track rails secured to the laterally projecting base of the opposite side, the top of the latter being surmounted by a removable cover adapted to shelter and protect the feed wire and contact bar.

533,873. Alternating Current Dynamo-electric Machine. Axel Ekstrom, Lynn, Mass. Application filed July 26, 1894.

The features of the arrangement illustrated in the accompanying diagram are coils carried upon a revolving armature, collecting rings connected to the terminals of the coils, a commutator in the lead from one of the terminals to one of the collecting rings, a shunt between the terminal and collecting ring carried upon and revolving with the armature, and a second shunt around the commutator.

533,877. Railway Signaling Apparatus. Charles L. Fielder, London, Eng. Application filed June 13, 1894.

A signal rod formed in two parts and a collapsible link connection, having its ends permanently pivoted to the parts, a pivoted locking blade having a normally vertical side for the link connection to slide against, whereby the parts of the signal rod are operatively connected, and the link connection is prevented from collapsing, and an electro-magnet having a projecting piece attached to its armature for holding the free end of the blade stationary.

533,885. Apparatus for Winding Armature Coils. Henry Geisenhöner, Schenectady, N. Y. Application filed August 22, 1894.

The device illustrated is described as a curved supporting body, part of approximately the same radius as the armature core to which the coil is to be applied, containing reciprocating parts upon each side provided with grooves for engaging the sides of the armature coil, means for retaining the wires of the coil in the grooves, and slides for engaging the ends of the coil, provided with movable blocks upon their ends. The parts are arranged to co-operate. The coil may be wound in a single vertical plane, the reciprocating parts engaging the sides may be separated and the slides brought nearer together to shape the coil, and the retaining means upon the reciprocating parts and the blocks upon the sides may be moved to release the coil from its engagement with the apparatus and permit its removal.

533,893. Electrical Exchange System. George W. Hey and Arthur E. Parsons, Syracuse, N. Y. Application filed March 30, 1893.

An electrical exchange system, consisting of a series of metallic circuits, and an automatic switching device suitably connected in the circuits and provided with means operated by electric currents passed over one of the wires of the circuits, whereby one of the circuits is connected to any of the others.

533,902. Electrically Operated Recording Instrument for Compasses. Charles L. Jaeger, Maywood, N. J. Application filed January 25, 1894.

The combination of a helical conductor, a conductor arranged adjacent to the same, means for feeding a tape between the two, and electrical connections, forms the first claim of this invention.

533,910. Tip for Electric Conductors. Amandus Metzger, Schenectady, N. Y. Application filed November 26, 1894.

The features of this invention are a conductor tip, comprising a flat body portion doubled upon itself and provided with a hole for a bolt or screw, a tube formed integrally with the flat portion of the tip, and upset or bent so that one side of the conductor is in the plane of the flat portion, and lugs also formed integrally with the flat part of the tip, and adapted to embrace the tube and secure the whole together.

533,913. Fuse Block and Socket. Frederick W. Mount, St. John, Can. Application filed July 16, 1894.

This is a fuse block provided with a hollow bushing, having a screw threaded end in combination with a socket screwed to

the end, and fusible conductors passing directly from the fuse block through the bushing into the socket.

533,919. Synchronizer for Clocks. Henry S. Prentiss, Elizabeth, N. J. Application filed June 30, 1892.

One claim reads as follows: In a clock system, the combination of a master clock constructed to close the circuit at a predetermined period before the hour, and to break it at the hour, and a secondary clock provided with a separable connection between two operative parts of the train, an electro-magnet controlling said connection, a detent for arresting the movement of the train when in a predetermined position, and two circuit closers operated by the train, the one being set to close the circuit through the electro-magnet in advance of the closing of the circuit at the master clock, and to break it simultaneously with the closing of the circuit at the master clock, the second circuit closer being set to close the circuit through the electro-magnet at the hour as indicated by the secondary clock.

533,920. Series Parallel Controller. Edward D. Priest, Schenectady, N. Y. Application filed November 24, 1894.

The method of operating electric motors described consists in closing the circuit through a resistance with the motors in multiple series, then cutting out the resistance, leaving the motors in multiple series as a running position, then reinserting the resistance and breaking the circuit, then changing the motors from series multiple to multiple by first shunting each motor with the circuit still open, then closing the circuit through a resistance, and then cutting out the resistance, leaving the motors all in multiple as their running position.

533,926. Electric Automatic Block System Signal. Joseph B. Stewart, Haverstraw, N. Y. Application filed March 8, 1894.

Claim one reads as follows: In an electric automatic block signal system, the combination with the normally open track section circuits of batteries, one at the end of each track section circuit, and polarized relays, one terminal of each relay being connected to one track section circuit at the end most distant from its battery, and the other terminal being connected to the end of the adjacent track section circuit at a point opposite its battery, and all the batteries being arranged with their like poles in the same direction, the connection being such that the polarized relays only from the circuit from the battery at the next station ahead.

533,930. Armature Winding. David P. Thomson, Schenectady, N. Y. Application filed August 4, 1894.

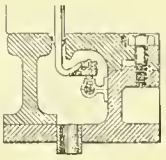
In a series wound dynamo-electric machine the features claimed are armature coils, a commutator having a plurality of segments for each armature coil, a lead from each armature coil to a point equidistant from the segments to which it is to be connected, and leads from such point to the several commutator segments, thus forming from each armature coil to its appropriate commutator segments leads of substantially equal resistance and self-induction.

533,931. Dynamo-electric Machine. Elihu Thomson, Swampscott, Mass. Application filed December 29, 1890.

The method described of regulating a dynamo for constant potential under changes of speed consists in applying a counter-excitation by means of a separate source of energy more sensitive to speed changes than the main dynamo.

533,932. Carbon for Arc Lamp. Elihu Thomson, Swampscott, Mass. Application filed November 26, 1894.

A carbon electrode for an arc lamp, comprising an outer shell of hard carbon and an inner core of softer material, the electrode having a cup at its tip, whereby the inner core is cut away from the end of the carbon.



NO. 533,869.

533,936. Electric Battery. James M. Wells, Peoria, Ill. Application filed July 31, 1893.

In a therapeutic battery the combination is claimed of an inclosing case or shell, having its interior divided into two compartments by a partition of insulating material, battery elements supported by the partition within one compartment of the case adapted to contain suitable battery fluid an induction coil arranged in the other compartment of the case, and having its core and primary helix separated by a metallic sleeve, electrical connections between the core and primary helix of the induction coil and the positive and negative battery elements respectively, a vibrating spring armature, a series of hollow plugs secured in the partition between the compartments of the inclosing case, and adapted to receive plugs carried by suitable electrodes, and electrical connection between such plugs, the helices of the induction coil and the armature.

533,967. Combined Telephonic and Telegraphic System. Christopher A. Shea, Boston, Mass. Application filed July 30, 1892.

In a metallic circuit for simultaneous telephonic and telegraphic service the combination is described of a main line or circuit connected on one side through a condenser with one terminal of the telephone or telephone converter, and with the telegraph battery and instrument by a line having an inductive resistance to telephone currents, and a branch line having a telephonic current resistance and condenser connecting the line to the telegraph instrument and battery with the other terminal of the telephone or telephone converter, the telephone or telephone converter being also connected with the other line of the metallic circuit through a condenser.

533,975. Automatic Heat Regulating Apparatus. William Waters, Oshkosh, Wis. Application filed July 20, 1894.

Claim 1: In an automatic heat regulating apparatus, the combination of a circuit, a thermostat in said circuit, a switch for shunting the circuit, a lever for moving said switch, a catch engaging said lever, a magnet in the circuit for releasing the catch, a damper connected to said lever, a continuously reciprocated bar adapted to move said lever and a source of electrical energy.

533,979. Electrical Time Alarm. Walther Wilke, Wermelskirchen, Germany. Application filed August 7, 1894.

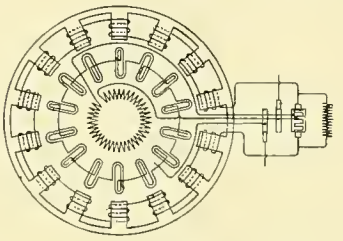
The combination is claimed of the arbor, hub mounted thereon, insulating packing on the conoidal end of said hub, the conoidal shell fitting on the said packing, the hand carried by said shell, contacts arranged to be successively touched by an attachment of the said hand as the latter is carried around by the said arbor, and circuit wires making connection with the said shell and the said contacts.

534,025. Automatic Telegraphing Machine. Charles E. Yetman, Oak Park, Ill. Application filed December 2, 1893.

In automatic telegraph machines there is the combination with the rotating driver, and with the circuit make and break ring mounted loosely and separately about the driver, but movable to and from the same, and supported intermittently thereon at the ring-rim, whereby the ring is revolved in single direction only, of the shifter brake controlled from the character key to throw said ring into and out of engagement with the driver.

534,036. Galvanic Battery. Warren P. Freeman, Brooklyn, N. Y. Application filed June 11, 1894.

In a galvanic battery, comprising an imperforate walled box, having a number of cells, there are an exterior boss on the bottom of the box for each cell, and corresponding to the porous cups within, combined with the porous cups, fastening elements which pass through the porous cups and enter said bosses, zinc electrodes, a transverse tray provided with a pocket in its under side above each cell, a carbon secured to and pendent from the tray in each pocket, means to seal the tray to the cover, and means to convey away the current, each pocket being provided with a sealing compound to prevent the acid fumes from escaping upward around the upper ends of the carbons.



NO. 533,873.

534,038. Dynamo-electric Machine. Rodolphus Fuller, Detroit, Mich. Application filed October 20, 1894.

The combination in a dynamo-electric machine of the armature shaft, two commutators on opposite ends of the shaft, two sets of brushes, the binding posts and two sets of field windings are claimed, comprising a series and shunt winding in each set, the terminals of the shunt windings being connected respectively to the brushes, and the series windings to a brush and a lead.

534,060. Electric Controller. George F. Card, Covington, Ky. Application filed May 17, 1894.

A series of contacts, a series of pivoted arms carrying contacts adapted to engage with the contacts of the other series, means for holding the contacts in or out of engagement, mechanism for imparting an initial movement to the pivoted arms, and means for automatically completing the movement are the features of this invention.

534,078. Regulating Device for Car Motors or Other Electrical Apparatus. Horace F. Parshall, Schenectady, N. Y. Application filed December 11, 1891.

This is a controlling device for electrical apparatus, having several coils, and consists of a rotatable, sectional shaft, a resistance conductor and contacts connected to different points therein, a switch arm movable over the contacts during the first part of the rotation of the shaft, and connected to one section of the shaft, a body on the other section having switch contacts, co-operating contact brushes or devices, the contacts being so located on the body as not to change the connection of the coils until the body has rotated through a considerable arc, and an automatically detachable connection between the sections of the shaft.

534,079. Armature for Dynamo electric Machines. Horace F. Parshall, Schenectady, N. Y. Application filed February 20, 1892.

A stationary field magnet, a stationary armature core of iron, and a rotating armature body consisting of an iron ring in the annular space between the field magnet poles and the stationary core, the ring having transverse passages, and insulated conductors in the same forming a winding for the armature.

534,083. Telephone Metallic Circuit. Christopher A. Shea, Boston, Mass. Application filed July 30, 1892.

The circuit described for the transmission of electrical impulses comprises two wires presenting reciprocally inductive sections to each other, the wires being connected at each end with the earth, and at one end being wound around a receiving instrument, at the other end one wire having therein the secondary coil of a telephone transmitter, and the other a coil similar to and balancing the secondary.

534,084. Combined Telephone and Telegraph System. Christopher A. Shea, Boston, Mass. Application filed July 30, 1892.

As a means of neutralizing the noise of telegraph currents in a telephone converter or telephone connected with a line used for both telephonic and telegraphic purposes, a connection with earth to a point in the coils of the telephone converter or telephone is made in combination with an auxiliary or neutralizing coil wound round the converter or telephone in the opposite direction to the telephone coil, connected to earth from one point therein and from another point to the telegraph line, and a telephone inductive or other resistance interposed in the wire or wires between the neutralizing coil and the point of juncture of the telephone loop with the main line.

534,085. Telephone Metallic Circuit. Christopher A. Shea, Boston, Mass. Application filed July 30, 1892.

The combination of two live wires between two stations, each wire being provided with means for transmitting and receiving an electrical impulse, including at each end a core and a coil of wire around it, with a third wire between stations wound round cores in succession in the opposite direction to the live coils round cores.

534,086. Electric Arc Lamp. Thomas Spencer, Philadelphia, Pa. Application filed June 6, 1894.

An arc lamp provided with a movable holder for each electrode, suspended to permit the carbons normally to gravitate together, a regulating coil in series with the arc, metallic guide rods for the lower holder, rods having their lower extremities terminating above the arc for the upper holder, and contact brushes mounted on the respective holders, are the features claimed.

534,092. Means for Mounting Dynamos on Railway Cars. William Biddle, Brooklyn, N. Y. Application filed May 23, 1894.

The last claim reads: The combination with the axle and dynamo of a frame passing beneath the dynamo, and to which the dynamo is bolted, a box bolted to the dynamo frame and extending over the journal of the axle, there being an oil box below the journal, a bearer upon which the dynamo frame rests, dust caps extending out from the dynamo frame and box respectively, and at both ends of the journal gearing for connecting the axle and the armature shaft, and a box for inclosing such gearing, having at one side an annular flange for receiving the edges of one of the dust caps.

534,151. Alternating Current Motor. Robert H. Hassler, Pittsburg, Pa. Application filed November 30, 1894.

A closed coil armature and a field magnet having its primary coils in circuit with a generator, closed secondary coils in inductive relation to the primary coils, each comprising two reversely wound portions, one of which includes that portion of the magnetic field which is of maximum density when the armature is at rest, whereby a resultant electromotive force is produced in said coils, which varies with the variations in the distribution of the magnetic lines of force in the field magnet.

534,158. Alarm Device for Mills. Charles L. Judge, Austin, Pa. Application filed November 5, 1894.

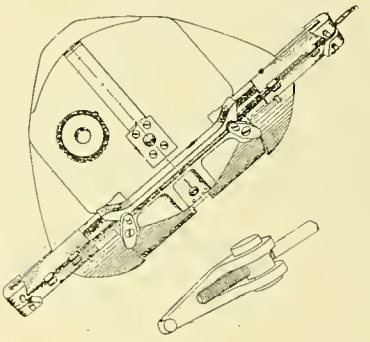
A pair of spaced upright contact posts included in a suitable alarm circuit, a pivotally supported oscillating lever carrying at one end a circuit-closing bar working over said contact posts, a ball chute attached to the end of the lever opposite the circuit-closing bar, a tube arranged under the lower end of the ball chute, and means for elevating weight balls from said tube onto the high end of said ball chute to provide for overbalancing the end of the lever carrying the circuit-closing bar.

534,192. Air Compressor. John F. Blake, New Haven, Conn. Application filed October 18, 1894.

The arrangement includes an electric motor and a pump, an expansible air receptacle connected to the pump, a weighted lever pivoted at one end and forked at its other end, the lever being actuated by the receptacle, a vertical oscillatory lever engaged by the fork of the first named lever, a sliding contact engaged by one end of the oscillatory lever, and a weight carried by the other end of the last named lever and operating to throw the contact in opposite directions to make and break the motor circuit as the weight is moved by the expansible receptacle to one or the other side of the pivotal center of the oscillatory lever.

534,206. Filament for Incandescent Lamps. Thomas A. Edison, Menlo Park, N. J. Application filed January 4, 1884.

The process of making incandescent conductors for electric lamps consists in boiling a horny animal substance in a suitable liquid to soften it, forming the material into the desired shape, and carbonizing it.



NO. 533,885.

534,207. Manufacture of Carbon Filaments. Thomas A. Edison, Llewellyn Park, N. J. Application filed December 27, 1886.

The last claim is for a group of covered receptacles or carbonizing boxes for incandescent lamp filaments, each box having outer walls, inner walls, bottom between the walls, tightly fitting cover, and standards or projections for separating the boxes when placed one above another, whereby air spaces are left between them.

534,208. Induction Converter. Thomas A. Edison, Llewellyn Park, N. J. Application filed May 21, 1888.

Claim 1: In an induction converter the combination of a stationary field coil and a stationary armature with two coils, said field coil and one armature coil being connected in multiple arc to a source of current by means of commutators, and the second armature coil being connected to the consumption circuit.

534,209. Incandescent Electric Lamp. Thomas A. Edison, Llewellyn Park, N. J. Application filed September 17, 1890.

Leading in wires pass through and are held in the glass stem by the fusing of the glass tube upon them, each being composed of an outer covering of readily fusible metal or alloy and an inner core or base of metal of comparatively high fusing point.

534,238. Supply System for Electric Railways. Malone Wheless, Washington, D. C. Application filed December 3, 1894.

The principal claim is for an electric railway system comprising a car provided with three contact shoes insulated from one another and from the body of the car, a source of electrical supply having its opposite poles connected to two of said shoes respectively, and a motor having one of its poles connected to one of said last named shoes only, and its opposite pole connected to the third shoe, in combination with track terminals in groups of three, one for each shoe, set at such intervals apart that the contact shoes on the car will reach one group before they leave the other, an all metal service circuit, a feeder from the supply side and a return wire from the return side of said service circuit connected to the two track terminals of each group through which the motor circuit is completed, normally open contacts in each feeder and return connections, an armature for closing both sets of said contacts, a pick-up magnet for each armature having its energizing coil connected to the appropriate two of each group of track terminals, and circuit connections whereby when the car shoes meet a group of track terminals, the energizing circuit of the pick-up magnet will be closed.

# Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, MARCH 2, 1895. No. 9


## President C. H. Wilmerding.

For the first time in its history the National Electric Light association has elected a Chicago man to be its president. Charles H. Wilmerding, the gentleman who now bears this honor, needs no introduction to the electrical fraternity, and especially to the members and friends of the association, with which he has been connected for a number of years, having heretofore, for several years, filled subordinate honorary offices in the gift of the organization. Mr. Wilmerding is devoted to the best interests of the association, and is a faithful attendant at its conventions. He has fairly earned his promotion. In Chicago Mr. Wilmerding is very well known in electrical circles through his connection with the old Arc Light & Power company and the Chicago Electric club, and as the present general superintendent of the great central station company of the city, the Chicago Edison company. His friends rejoice over the new distinction which is his.

Charles H. Wilmerding was born in the city of New York on August 19, 1858, and he comes from a long line of New York and New England ancestors, although the original bearer of the name in this country was of German birth. Mr. Wilmerding was educated partly at home and partly abroad, and attended Yale University. He was trained as an engineer, and since 1888, the date of his coming to Chicago, he has devoted himself to electrical pursuits. At first interested in the storage battery business, he soon became connected with the Chicago Arc Light & Power company, and in time was made superintendent. On the consolidation of this company with the Chicago Edison company Mr. Wilmerding was made general superintendent of the latter, which important position he now holds. He was a prominent figure in the old Chicago Electric club, in which he held several responsible positions. Mr. Wilmerding is also president of the state association of electric lighting companies, organized several years ago, to look after the interests of central station companies.

Mr. Wilmerding's intercourse with his fellowmen is marked by a certain dignity and reserve, and he is not a man to encourage undue familiarity on the part of casual acquaintances. He is, however, thoroughly grounded in the business of generating and selling electric light and power, and he has the faculty of accomplishing much without the least apparent exertion or the slightest evidence of perturbation.

Mr. Wilmerding was married in 1889 to Miss Lily Valeria Fay, and he has two children. Both Mr. and Mrs. Wilmerding are fond of society, and Mr. Wilmerding is a member of several of the leading clubs.

## Illustrated Exhibits.

The pictures scattered through the pages of the WESTERN ELECTRICIAN for this week tell their own story. They show that the exhibits of electrical apparatus at the Cleveland convention were varied and complete and representative of the industry. The greater portion of the apparatus was shown in the basement of the hotel, but many attractive exhibits were arranged on the parlor floor, while the Westinghouse company made use of a store on the ground floor of the hotel building, and the General Electric company displayed its monocyclic system in operation in the station of the Cleveland Illuminating company on Canal street. As a whole, the exhibition possessed much intrinsic interest, and it attracted the attention of many of the residents of Cleveland as well as of the electrical men. A number of attractive souvenirs were distributed. A very large proportion of the exhibits is illustrated in the accompanying pictures—larger, it is believed, than in the case of any previous convention report in an electrical journal. The different views are clearly marked, and brief reference is made to each exhibit in the department headed "Convention Notes and Personals."

## The Chicago Delegation.

Seldom has a larger delegation of electrical men left Chicago to give vim and energy to a convention than the one that was carried in three special cars over the Lake Shore railroad to Cleveland on the night of February 18th. The ride was a short and pleasant one, the hours of departure and arrival were convenient, and the party proved to be a sociable gathering of travelers—congenial but not boisterous. In all there were 52 persons in the party, almost all from Chicago, including two ladies. E. L. Powers, who was in charge of the traveling arrangements, was untiring in his efforts to secure the comfort of all. The roster of the party is as follows:

Chicago—B. E. Sunny, General Electric company; C. H. Wilmerding, Chicago Edison company; M. A. Sullivan, Charles A. Schieren & Co.; W. H. McKinlock, Metropolitan Electric company; C. E. Gregory, Charles E. Gregory company; J. B. Wallace, Wallace Electric company; Wm. S. Hine, Wallace Electric company; S. F. B. Morse, S. F. B. Morse & Co.; George S. Searing, Hart & Hegeman Manufacturing company; F. S. Terry, Sunbeam Lamp Manufacturing company; Charles G. Burton, Central Electric company; J. C. Shainwald, Standard Paint company; R. J. Randolph, Excelsior Electric company; M. B. Austin, Safety Wire & Cable company; E. H. Fox, Phœnix Glass company; Carl K. MacFadden, Nutting Electric company; George Cutter; H. H. Cutler, Cutler-Hammer Manufacturing company; A. B. Conover, Jr., J. A. Roebling's Sons' company; Prof. W. M. Stine, Armour Institute; W. F. Collins, F. L. Perry, W. E. Keily, WESTERN ELECTRICIAN; M. J. Sullivan, *Electrical World;* Mrs. M. J. Sullivan; H. M. Angle, Chicago Cross-Arm company; Carl Kammeyer, *Electrical Engineer;* E. L. Powers, *Electrical Industries;* E. Nashold, Nashold Cleat company; Charles F. Foster; Thomas G. Grier, Bryant Electric company; M. M. Wood; F. E. Donohoe, American Electrical Works; Charles S. Marshall, Chicago Cross-Arm company; J. W. Wolff, New York Insulated Wire company; W. A. Remington, *Electrical Industries;* G. A. Hurd, Crane company; J. H. McGill, Peru Electric Manufacturing company; Hugo Benedix; W. B. McDonald, Calumet Gas company; H. F. Tate, National Conduit Manufacturing company; Charles E. Wilson, Ft. Wayne Electric corporation; Albert Hoppin, Edward P. Allis company.

Detroit—W. H. Fitzgerald, Detroit Electric Light & Power company; George E. Fisher, Commercial Electric company; J. F. Cummings, Cummings-Engelman Conduit company; W. H. Yawkey, Cummings-Engelman Conduit company; J. E. Lockwood, Michigan Electric company; J. H. Livesey, General Electric company; A. Chase.

Rockford, Ill.—M. A. Beal, Forest City Electric Light & Power company.

Peoria, Ill.—A. M. Searles, Diamond Electric company.

Des Moines, Ia.—J. A. Colby, Des Moines Edison Light company; Mrs. J. A. Colby.

Milwaukee, Wis.—S. G. Coleman, Badger Illuminating company.

Cedar Rapids, Ia.—Mr. Green.

Hoopeston, Ill.—William M. Case.

The Detroit visitors met the Chicago train at Toledo.

The Chicago men made a merry party returning on Thursday night. Many obtained berths in the regular cars, and Mr. Powers secured an additional special car for the benefit of the others. During the trip an impromptu meeting was held, and W. S. Hine, acting as the spokesman of the party, conveyed the sincere thanks of all to Mr. Powers for his thoughtful attentions. He also confounded Mr. Powers by announcing that the gentlemen of the party could not allow the occasion to pass without expressing their gratitude in more tangible form, and that the Chicago master of transportation must be prepared to accept a testimonial on some future occasion. Mr. Powers was entirely surprised, but expressed his thanks briefly.

C. H. WILMERDING.

## Social Features.

There was no banquet at the Cleveland convention, but in its stead a reception was given to the members of the association by the ladies of the reception committee on Wednesday evening at the art exhibit in the Garfield building in the rear of the hotel. This was the most ambitious social feature of the meeting, and was a pleasant gathering of the ladies and gentlemen of the association and their Cleveland hosts. The visitors inspected a fine collection of pictures and listened to good music.

The ladies of the reception committee tendered a delightful luncheon to the visiting ladies on Wednesday afternoon at 2 o'clock at The Stillman. The tables were arranged in the form of a hollow square and were decorated with La France roses, lilies of the valley and maidenhair fern. Mrs. Francisco, wife of the president of the association, in a few appropriate words thanked the ladies of the reception committee in behalf of the visiting ladies. Mrs. S. H. Short of the reception committee responded in a fitting manner. The Schubert club furnished the music. Plate cards in water colors were presented to each one present.

The ladies of the association sent a large basket of flowers to the convention hall on Wednesday afternoon.

The association tendered a formal vote of thanks to the ladies of Cleveland for their courteous attentions.

## St. Louis Electric Circuit.

The Electric Circuit of St. Louis held its second annual banquet at the New Union station, Saturday evening, February 16th. Toasts were responded to as follows: "The Electric Circuit of St. Louis," by W. S. Merkle; "A Social Talk," by J. B. Chopin; "Progress of the Telegraph," by Robert S. Ingle; "A Model Electric City," by Gus. Sachs. Among those present were: Prof. G. W. Krall, D. B. Grandy, H. D. Cunningham, Tyler Sturgeon, W. H. Palmer, T. S. Clark, L. Long, J. H. Fenton, E. Kicker, O. Uthoff, W. S. Merkle, W. Meissner, Robert S. Ingle, J. Mitchell, T. J. Irwin, E. Wurdach, T. Maloney, J. J. Dillon, W. C. Olive, Gus. Sachs, A. Boechenstein, George Bahret, Charles Young, H. H. Beardslee, J. B. Chopin, A. R. Pike, F. Breiner, Charles Wolff, C. F. Bartlett, F. D. Beardslee.

The election of officers for the ensuing term was held February 14th, with the following results:

H. D. Cunningham, president; Tyler Sturgeon, vice-president; T. S. Clark, treasurer; T. W. McClelland, secretary, and Charles Wolff, sergeant-at-arms.

# THE CONVENTION

## Of the National Electric Light Association at Cleveland.

With large attendance, valuable and intelligently discussed papers, pleasing social features and the usual throng of enterprising supply men, the eighteenth convention of the National Electric Light association at Cleveland last week has taken rank with the best of its notable predecessors. The Hollenden, which provided hotel accommodations for the electrical men, was severely taxed by reason of the fact that a largely attended convention of another organization was in session at the same time, but it afforded excellent opportunity for displaying exhibits—a fact of which the salesmen took full advantage. The sessions of the association were held in Army and Navy hall and were unusually well attended, the social features not being allowed to predominate. The hall was attractively decorated with flags and streamers, and the Cleveland electrical men exerted themselves to make the stay of their visitors a pleasant one.

President Francisco called the association to order at 11 o'clock on the morning of Tuesday, February 19th. He introduced the Hon. Robert Blee, mayor of Cleveland, who addressed the delegates.

### Mayor's Welcome.

I hardly think it would be proper for me at this time, as mayor of the city, to give the delegates full freedom of the city, as I have found from personal observation that they have already taken it. As mayor, however, I greet you, and extend to you a very cordial welcome to this, our beautiful Forest City. We have here a very large manufacturing city and a convention city. We have to-day with us the superintendents of the schools of the United States in convention assembled, and, taking them together with the electrical gentlemen and their ladies who are here present, we may have our hands full, but we will try to entertain you the best we can. The city is yours, and as mayor of the city I extend to you its full freedom; and will turn you over to my friends Brush, Andrews, Wason and others of the local electrical gentlemen here, who, I have no doubt, will treat you very kindly during your sojourn in our city. If they fail in their attempt, if you will then call on the mayor, I will try my hand at it.

I trust that your deliberations may be harmonious, and that you may figure out a plan whereby you can light the entire business portion of our beautiful city with electricity at reasonable rates.

I am informed that the next governor of Ohio, who is an able after-breakfast speaker, is to follow me, and I now resign in his favor, after extending to you again a most hearty welcome and the entire freedom of our city during your stay here.

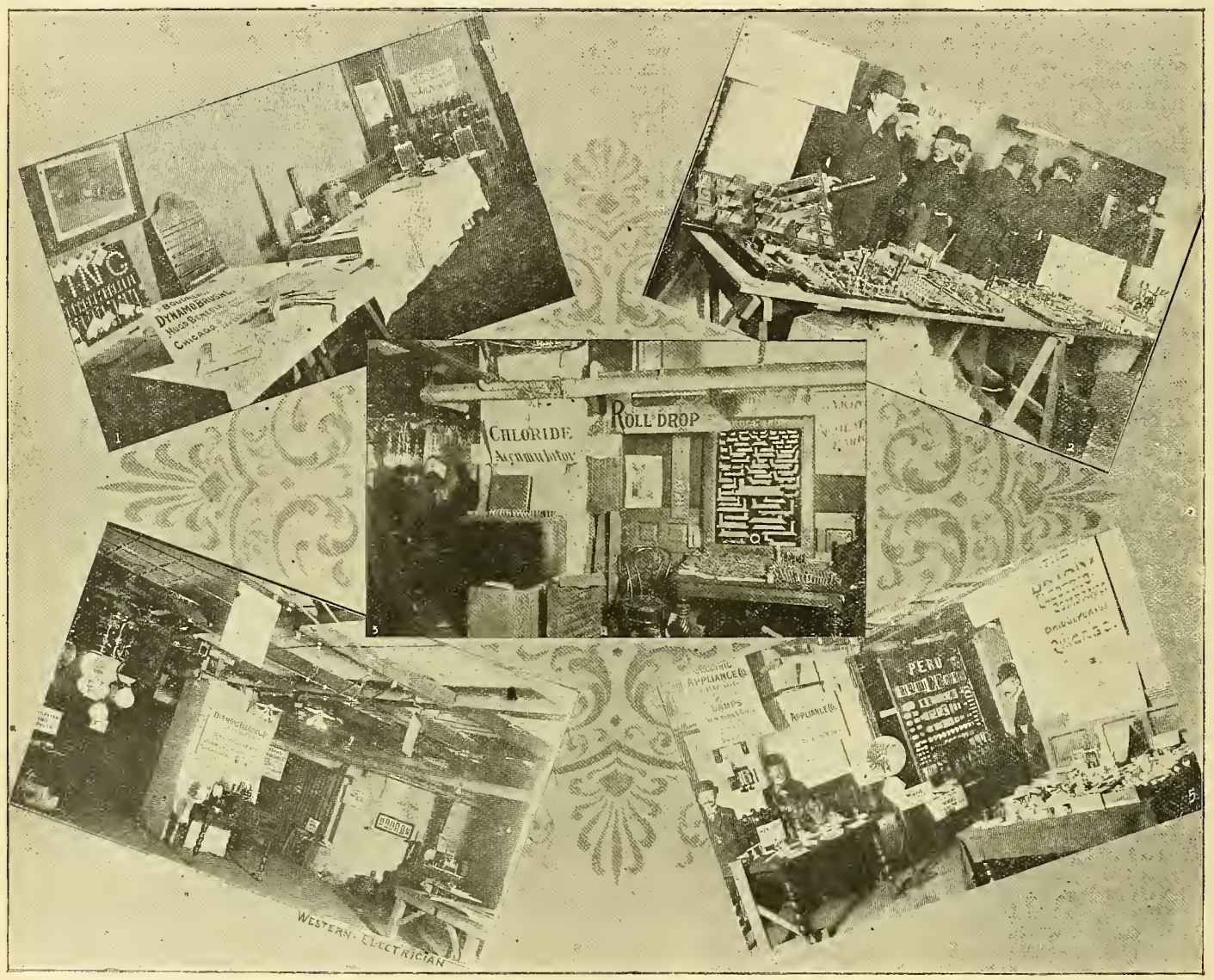
The president then introduced James M. Hoyt, a prominent attorney of Northern Ohio, who greatly entertained the delegates.

### Mr. Hoyt's Speech.

The Honorable Mayor Blee is right in saying I am an after-breakfast speaker, for I never remember to have made a speech before breakfast in my lifetime. I understand that the reason that this association has been a little slow in gathering this morning is because there has been heretofore some doubt in the minds of some of you as to whether or not electricity is a fluid, and that you have tarried in the barroom of the Hollenden, I understand, experimenting. It is with great pleasure that I arise to add what emphasis I may to the hearty welcome extended to you by His Honor.

It is time for this association to meet here in Cleveland, for while Franklin of Philadelphia first harnessed the lightning, and Morse of New York made a winged messenger of it, and Bell of Washington endowed it with the power of speech so clear and penetrating that not distance, but only the telephone girl, could render it inaudible, and while Edison of Menlo Park made a mock echo of it, it was Brush of Cleveland who has made illumination of it, the beams of which are even now penetrating into the remotest corners of the earth; and while I talk the electric light is piercing the fog of London, shining on the boulevards of Paris and Vienna, glistening on the icy surface of the Neva and rending apart the mantle of darkness and throwing a kindly light over the horrors of the battlefields in distant Asia. It was at the commencement of the electrical world, as it were, that a citizen of Cleveland said, "Let there be light;" and there was light.

A little while ago I visited a distant city with a party of gentlemen. We found it necessary to go from one side of the city to the other, and we took a street car to transport us. There were three cars in the train, and as we were nearing the end of our journey we went up quite a steep hill. One of the gentlemen with us, who had been looking around him with interest, said: "Gentlemen, the future of electricity no man can foretell or fathom. It is perfectly marvelous what electricity has done. Think of it drawing three loaded cars up this hill! I do not know how much we all weigh, but think of the enormous weight, and we are carried directly up a hill." There was a pause, when the critic of our party said: "Look out of the window; this is a cable road." Although my friend used an unfortunate illustration, the fact remains—what the future of electrical development is to be no man tell. The possibilities are simply incomprehensible. Certainly fifty years ago, if anyone had foretold the telephone, the phonograph or electric light, I feel sure that the scientists of that time would have said to him, "That is simply impossible; it runs counter to the fundamental laws of nature." The idea of talking easily, without trouble, between Cleveland and New York; the idea of having a dead friend's voice reproduced; the idea of having this subtle and inexplicable substance, or fluid, or movement in the ether, or whatever you may decide to define it, light a large city, seemed ridiculous; and yet at the same time only a few years have rolled away nd all of these results have been accomplished. In doing this, no law of Nature has been broken; it has been simply the result of a knowledge on the part of the men who have made these applications of the forces of Nature; of the laws of Nature of which they were ignorant before. As I stand here and consider all the development that has already been made in electrical science, I must say there is a solemnity about it; and it ill becomes a scientist of this age, with the record of these tremendous achievements before him, to




1. John A. Roebling's Sons company. Boudreaux Dynamo Brush company. E. P. Roberts. Paragon Insulating company.

2. Brooklyn Electric Manufacturing company. Huebel & Manger.

3. Chloride Accumulator (Electric Storage Battery company). Forest City Electric Works. Akron Insulator & Marble company.

4. Manhattan General Construction company. Diamond Electric company. Crane company.

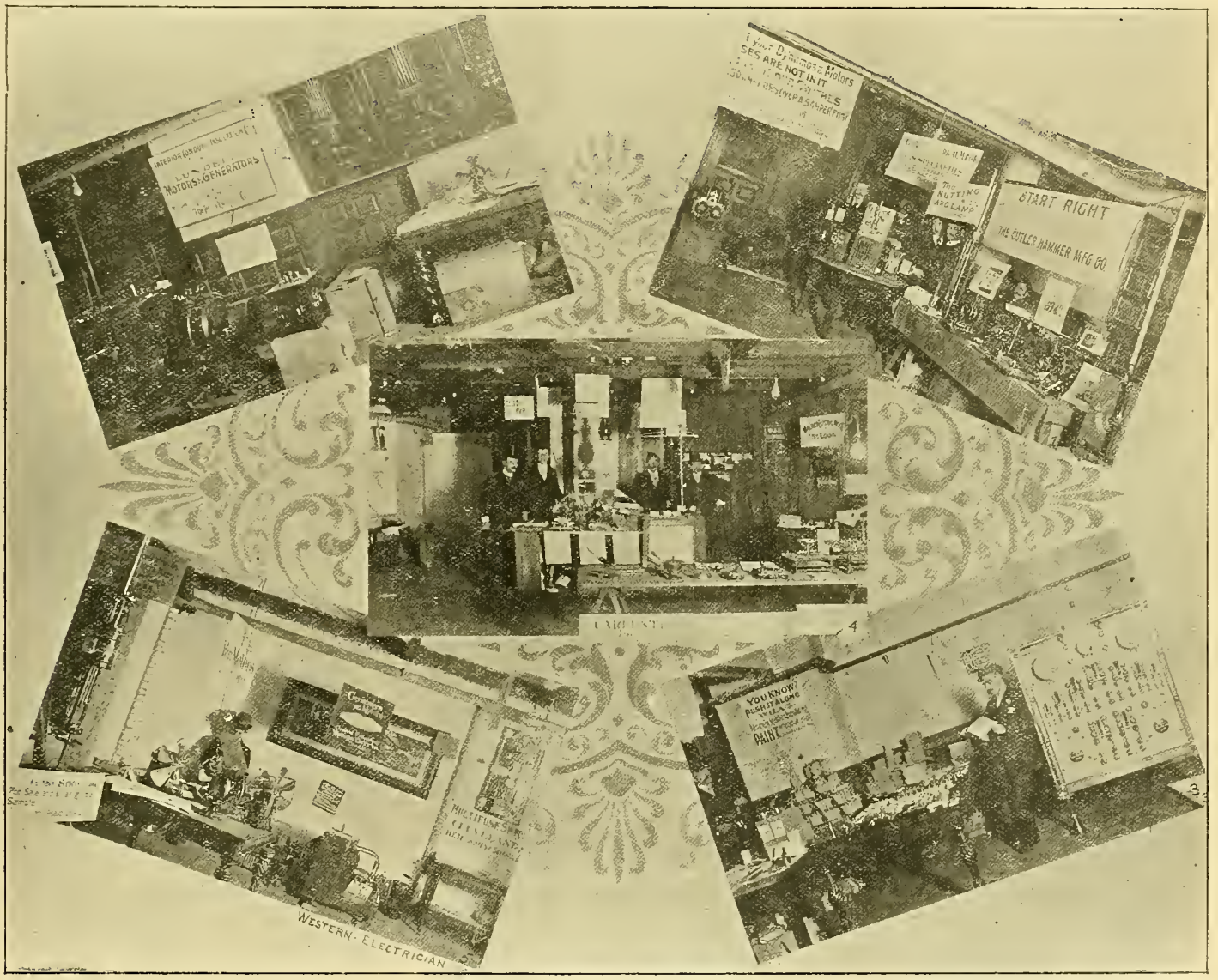
5. Electric Appliance company. New York & Ohio company. Packard Electric company. Wood's Cleat. Peru Electric Manufacturing company. Bryant Electric company. R. Thomas & Sons company.

CONVENTION EXHIBITS.

throw any doubt upon any mystery, whether it be physical, religious or spiritual.

I want to say again, as one of the representatives of the city of Cleveland, that we welcome you warmly and with open arms. We are delighted to have the city selected as a place of gathering for the representative men of this country, and there is no class more representative than the members of the National Electric Light association. We are beginning to become a convention city. Cleveland is becoming the place where men who meet together for the purpose of exchanging ideas find a congenial locality for assembling, and we trust that you will find Cleveland congenial. We welcome this association with heartiness, and we hope you will come again. We certainly extend to you the warmest hospitality of which the descendants of the pioneers of the Western Reserve are capable. We thank you for your attendance, and I thank you for your attention.

The president then introduced Charles F. Brush of Cleveland, who was greeted with great applause.




2. Interior Conduit & Insulation company.

5. Holtzer-Cabot Electric company. Walker Manufacturing company. Michigan Electric company. Multiphase Switch company.

4. Carpenter Enamel Rheostat company. Wagner Electric Manufacturing company. Helios arc lamp (Central Electric company). Solar Arc Lamp company. McCreary electric specialties.

1. Sweet Electric & Manufacturing company. Cutter Electrical & Manufacturing company. Nutting arc lamp. Cutler-Hammer Manufacturing company.

3. Morris & MacCurdy (Phœnix paint). Vulcan torch exhibit. Electric Engineering & Supply company of Syracuse, N. Y.

CONVENTION EXHIBITS.

## Address of Charles F. Brush.

A few days ago I was asked to make some remarks on this occasion concerning the early history of electric lighting, strictly from my own standpoint. Now, as most of you are aware, I retired from the electrical business several years ago to give my competitors a chance on the field. I therefore objected that this ancient history was forgotten and buried, and I pleaded that I could not spare time to take it up again and polish up the bones, and arrange them in sequence and articulate them, and make the whole thing presentable. However, I really cannot afford to let you go, now that you are here, and I will say a few words.

I will begin by calling your attention to the fact that dynamo-electric machines for electro-plating antedated by a considerable period the use of such machines for lighting purposes. This is interesting from a historical standpoint, because when I invented compound field winding for constant potential, now so generally used in lighting and power transmission, I applied it first to plating machines. That, I believe, is not generally known, and may therefore be interesting. Some of you will remember that all of the early Brush arc lighting machines were single lighters. Two of these machines were exhibited in the summer of 1877 at the Franklin Institute in Philadelphia. My two friends at the left (Messrs. Houston and Kennelly) will remember all about it. It was soon after that when we sold a single lighting machine to Dr. Longworth of Cincinnati. This was one of the very first, if not the first, sale of a Brush arc lighting machine. It was late in 1877, or the very beginning of 1878; and the doctor paid for it—paid cash for it, like a little man. I hear these things are done differently now. At any rate, I went down to Cincinnati to show the doctor how to run that machine, and one evening while I was there he exhibited the light from the balcony of the building in which he lived, on one of the principal streets. It was a 4,000 candle light, and of course it attracted a large crowd of the natives, and every man in that crowd was ready and willing and anxious to tell his neighbors all about it. I mingled in the crowd for a time to hear the comments. I found one man who had collected quite an audience about him. He called attention to the solenoid at the top of the lamp. He said, "That is the can that holds the oil;" and speaking of the side rod of the lamp, "That is the tube which conducts the oil from the can to the burner." He did not say anything about electricity at all—a little oversight that was not noticed by his hearers, and it was all right.

These early single light machines were quickly followed by two and four-light machines; that is to say, machines adapted to furnish two or four separate, distinct currents, each adapted to run a single arc light. Several of these machines were sold during the season of 1878, for lighting stores and shops. Among others, Mr. Wanamaker of Philadelphia bought a number to light his store. One of the earliest of these four-light machines was exhibited at the works of the Union Steel Screw company in this city to a number of invited guests. One gentleman on that occasion looked the whole apparatus over very carefully, perhaps a half hour, sized it up, and then, pointing to the line wire, he said to me, "How large is the hole in that wire that the electricity flows through?" Another gentlemen connected with the screw company observed the machine running for perhaps five minutes in complete silence. Then he had fully digested the whole thing and was ready to tell me all about it. He said: "The electricity in that thing is generated by that revolving business, there, rubbing the air up against these iron blades (meaning the magnets), just as you get sparks when you rub a cat's back." I raised the objection that while that was a good theory, it did not fully meet the facts, but he would not hear anything from me. He said: "The whole thing is plain. If you should run that machine in a vacuum where there is no air, you could not get any electricity." His ignorance was so blissful that I thought it would be folly to enlighten him, and did not try to do it.

The year of which I am speaking—1878—was memorable in the history of electrical lighting. It was during that year that I had the great pleasure and good fortune to invent and develop and commercially introduce the modern series arc lamp, with the shunt coil. It was this invention—I am sure you will all agree with me—which first made arc lighting from central stations commercially possible, and I think it may justly be considered as marking the birth of the electric lighting industry of the world to-day.

One of the first instances—I think quite the first instance—of the use of arc lighting for purely commercial purposes, was in our little public square in this city. Twelve lights were carefully installed in the park on high, ornamental poles. The lamps used were of the ordinary so-called 2,000 candle power. In this connection, it will be remembered that a professor in New York once said he imagined the electrical companies arrived at the 2,000 candle power by measuring it north, south, east and west, giving 500 each way, and added them all together. That measurement was taken in the interest of the gas company, as I have learned. While we were installing this plant in the public square a great deal of interest was manifested in the installation by the public, and, on the occasion of starting the lights, our little park was packed from side to side, and it was evident that many of the people expected a blinding glare of light, as evidenced by the fact that many of them had provided themselves with colored spectacles or smoked glass. Of course there was a general feeling of disappointment at first in

this respect, although everyone was ready to admit that he could read with perfect ease in any part of the square. After a few weeks, when the novelty had worn off, and the people had got tired of staring at the arc and had time to see how nicely the little park was lighted, the general verdict was that those electric lights in the park were a pretty good thing after all; and that is the general verdict everywhere.

Of course, we had lots of trouble in the early days with carbons. The history of the carbon business is peculiar. Our first carbons were crooked, of course, and were soft, and had high electrical resistance, and burnt out rapidly, and were very expensive. To decrease the electrical resistance and prolong the life of the carbons, we electroplated them with copper, which is still done. This little scheme of covering the carbons with just enough, and not too much copper, was the only easy invention that it was my good fortune to make, and it paid fairly well, considering the effort involved, which was mighty small. It yielded, if I remember, something like $150,000 in cash on royalties before the bottom fell out of the carbon business. They were sold at the rate of $240 a thousand. I say at the rate of $240 a thousand, because nobody ever thought of ordering a thousand carbons at once. They could not use them up in a generation. Fifty or a hundred was considered a fair order. As the business increased a little, we were able to reduce the price of the carbons, and we did reduce it one step to $150 a thousand. It was at a loss for a time, but, then, we held our own, and afterward made a little money. We subsequently reduced them from $150 to $62.50, on the theory that cheaper carbons would stimulate the growth of the electric light industry, and our theory was proven correct. Their use was stimulated and the business increased enormously, so that while we lost money on the carbons for a good while, at that price, later we made a handsome profit at that price. Others seemed to grasp the situation about that time, and competition sprung up, and it knocked the profits of the carbon business all to pieces. I presume now you can get your carbons for next to nothing a thousand, with "a beautiful chromo in each box;" and I have no doubt if you insisted, you could get a nice gold frame for each of the chromos. This is a pointer for you.

As to electrical lighting at the present day, most of you know more about it than I do, for I have been accumulating rust for several years, and I will not attempt to tell you anything about it, but will simply thank you for your attention.

President Francisco then delivered the annual address.

### President Francisco's Address.

By the ceaseless revolutions of the wheel of time we have arrived at another epoch in our association, and meet to-day to celebrate our tenth anniversary and place a record upon the tenth page of our history.

Mr. Brush, being the inventor of the double arc lamp now in use, and the Brush Electric company of Cleveland the first manufacturer of the same, it seems eminently proper that the National Electric Light association should celebrate the present anniversary at the home of one of the pioneers in the field of electricity. We know that the people of the Forest City were noted for their culture, conservatism, industry and wealth, and the large number gathered here today afford sufficient proof of the wisdom of holding the eighteenth convention in this city.

Ten years ago a few men gathered in Chicago for the organization of a National Electric Light association. How momentous the evolutions of science and what gigantic strides have been made in electric lighting during the short cycle of time that has since elapsed!

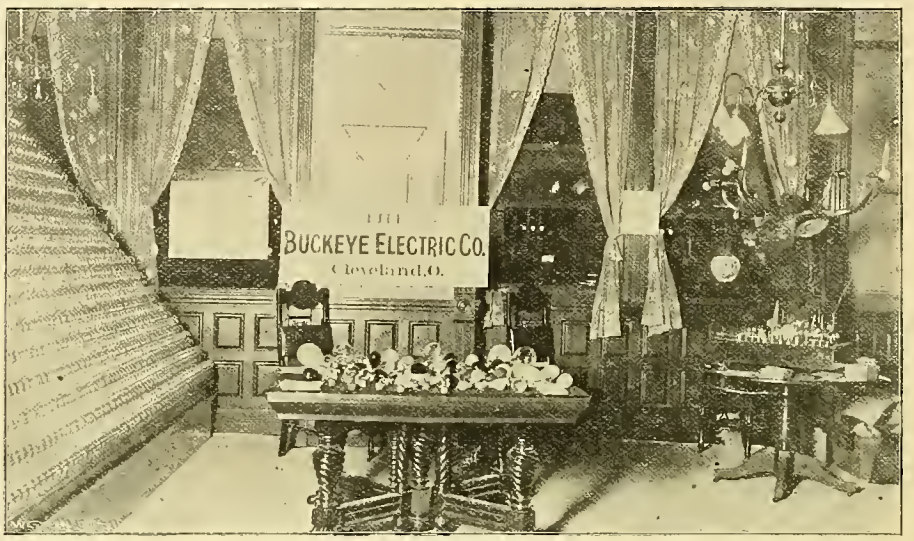
At the beginning of the present decade the association was represented by a few courageous men who believed in future enlargement and success, and the results far exceed the wildest dreams of any one of that group. To-day we are an association whose members are numbered by hundreds; who represent the entire continent, from the Atlantic to the Golden Gate, and from the Gulf of Mexico to the queen's dominions on the north. We have even invaded those dominions and appropriated one of her most loyal and enterprising subjects to serve as our second vice-president, beside reaching across three thousand miles of ocean and securing the most talented of England's scientists. In addition to this we have gained two faithful allies, the ladies and the press, the two powers that control the world. Such is our record of membership.

The financial progress is a marvel, even in this nineteenth century. The first arc lamps used required a separate circuit and a dynamo for each. After a while dynamos were constructed to run two lamps, and when the time came that they could run four lamps from a single dynamo it was considered a wonderful achievement. At the present time many stations are using as many as 120 arc lights on a single dynamo. With a nucleus of about 100 central stations in existence ten years ago, we have to-day 2,500 such stations, representing assets of over $300,000,000, not including 7,500 isolated plants valued at $200,000,000 more. Ten years ago the total number of arc lamps could be counted in a moment's time; now they are like Father Abraham's army, "five hundred thousand strong."

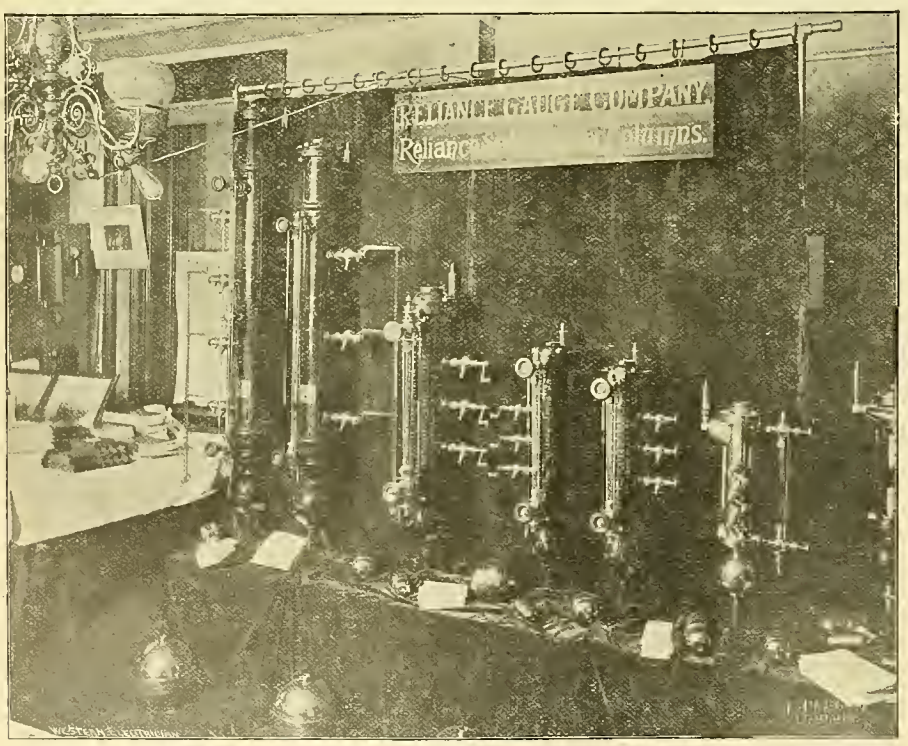
The first central station for incandescent lighting was established in the fall of 1882. The building was frame, one story, 15 by 18 feet, with a capacity of about 250 lights. Volt and ammeters were not in use, and the lamps were regulated by their appearance and the judgment of the station engineer. In case of trouble with the lights, the station was shut down and all hands turned out to hunt and repair damages. While this was going on customers mused in the dark over the wonderful mysteries of electricity. That blessed time, with its indulgent customers, has passed into oblivion, and now the electric light manager has reason to think many times when accidents occur that Hades has been removed to his special locality, and very near his station. To-day we have single stations furnishing 150,000 lamps, and it would be almost as difficult to count the incandescent lights in use as to number the stars in the sky.

In 1884 an experimental street railway was started in this city, using one car. To-day there are nearly 1,000 electric railways in operation, with 10,000 miles of track, and assets amounting to $600,000,000.

Thus it will be seen that electrical industries have caused an investment of over $1,000,000,000, not including the millions invested in telegraph, telephone, mining, etc. If the employes of these industries could be called together, they would dwarf the largest armies of the world.




Buckeye Electric company.
CONVENTION EXHIBITS.




Reliance Gauge company.
CONVENTION EXHIBITS.

When this association was organized not an educational institution of high grade had a course of study in electrical engineering, giving practical knowledge of electricity. To-day there are over fifty such institutions preparing the best young men of the nation to do scientific and practical work. American genius has proved of incalculable value to mankind and leads the world in electrical achievements. The members of this association should see to it that those who have developed this science occupy their rightful places of honor, and receive acknowledgment for the wealth that their inventions have created. The benefits of their services are for all time, for future generations will continue the course we have begun, while human energy and force will go on forever.

A recent craze has been developed for municipal ownership, and some aldermen of various municipalities have heard a rumor that there is one instance where something was created from nothing. Therefore they believe that electric lights can and ought to be produced in the same way, especially if there is a prospect that the benefits to be derived from this style of production are to revert to themselves. This subject should have the careful consideration of the members of this convention.

Your committee on data has worked energetically, and I think its report will prove of great practical value to all our members. The papers to be read and topics for discussion embody the live issues of the day, and I trust will be carefully and thoroughly discussed, as in this way the practical knowledge and experience of men who have devoted their lives to the business are furnished to every member of the association, and in many cases may enable them to avoid the shoals and quicksands that have wrecked many electrical enterprises.

The membership and financial condition of the association never were in as flourishing a condition as at the present time, and your secretary deserves credit for his able and energetic work.

There is another subject that should receive immediate attention; that is, so amending the constitution as to arrange the time of the annual meeting at a more convenient, as well as a more seasonable, time of the year. Other rules relating to various plans of doing business should be changed to apply to our present style of work.

Among the subjects that have had the attention of the National Electric Light association since it was organized, none has called for more investigation and discussion than underground wires. I trust we shall have an able analysis of the subject at this convention, as it is a question of vast importance to many companies, and one upon which no company can afford the chance of a failure caused by improper construction or useless experiments.

The relations between central station companies and manufacturers have been discussed by this association at every convention. The time has arrived when the plan adopted by manufacturers for destroying the business of the local company, by establishing competing plants in places where there is only business sufficient for one, must be abandoned. This has been done with the intention of compelling the local company to either buy them off, or see their own business ruined. The infamous scheme of forcing a sale of apparatus for a city plant by representing to city officials that the price charged by local companies is far in excess of the cost if the city owned its own plant, needs the searchlight of electricity thrown upon it by this association. This is a question of vital importance to every central station in the United States, for sooner or later its own business will be attacked, and it may be through the influence of the very manufacturer whose apparatus they are using.

During the past ten years many who have met with us and taken an active part in the development of electricity have crossed the river that leads to the far-off shores of eternity,

there to await the coming of their fellow workers. They have won release from their labors, while to us remain—

Pain of pleasures not yet won,
Pain of toiling not yet done.

TUESDAY—AFTERNOON SESSION.

Nelson W. Perry read his paper on "The Storage of Energy Essential to Economy of Working in Central Stations." This evoked a lively discussion of the storage battery question.

The paper on "A New Method of Measuring Illumination," by E. J. Houston and A. E. Kennelly, was read by Prof. Houston. It was discussed by Messrs. Haskins, Ayer and the authors.

A letter of invitation from the Cleveland Electric Railway company was read, extending to the delegates the courtesies of the company in the way of free transportation during their stay in the city.

The Cleveland Telephone company tendered to the delegates the free use of its local and long-distance lines to New York, Chicago and other cities.

Letters and telegrams expressing regret at the inability of the writers to be present were read from the following named gentlemen: Howard W. Sexton, Charles W. Price, Silvanus P. Thompson, Marsden J. Perry, Nikola Tesla, William McKinley, George W. Westinghouse, Jr., and C. A. Coffin.

WEDNESDAY—MORNING SESSION.

The first business transacted was the reading of the report of the finance committee. The report showed that the receipts during the fiscal year had been $5,998.69, and the expenses $5,449.95, leaving a balance of $548.74. Mr. Seely, chairman of the committee, reported that there were no liabilities against the association.

Quite a commotion was created by the effort made by John I. Beggs of the Cincinnati Edison company to secure a reduction in the membership fee from $25 to $10. Mr. Beggs thought the expenses of the association might be reduced by cutting down the secretary's salary. This argument was vigorously combatted by several members, who pointed out the value and importance of the secretary's duties. Surprise was also expressed at Mr. Beggs' sudden interest in the affairs of the society, as, it was alleged, he had been dropped for non-payment of dues and only recently reinstated. Mr. Beggs' opponents also raised the point that he was devoted to the Edison interests, which had been inimical to the association until it was discovered that opposition to it was futile. Mr. Beggs replied that he had only the best interests of the association at heart and the discussion became animated. Consideration of the whole matter was finally deferred until the executive session.

W. E. Harrington's paper on "The Correct Method of Protecting Electric Circuits" was read. As there was no discussion on this paper, the paper by C. N. Black on "Large Arc Dynamos" was then given. Mr. Black's paper was discussed by S. M. Hamill, Prof. Elihu Thomson, Calvert Townley, I. R. Prentiss and T. Carpenter Smith.

A communication from the ladies of Cleveland extending an invitation to the visitors and their ladies to attend the exhibition of paintings in the Garfield building was read, and the invitation was duly accepted with thanks. Resolutions endorsing the Southern States Cotton Exposition and urging a representative electrical exhibit were passed.

WEDNESDAY—AFTERNOON SESSION.

The topic, "How to Light Large Cities," was first taken up. It was discussed briefly by C. H. Wilmerding of Chicago and George A. Redman of Rochester, as follows:

MR. WILMERDING: The cost of lighting in Chicago, according to Professor Barrett's figures of a year ago, if I remember rightly, was $96.25 per lamp. This figure, it was stated, included nothing of interest, depreciation, insurance, taxes, etc., or what in a lighting company would be called general expenses. In other words it might be said to include simply labor and material. The cost per lamp installed was something in excess of $500, which, at six per cent. interest on the original investment, would amount to $30 per lamp, and a fair depreciation might be six per cent., which would add another $30 or a total of $60 to the cost—in other words, about $156 per lamp per annum. We are furnishing a few lamps to the city at $137.50 per annum, so that as a matter of fact we are supplying lights at a lower cost to the city than they can make it themselves. On that basis it seems reasonable to suppose that large cities should be lighted by private corporations rather than by the city itself. There is no question that in every municipal organization in this country the cost of carrying on what may be considered a commercial or private business is much greater than where it is carried on by a private corporation, where all expenses are carefully considered.

MR. REDMAN: I think the best answer I can give to this question is to give a description of the city lighting by the two companies with which I am connected. The city of Rochester, with a population of 165,000, has 2,010 arc lights on the streets—1,109 of the Brush company and 901 of the Rochester company. In the center of the city we have one street 7,940 feet in length, with no wooden poles and no overhead construction except the trolley wire. That street is lighted with 76 pairs of eight ampere lamps, on the Edison system, which give general satisfaction. They are so popular that the cry is for lighting the entire city on that system.

Dr. Louis Bell then read his paper on "The Monocyclic System." The new system was criticized by John F. Kelly of Pittsfield, Mass., and Charles F. Scott of Pittsburg and approved by Charles P. Steinmetz of Schenectady, N. Y., and Prof. Elihu Thomson of Lynn, Mass.

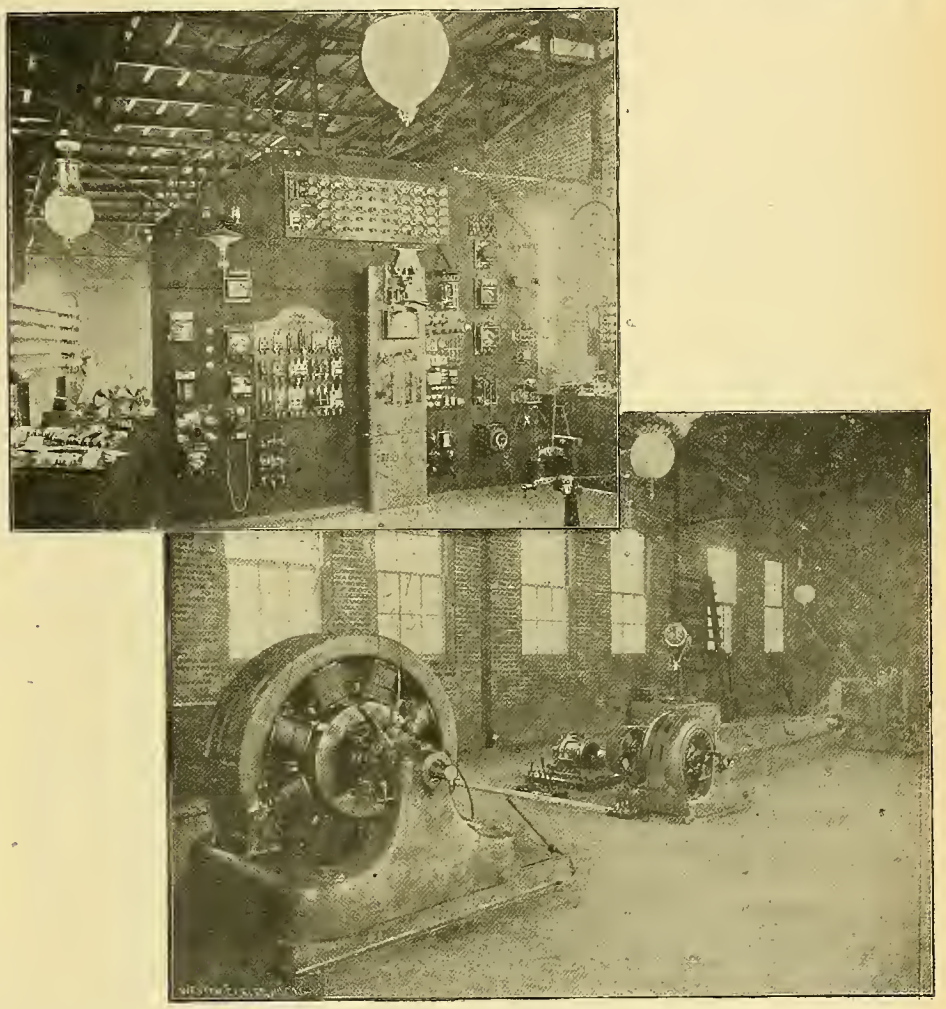
WEDNESDAY—EVENING SESSION.

A. J. Wurts of Pittsburg gave some "Practical Demonstrations of Protecting Lines from Lightning," which were well attended and received with much approval. The operation of the Wurts lightning arrester was clearly shown by practical experiments.

THURSDAY—MORNING SESSION.

The president called the meeting to order at ten o'clock sharp, and stated that the paper of Dr. Bell was open for further discussion. W. R. Gardener of Pittsfield, Mass., made a few remarks on the subject.

President Francisco then called for the report of the committee on data, which was read and discussed at some length.



General Electric company's Multiphase Machinery and Display of Supplies.
CONVENTION EXHIBITS.

Mr. Ayer presented a resolution, which was adopted, to the effect that the committee be directed to send out, as soon as possible after the adjournment of the meeting, blanks upon which records of central stations may be kept, with full instructions how to make the returns. The president called upon those managers of central stations present who would keep these records and make returns, to signify the fact. Some thirty gentlemen indicated their willingness to do so. Mr. Hadley suggested to the committee that one item of information called for would be the evaporation of water. There are many stations not in a position to know how to get at this information. He thought that the committee should collect information on this point. On motion of Mr. Ayer a vote of thanks was tendered to the committee on data.

The meeting then adjourned to executive session. At this session the report of the committee on relations between manufacturing and central station companies was fully considered, and the following named delegates were appointed a special committee in connection therewith: A. J. DeCamp, John I. Beggs, E. A. Armstrong, T. Carpenter Smith, F. Gilbert.

Messrs. Seely, Armstrong and Colburn were appointed a committee to nominate officers for the ensuing year.

Messrs. Ayer, Nicholls and Burleigh were named as the committee on resolutions.

The constitution was amended, providing for the holding of one meeting in each year, in May or June. A motion was carried recommending that the next meeting be held in New York city.

L. B. Marks' paper on "Arc Carbons and the Rating of Arc Lamps" was read by the author and discussed by E. F. Peck of Brooklyn, Prof. B. F. Thomas of Columbus James I. Ayer of New York, E. A. Armstrong of Camden, N. J., and others.

RULES FOR SAFE WIRING.

The report of the committee on rules for safe wiring—W. J. Hammer, J. I. Ayer and H. M. Smith—was then presented, as follows:

At the last meeting of the association the rules were carefully revised, and in the opinion of your committee but slight changes could be desired. Recent work of your committee indicates that in the near future joint meetings will be held with committees of the underwriters, Street Railway association, telephone and other interests, which will be productive of much good, and will enable a very satisfactory report to be made at the next meeting. In view of the above your committee recommends that the present rules be approved and continued.

MR. WOODBURY, Boston: This subject is one of infinite detail, which must necessarily be carried out in the hands of the committees, who can give long and detailed attention to the several matters that are brought up, reaching out into every application of electricity. The rules pertain to every element of application of electrical apparatus, no less indeed to the harmless telephone wires than to the apparatus producing the infinitely greater currents. It is here that the interest of makers of apparatus, operators of plants, the owners of property and the patrons of all electric companies concentrate, and therefore it goes without saying that there is every reason why there should be a unification of rules for a unity of purpose. These interests have naturally different relation to these rules. While in the initial steps in the construction and operation of apparatus the members of this association have the fundamental relation to these rules, yet their subsequent action in regard to their application is not so general.

THURSDAY—AFTERNOON SESSION.

President Francisco said that certain members desired to hear the experience of central station managers with reference to the Welsbach burner.

WELSBACH BURNER DISCUSSION.

MR. GARDENER: In the city of Pittsfield there are at the present time about two hundred and fifty of these burners

in use. I understand that more have been ordered, but the agent has not been able to supply them. A dentist in North Adams was operating upon a patient under the light of a Welsbach burner, when the lamp exploded and embedded pieces of glass in his cranium. I immediately investigated the subject and found that he was no longer using it. We had a customer who was using our lights in his store and workshop; and he substituted the burner in his store but not in the workshop, the reason being that the hammering of his workmen on the benches caused a vibration, which would gradually shake the mantle to pieces.

MR. EDGAR, Boston: We have had as much experience as any other city, but to sum up a long story, I will say that the burner is gradually disappearing. I put one in my house two years ago. At first it saved considerable gas and gave a beautiful light, and the first outfit of mantles lasted over two years. Since that time the mantles have gone to pieces very fast, and my gas bills are larger than they ever were with the old burner; and I do not think we are using any more light. We have just completed a contract with a large store, which is going to take out the Welsbach and put in our lights. We have a letter from a drug store, stating in emphatic terms what the proprietor thinks of the Welsbach. Often when his store door opens the mantle breaks from the draft of cold air. We are naturally prejudiced against the burner and want to see the thing disappear; but leaving that out of consideration, I should say the burner is losing ground in Boston within the last six months.

MR. CAIRNES: In Memphis we became very much alarmed. They displaced probably fifteen hundred to two thousand lights in from thirty to sixty days, and no amount of argument could stop the stem of popular favor in the direction of the Welsbach; and we sat down and mused over the possibilities of an assignment in the near future. That was about a year ago. I presume we have back from fifty to sixty per cent. of the patrons we lost by the burner, and I have assurances that we will get back as much as twenty-five or thirty per cent. more within the next two months. They have lost ground in Memphis as rapidly as they came in favor.

MR. BUBLEIGH: For what reason have they lost favor?

MR. CAIRNES: The fact that the longer they are used the more objectionable the light produced becomes; and in like proportion the greater amount of gas is consumed as the burner begins to be used.

MR. SEELY: I do not think it is a very serious menace to the electric light business where people are at all discriminating as to the character of light they get. In smaller towns people are not as discriminating as they are in larger cities. It seems to me that one of the things the local companies want to do is to maintain better service themselves. One of the reasons that encourage the use of the Welsbach burner is that in some places the service of the electric light companies is irregular.

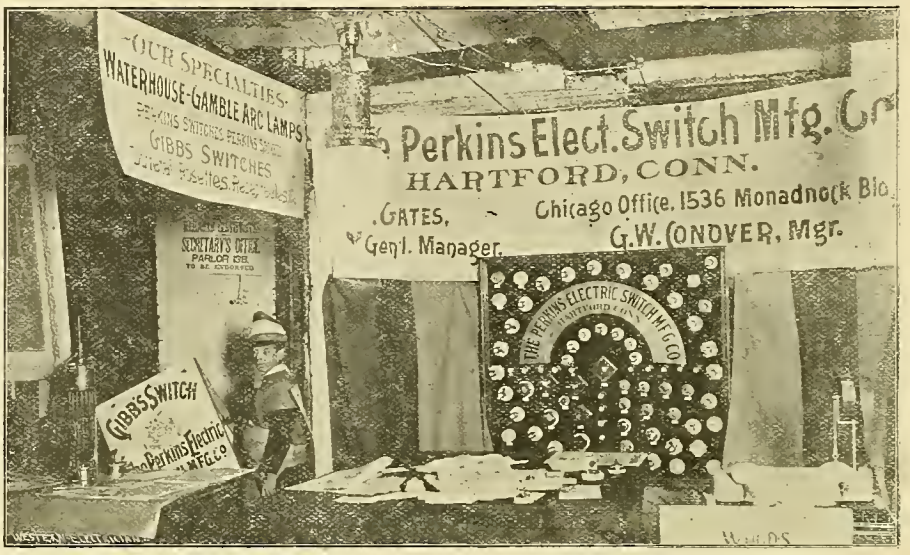
MR. PECK: Our station in Brooklyn is almost entirely given to arc lighting. I noticed some four months ago that about twenty-five large stores used the Welsbach burner. I noticed the same stores a week or two since and discovered that ten out of the twenty-five have gone back either to simple gas or the incandescent light.

MR. ARMSTRONG: This is very encouraging to us. The fact of the matter is that electric light is a luxurious light; and it will compete, perhaps, with gas in larger quantities, but it will not with the small consumer. That is the thing we must face. The practical difficulty is that it does not pay us to supply very small consumers; it does not pay for the installation, the meter and all that. I am pleased to hear from Memphis and Boston as to what has been the history of this thing; but so far as our incandescent business is concerned it has been and is now a very serious problem. We lost during the last quarter seventy-five customers, and we do not see any cessation to it. I hope to report by next year that the number has been diminished in accordance with the statement made from other cities.

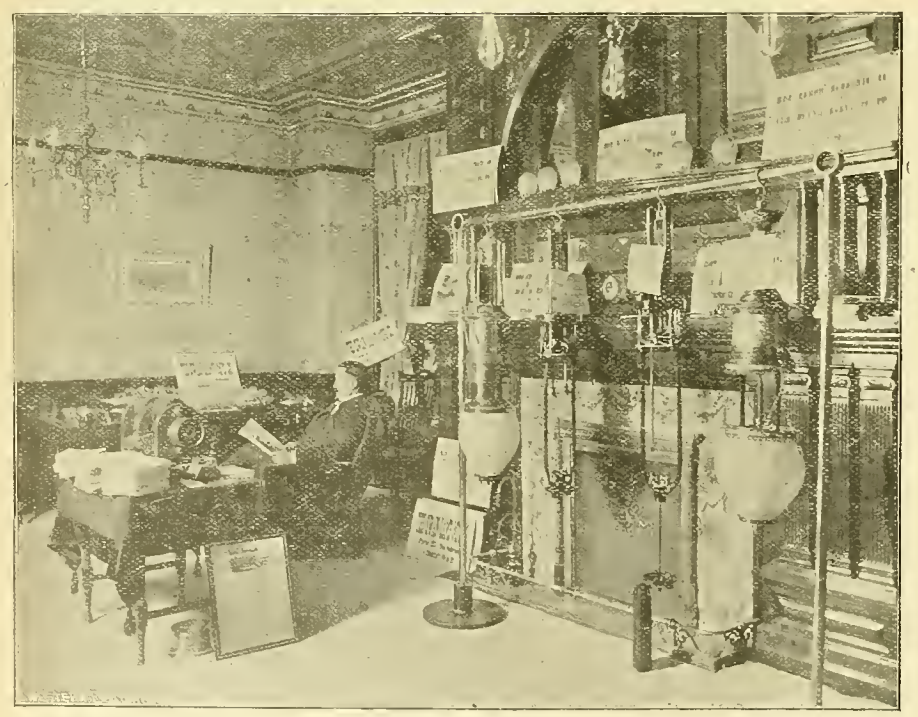
MR. STETSON: I know a town a little north of Boston where I heard the manager say if he could have seen the Welsbach burner before he bought his electric light plant—he manages both wings of the service—he never would have troubled himself about the electric plant, and is only hoping that the municipal authorities would come along and buy his plant. You cannot compete with gas in small towns cities the incandescent lamp can hold its own. I find the greatest annoyance in our community to come from the multiplication of the oil wagons. The Standard Oil company has put up a very large tank holding thousands of barrels of oil, and they run out wagons just as the milk peddler does; and as our cities in the East are largely composed of people working in factories, there is no hope of our trying to get anything out of them with the electric light. If we could only increase our product we could decrease the cost; but there is no hope of this in those communities.

A. J. CORRIVEAU, Montreal: I do not think there ought to be much alarm felt about this Welsbach burner, or what we call in Montreal the oil light. I do not think there is a city in America which is provided with so many of these burners as Montreal at the present time. They have had them about a year and a half, and several thousands of them are in use, but I am pleased to state that to my personal knowledge eight or ten large stores have gone back to the electric light, and the reason is that they are completely displeased with the burner on account of the breakages of the mantle and the bad color of the light; and I believe it will only be a short time before this will be general.

THE PRESIDENT: We had a customer who put in the Welsbach, and after using them a month returned to the electric light. I asked the reason, and he said, "I had about two hundred of those burners and I wanted to sell them; but I do not propose to lose on my own light the profit that I made on those burners."




Perkins Electric Switch Manufacturing company. Jewell Belting company. Cook Boiler (the J. C. McNeil company).
CONVENTION EXHIBITS.



Brush Electric company.
CONVENTION EXHIBITS.

CONCLUDING BUSINESS.

The committee on resolutions offered the following:

*Resolved*, That the thanks of the association are hereby tendered to Mrs. Sidney Short and the ladies of the local committee; to Mr. Wason and the gentlemen of the reception committee; to the Cleveland Telephone company and the Long-distance Telephone company; to the Cleveland under twenty-five thousand inhabitants. In the larger City Railway company, the Cleveland Electric Railway company and the gentlemen of the local press.

*Resolved*, That the many courtesies extended to the visiting members of the convention have been fully appreciated, and the result has been that this Cleveland meeting will be remembered as one of the most pleasant, from a social standpoint, and also one of the most interesting and instructive in the history of the association.

The resolutions were unanimously adopted.

The committee on nominations presented the names of the following gentlemen:

President—C. H. Wilmerding, Chicago.
First vice-president—Frederic Nicholls, Toronto.
Second vice-president—E. F. Peck, Brooklyn, N. Y.
Executive committee—E. H. Davis, Williamsport, Pa. (one year); W. R. Gardner, Pittsfield, Mass.; George A. Redman, Rochester, N. Y., and J. J. Burleigh, Camden, N. J.

The gentlemen were duly balloted for and elected.

The retiring president said: "In resigning my duties as president of the association, which office I have filled during the last year, I wish to tender to the members for the sincere and generous support I have received my heartiest thanks. I have been courteously treated in all the dealings I have had with the members and been assisted in many ways, which has been duly appreciated. I expect as a private to do all that I can for the association; and I think it is unnecessary to say that you will find me first, last and all the time assisting the central station managers in all departments."

Mr. Armstrong moved that the next annual meeting of the association be held in the month of May or June, as selected by the executive committee, in the year 1896. This motion was carried.

On motion the association then adjourned.

## Convention Notes and Personals.

As usual, L. Stieringer was in attendance.

"P. & B." from Pittsburg came in the person of James A. Breen.

Chas. P. Raymond of "Goodrich fame" came, too, and in due season.

Bradley's electric light mast-arm and Thomas H. Bradley were there, too.

You couldn't have been at the convention unless you heard about Page belting.

C. W. Hazeltine kept the Hazeltine long-life carbons before the convention people.

Secretary Geo. F. Porter was heartily commended for his untiring and successful work.

H. A. Whittemore represented the Electric Lighting company of Jamestown, N. Y.

Charles E. Gregory was on hand and so were the pictured faces of his "stockholders."

Lawrence Polland, of Cincinnati expected to be at the convention—was he there? Who saw him?

Aylsworth & Jackson, manufacturers of incandescent lamp filaments, sent F. E. Jackson, who nobly did his duty.

It was exceedingly pleasant to see such old-timers as P. H. Alexander at the convention again. His large and extended acquaintance in the electrical trade made him ex-

ceedingly busy in returning the many salutations of friendship.

Of course Edward Lasell of Chicago was in attendance, talking telephone material and incandescent lamps.

Of course the Card Electric company had to be present, and President Carpenter came up from Mansfield, Ohio.

S. Dana Greene of the General Electric company, found time to spend a while with the General Electric force at the Hollenden.

Mrs. Packard, accompanied W. D. Packard from Warren, Ohio, and made one of the jolly party of ladies who hugely enjoyed Cleveland's hospitality.

H. Ward Leonard, a little stouter but in other respects the same as ever, stood as sponsor for a line of his very interesting and novel heating devices.

City Electrician John A. Cabot of Cincinnati found time to spend a day or two away from his arduous duties to see what was new in electrical circles.

Besides Manager H. L. Shippey of Roeblings Sons company of New York, A. B. Coenover, Jr., of the Chicago office, assisted in "doing" the convention.

President N. Marshall represented the Anchor Electric company of Boston and distributed a large amount of literature relative to his lighting specialties.

J. H. Gates of Chicago did not come down on the train with the "boys," but he presented himself for a short while, just long enough to shake a few hands.

"Micanite" was impressed upon the convention at nearly every turn about the Hollenden through its local agent, the Cuyahoga Supply company of Cleveland.

The South was represented by James L. Belote of Norfolk, Va. Mr. Belote came a long way, but it is safe to say he feels amply repaid for his northern trip.

President Chas. D. Jenney of the Jenney Electric Motor company of Indianapolis was seen every day and everywhere. Mr. Jenney is now building a new factory.

J. C. McNeil of Akron, Ohio, had a very interesting model of his boiler in exhibition hall, which was carefully examined by a constant stream of visitors.

W. E. Harrington talked "circuit breakers" in a way that should be thoroughly appreciated by the Cutter Electrical & Manufacturing company of Philadelphia.

Ed. Wertheim, the high class carbon importer and asbestos man of Chicago, should have been at the convention, but his trip East came a little ahead of time.

Of course D. B. Dean, the popular representative of the Terre Haute Car & Manufacturing company, appeared to meet his many old friends in the electrical business.

Vice-President and General Manager S. W. Glover of the Post-Glover Electric company of Cincinnati couldn't resist the temptation to mingle with the crowd at the Hollenden.

It is safe to state that T. Carpenter Smith, now with M. R. Muckle, Jr., & Co., engineers, Philadelphia, has never missed a convention, and the one at Cleveland was no exception.

Albert Hoppin of Chicago represented the Edward P. Allis company at the convention and went down on the Chicago train, although not in the party occupying the special cars.

The National Carbon company of Cleveland was represented by Vice-president B. F. Miles. Mr. Miles is looked upon as one of the most energetic workers in the electrical business.

The Eppinger & Russell company of 66 Broad street, New York, had a large and interesting exhibit of its wood conduit which is made serviceable by a patent process of creosoting.

The "coming belt" came to the convention in the person of H. A. Bliss, who was daily about the hotel. Mr. Bliss makes a specialty of rawhide belting, with office at 454 Arcade, Cleveland.

The Falls Rivet and Machine company did the honors for Cuyahoga Falls, O., in the persons of E. L. and C. A. Babcock. It was a matter of regret that Mr. Stambaugh could not be present.

J. A. Colby and his wife of Des Moines, Ia., came with the Chicago delegation. Mr. Colby's work with the Des Moines Edison Light company brings him yearly to the national convention.

Herbert A. Wagner, John Mustard and E. H. Abodie told the convention visitors of the merits of the "Type D" transformers of the Wagner Electric Manufacturing company of St. Louis.

President D. N. McBrier and Vice-president D. N. McBrier, Jr., of the Ball Engine company found time to run up to Cleveland from Erie to mingle with their old customers and to get new ones.

The Page Belting company of Concord, N. H., distributed a neat little pocket memorandum book which had numerous illustrations showing how its well-known belt is manufactured.

Popular R. B. Corey turned up the second day, and it is safe to say there wasn't a man at the convention who was not glad to see him and shake his hand. Mr. Corey's popularity is of the kind that lasts.

J. A. Seely is never more at home than when at a convention. His various duties in the executive branch of the association and his numerous social obligations only seem to add to his pleasures.

Why wasn't Col. S. G. Booker at the convention? Col. Booker has rarely missed a convention and the many inquiries made concerning his whereabouts would seem to indicate that he should not have let "pressing business" keep him away.

The Cook boilers were kept before the steam men of the convention by a pictorial exhibit, illustrated elsewhere in his issue. This boiler is manufactured by the J. C. McNeil company of Akron, O., and they claim for it that it is the only perfect waste heat boiler. This concern, however, makes everything in the line of boiler iron work. They can tell you a "thing or two" about prices, too.

President Rafferty of the Dearborn Electric company of Chicago was one of the delegates who failed to put in an appearance, but he is excusable and the next convention will see him, without doubt.

Manager Chas. L. Rodman of the Globe Carbon company came up from Ravenna, Ohio, and mingled with the convention members in the rotunda of the Hollenden. Mr. Rodman made no exhibition.

Fred W. Royce of Royce & Marean, Washington, D. C., joined the "boys" at the Hollenden. Mr. Royce did not come up with the New York delegates, but cut "across country" from Washington.

Secretary E. R. Stettinius headed the Stirling boiler coterie consisting, besides himself, of E. J. Wehrly, F. E. Bruce and H. S. Pell. Pictures of the Stirling boiler constituted the company's exhibit.

The Western Telephone Construction company, Chicago expected to have a representative to show the delegates "the best on the market" in the way of high class magneto-telephones, but he didn't appear.

The Charles Munson company of Chicago was represented by J. H. Shay, and in some mysterious way a very handsome little note book managed to find its way into letter-boxes of many an interested convention man.

E. B. Hatch of Hartford, Conn., who is often called "Johns" Hatch from his connection with the H. W. Johns company of New York, represented this well-known concern at Cleveland. Few there were that had any interest in insulating material that did not consult him regarding his numerous specialties. Mr. Hatch is one of the most prominently known experts in this line of business.

"Tom" Creaghead of the Creaghead Engineering company of Cincinnati saturated the air with a few magnetic words on the new Creaghead specialty. Mr. Creaghead's new pulley came in for its share of his attention.

Manager E. F. Peck of the Edison Electric Illuminating company of Brooklyn, was often interrogated regarding his well-known model plant. Mr. Peck's "pointers" on electrical apparatus were very valuable.

The Tucker Electrical Construction company of New York, through Thos. Macoubray, presented a very convincing circular of its new auto-telephone system, which was replete with general information of the telephone.

Ohio Manager W. D. Kearfoot of the Henry R. Worthington Pump company, had several models of these celebrated pumps, which have received of late so much favorable comment from the electrical fraternity.

The Brodie Electric company of Manchester, N. H., through its president, J. D. Brodie, distributed a circular giving a complete list of its new form of insulators, which received a large amount of favorable comment.

Clark and Valentine of the Valentine-Clark company, Chicago, should have been there to talk "cedar." It was rumored, though, that there was good reason for Clark's staying at home. As for Valentine—well—!

The Nashold cleat was visible, and so was its genial designer, E. Nashold, so well-known and popular among the frequenters of the Monadnock building, Chicago. Mr. Nashold has only recently put his specialty upon the market, but the manner in which supply men seek him out to be his "exclusive representative" in their particular territories would indicate that the Nashold cleat is a "winner." It is rumored that General Manager Nashold placed several agencies for his cleat during his stay in Cleveland.

The works of the King Bridge company in Cleveland were one of the attractions offered to visiting delegates, and Vice-president King stood ready to entertain those interested in high class iron and steel structural work.

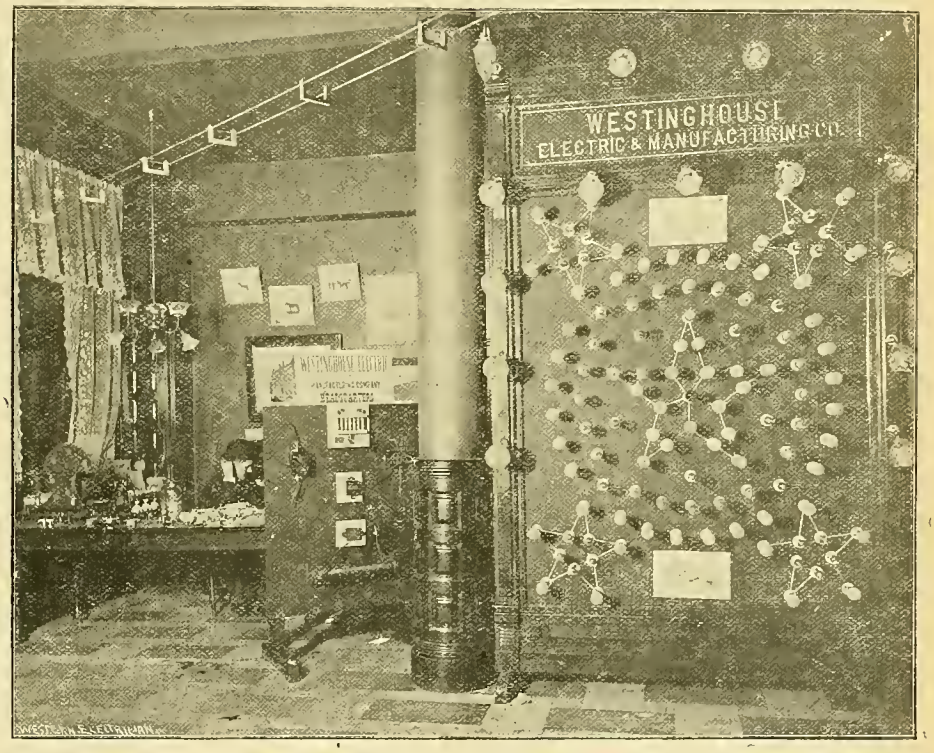
Hugo Benedix, with his Boudreaux brush, had a very interesting exhibit in parlor 101, and his device was carefully examined. Of this brush it is said: "No copper, no woven wire, no gauze, no carbon—something infinitely better."

F. R. Colvin, who has been so long identified in the electrical newspaper field, was an attendant at the convention, representing the Interior Telephone company of New York, of which he is president. Not a few orders came his way.

General Sales Agent F. L. DeRonde of the Standard Paint company of New York had the usual good brand of P. & B. cigars, which were generously distributed among the attendants at the convention. Mrs. DeRonde accompanied him.

The Bethlehem Iron company of South Bethlehem, Pa., which is noted for its famous castings, was represented by Albert Fisher, who is so well known among the delegates that he came armed only with his pleasant countenance and familiar card.

The Crane company of Chicago is now energetically pushing, and with marked success, for business among the electrical people of this country, and General Sales Agent G. A. Hurd was at the convention to remind buyers that his company had valves and other central station fittings well worth their most careful study. The Crane company has already done a large amount of high class work in some of the best electrical plants in America, and Mr. Hurd's energy and courteous manner of making new friends for the Crane company will, without doubt, in the near future be felt by the home office.




Westinghouse Electric & Manufacturing company.
CONVENTION EXHIBITS.

Thos. H. Brady of New Britain, Conn., only brought his smiling countenance to the convention. His well-known mast arm, which has been in use so long, did not need a formal introduction, and it is said that not a few orders found their way into his pocket.

James F. Kelly made his initial bow before the electrical convention as representing the New York Insulated Wire company. Mr. Kelly's numerous friends were glad to greet him, and extended their wishes for his success with his new business connection.

J. L. Hayes & Co. of Pittsburg also saw the advantage of advertising its high class tablet boards among the large number of interested electric light men who congregated at the Hollenden. This device is well worth investigation on the part of construction men.

It was rumored that the Hill Clutch Works' parlor contained something very mysteriously attractive. Next time you are down at "Hill's," ask H. W. Hill what it was. Messrs. Leonard and McCarthy did the honors most gracefully in company with Mr. Hill.

The Belknap Motor company of Portland, Me., showed its usual originality in the shape of a display in which revolving incandescent lights played a leading part. This company on this occasion paid particular attention to the pushing of its composite graphite and copper woven wire brushes. These brushes are made up of the concern's "happy combination" of all the essential qualities of both copper and carbon, the graphite acting as a lubricant and the copper as a conductor.

(*Continued on page 109.*)

Western Electrician.
EVERY SATURDAY.
PUBLICATION OFFICES:
6 Lakeside Building, - - CHICAGO.
TELEPHONE, MAIN 1746.
EASTERN OFFICE: 534 TEMPLE COURT, NEW YORK.
Trade Supplied by Western News Co.

COPYRIGHT.—Not only the title but the *entire contents* of each number of the WESTERN ELECTRICIAN are copyrighted. This paper is entered at the Chicago Postoffice as mail matter of the second class.
SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50 with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies 10 cents. When change of address is requested, the old address as well as the new should be given.
CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.
ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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ANOTHER "largest trolley system in the world" has been started in New Jersey and, according to the plans of the projectors, it will eventually connect the cities of Philadelphia and New York. A wealthy corporation is back of the scheme, and it is bound to develop into an important undertaking, even though the present plans be greatly modified. The company has secured right of way through one of the richest localities in the country, and with good management the system is bound to prove a paying investment. It is proposed to operate combination cars carrying express and light freight as well as passengers.

MR. BRUSH'S reminiscent talk at the Cleveland convention, although all too brief, is replete with interest. It is reported in full in this issue, and should be read by all interested in the art of electric lighting. Charles F. Brush is in many respects a unique figure in the electrical world. His work has been of the utmost value to the industry, and he is one of the very few electrical inventors who have secured both fame and fortune by the application of electricity to illumination. Rich and retired from the field, he now has very little to say about that electrical development with which he has had so much to do, and his words are therefore the more interesting and significant.

THE report of the commissioner of patents which was made public last week contains interesting statistics which go to show that the inventive genius of the country is not exhausted, provided there is any real merit in a small percentage of the total number of patents issued. Electrical patents form one of the most important classifications in this department, and the number of applications made each year is increasing steadily. A perusal of the "Illustrated Electrical Patent Record" in the WESTERN ELECTRICIAN each week will be sufficient proof of the importance of this department. This record also shows that there is considerable delay in many cases, which might be avoided if the department had better facilities for transacting its business. On this account special interest is felt in the recommendation that the working force of the office be increased and that the appropriation be increased by $64,000 in order that the work of classification, which now falls to the present examining corps, may be assigned to the increased force. Another very important advantage that would be gained by the granting of this increase is emphasized in the report, where the commissioner calls attention to the fact that if it were possible to make accurate examination upon the question of novelty very much litigation concerning patents would be avoided.

COMPLAINT is made against the policy of overcrowding the Broadway cable cars and a writer in the *Herald* says: "There is no other city in the world where street railway cars are allowed to be so crammed with passengers. There is no earthly reason why it should be tolerated for a day longer in New York." Chicagoans have long since grown accustomed to riding in crowded cable cars, and although they have repeatedly urged the companies to operate more cars, nothing has come of the movement. The writer from whose communication we have already quoted calls attention to the fact that in Paris, Berlin and other large European cities such vehicles are prohibited from carrying a single passenger beyond the number capable of being comfortably seated. No crowding, either, is permitted in London. There are many other regulations enforced in European cities which would not be respected in this country.

THE hundreds of electrical men who are interested in the meetings of the National Electric Light association, had best make the most of their stories about the Cleveland convention, for they won't have a chance to attend another for at least fifteen months. The next meeting will not be held until May or June, 1896, when the association will gather its hosts in the city of New York. There is much talk of holding the convention immediately succeeding in Chicago, and thence alternating in the two cities named. This plan has every advantage of convenience and utility to recommend it, but has been criticised on the ground that the members would be tempted to neglect the convention proper owing to the many outside attractions of the larger cities. At any rate it is worthy of the trial which will probably be given it. The change in meeting time to a more pleasant season of the year is very generally commended.

THE Cleveland convention of the National Electric Light association was an eminently successful one. It was largely attended, and a larger proportion of the members attended the sessions than has been the case of late years. The social features were very properly subordinated to the real business of the meeting; and the gathering proved to be a practical and sensible one. For the first time in its history the association elected a Chicago man as its president, and thus further entrenched itself in the regard of the electrical industry of the Northwest. With a western president and an eastern place of meeting, the sectional question seems to have been satisfactorily met. In a commercial sense, also, the convention has left a gratifying record, as the influence of reviving trade seems to have been felt in all branches of the electrical business represented in what Mr. Beggs terms the "bazaar"—a very important adjunct of the annual meetings, by the way, and one that the association could ill afford to lose. All in all, it may be fairly stated that few of the visitors left Cleveland without the gratifying sense of time well spent.

THE hearing in the telephone controversy at Albany, as reported in the daily papers, indicates that both parties to the controversy made wild and sweeping statements concerning the cost of construction and operation. Representatives of business men's associations from every city in the state were present at the hearing last week, and many of these participated in the proceedings. The principal argument for the telephone companies was made by General Tracy, who appeared for the Metropolitan Telephone & Telegraph company of New York city. He said in part: "The statement that the charge of the company to each of its subscribers is a flat rate of $240 a year is a mistake. The truth is that only about one-half of the 10,600 stations pay the flat rate of $240 per year. There are 9,500 regular subscribers, and the average rate which these subscribers pay does not exceed $175 per year. This bill seeks to reduce telephone rates to each subscriber to a flat rate of $78 per year. This would give to the company a total revenue on its 9,500 regular subscribers of about $740,000, a sum which is not more than one-half the amount of money actually paid year by year for the cost of maintaining and operating the subscribers' stations. At the rate of $78 per year for each subscriber the company would not only receive nothing by way of dividend or interest on the money invested, but would sink over $700,000 per year in actually maintaining and operating the plant." It would be interesting to know the basis for these figures. No doubt Gen. Tracy's statement is based upon statistics supplied by the company he represented, and now that company should explain these figures in the interest of the public and the electrical fraternity.

AN interesting bit of news comes from Bridgeport, Conn., in connection with the recent official announcement that the Nantasket branch of the Old Colony division of the Consolidated system would be equipped with electricity, and the passenger coaches running over it be propelled entirely by electric power. Colonel N. F. Heft, president of the Bridgeport Traction company, has been secured by the Consolidated to take charge of the work at Nantasket. The Bridgeport Traction company operates forty-two miles of street railway system. The Nantasket branch is only seven miles long, and as railroad salaries go could not afford to pay a man like President Heft the salary his position as head of the traction company offered. The consideration of this circumstance led to an inquiry which resulted, according to the story in the statement from an official of the road, that the Consolidated intends to push the construction of the largest electrical system in the world. The electrical equipment of the Nantasket branch, it is said, is merely to test apparatus which in the judgment of railroad officials is suitable for the purposes of railroad propulsion. This step, it is claimed, is the beginning of the ultimate electrical equipment of the entire system. It is evident that the company is interested in the problem of equipping its lines electrically and whether the reports concerning its plans and purposes be correct, it is evident that extensive experiments will be conducted.

CONSIDERABLE interest was manifested in street railway circles throughout the country when the announcement was made in the daily papers that William J. Richardson had delivered an address before the Atlantic Aid association, a benefit organization composed of employes of the Atlantic Avenue Railroad company, who have been engaged in a strike. Mr. Richardson found himself in a peculiar position when called upon to address the association. As president of the organization he might naturally be looked upon as representing the employes who were engaged in the strike, but as a stockholder and director of the Atlantic Avenue company he was bound to uphold the policy of the management in dealing with the men, and as secretary of the American Street Railway association and the New York State Street Railway association he had additional responsibilities as an official representative of the men who had developed the street railways of the state and country and had so much capital invested in these ventures. It is safe to say that no other man in the country could be selected who would be so generally approved by the street railway companies as their representative, as no other man has so persistently upheld the rights of the owners of these enterprises. In view of this fact, it was very complimentary to Mr. Richardson, and certainly a high tribute to his character, to be selected by the employes as the man to whom they were ready to submit their differences for adjustment. It is to be regretted that Mr. Richardson allowed the conflicting interests that he represented to prohibit him from discussing the matters of difference between the companies and the men. It is of interest, though, to learn Mr. Richardson's views on the subject of franchises and taxation of corporations. In his address Mr. Richardson said that there were three parties interested in the controversy —the public, the employes and the companies. It was to the consideration of the first party, its duties and responsibilities, that he directed the attention of the association. He believed that the public, through its representatives in the state legislature and city council, had not faithfully discharged its duty, and that the unjust treatment of the companies at the hands of public officials was reverting upon the community. In this connection Mr. Richardson said: "The ingenuity of the legislature is taxed to its utmost to conceive ways in which to draw the very life-blood out of a street railway company. The company is taxed on its capital stock, on its gross earnings, its dividends, its real estate, its tracks, and finally must pay a license for running its cars over its own rails above a pavement it does not use, though it had paid for it, as well as between tracks and two feet outside thereof." He did not consider it fair that a special system of taxation should be devised for corporations of this class.

One of the lessons of this and similar controversies is that the present method of dealing with corporations performing public service should be abolished. At the present time the companies are practically at the mercy of the state and city or village officials. As long as this arrangement continues the companies cannot be expected to give the service that the public has a right to expect.

## The "Western Electrician" at the Cleveland Convention.

The 52-page special convention issue of the WESTERN ELECTRICIAN—the largest in advertising that this journal has ever issued—was received with enthusiastic congratulations on all sides at Cleveland, and the favorable comments were many. No better tribute could have been paid to the business sagacity of those whose announcements appeared in it and the hard work and enterprise entailed in is production. Numerous regrets, too, were expressed by advertisers who had failed to be represented in it. The paper was in the hands of everyone on the "special" from Chicago, and in the lead at the convention—read and re-read by everyone—in marked contrast to some of its slow going eastern contemporaries which were not to be found at all on the eastern "special." These facts simply go to prove that the electrical newspaper of the West does have an exclusive field that it is impossible to cultivate to advantage without it—all the assertions of interested rivals to the contrary notwithstanding.

There is one thing that those who favor this journal with their patronage can rest assured of—that there is no electrical paper in existence to-day which gives a service more effective, more far-reaching and distinct. This week we again publish a great issue, with its 50 pages of advertising and an authentic report of the convention proceedings, and one that will be eagerly read by thousands far and wide.

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ONCE MORE the WESTERN ELECTRICIAN exceeds, in advertising pages, all records made by it in previous years. Fifty pages is the record this week; last week it was fifty-two; while the best showing made previous to 1895 was forty-two pages of advertising in a single number at the St. Louis convention of 1893. Twice, then, this year, the paper has gone ahead of its previous best record. And these are hard times, too. But advertising in the WESTERN ELECTRICAN pays in hard times and it pays in good times and it pays at all times, for the WESTERN ELECTRICIAN is pre-eminent in standing, influence and circulation throughout the great consuming district—the Central and Western states.

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THE BUYER who looks carefully through the advertising pages of this and the previous number of the WESTERN ELECTICIAN—the greatest numbers from the standpoint of advertising patronage in the history of the paper—cannot help but notice the prominent position occupied by the manufacturer of the goods advertised. There can be no question about it. The manufacturer is making a drive for the trade direct, and he is strong in numbers and in amount of space occupied—stronger, it seems to us, both actually and relatively, than in the past. Well, we make him one assurance; namely, that there is no surer or more direct way of reaching the electrical consumer of the West than by placing his business announcements in the electrical newspaper of the West—the WESTERN ELECTRICIAN. In fact, by newspaper advertising, there is no other way of doing it effectively and thoroughly.

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AS WE expected, our more or less respected contemporary, the *Electrical World*, carried, last week, each and every advertisement declined by the WESTERN ELECTRICIAN. These will, no doubt, with many more like them, go to swell the *World's* next "comparative statement" of amount of advertising carried. Oh, well! we can stand the "comparative statements" if the *World* can stand the dead advertising. But how about the *World's* paying advertisers? How long will they continue to put up with such unjust discrimination against themselves!

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At the annual meeting of the Wisconsin Telephone company at Milwaukee the board of directors was increased from seven to nine. The two new directors are Jesse Stone of Watertown, Wis., and W. A. Jackson of Detroit. Charles F. Pfister took the place of Fred Vogel, Jr. The board is now composed as follows: H. C. Payne, F. G. Bigelow, B. K. Miller, Charles Ray, C. G. Stark and C. F. Pfister of Milwaukee; W. A. Jackson and Jesse Stone. The board organized by re-electing the following officers: President, H. C. Payne; vice-president and treasurer, F. G. Bigelow; secretary and general manager, John D. McLeod; general superintendent, E. B. Cottrell; auditor, D. E. Roberts; purchasing and contracting agent, S. O. Giddings.

## Convention Notes and Personals.

(*Continued from page 107.*)

Clarence E. Stump, well known in the technical newspaper field, is now secretary and treasurer of the Columbian Equipment company of 66 Broadway, New York. This company will construct and equip an extensive southern system of steam and electric railroads.

Wm. C. Temple, the genial representative of H. E. Collins & Co., Pittsburg, Pa., could not resist the temptation to say a few words for his old "standby," the Cahall vertical water tube boiler, manufactured by the Aultman & Taylor Machinery company of Mansfield, O.

John H. McGhie, the popular and efficient advertising manager of the General Electric company, was the source of general information regarding this concern's electrical interests at the convention. Pleasant and accommodating, he extended every courtesy to delegates.

Old New York friends of M. M. Hayden, now with the National Carbon company of Cleveland, spent several pleasant evenings in his company. Mr. Hayden is a New York man who has been West for some time, but his old friends have by no means forgotten him.

President H. C. Adams of the Phillips Insulated Wire company of Pawtucket, R. I., represented this well-known concern at the convention, but depended upon his Chicago agent, the Electric Appliance company, for an exhibit of the well-known "O. K." and other brands of wire.

A. P. Seymour, as usual, represented the well-known firm of Pass & Seymour of Syracuse, N. Y., whose porcelain specialties are so universally used and known by the electrical trade. Mr. Seymour did not bring anything but a few cards and his smiling countenance—all that was necessary.

The D. VanNostrand company of New York had a very complete catalogue of books in relation to electricity, which the delegates appreciated by carefully stowing away in their pockets, and, without question, this well-known publishing company will receive numerous orders for standard works.

Chas. A. Schieren & Co. of New York were represented through their Chicago office by M. A. Sullivan, who distributed interesting reading matter regarding their well-known oak leather belting. Mr. Sullivan is a new hand at electric light conventions, but he made many friends.

Thos. C. Warley & Co. of Philadelphia is the name of the firm succeeding S. W. Lord & Co., manufacturers of the celebrated boiler cleansing compounds. This firm distributed a very convincing circular regarding its material for the users of steam boilers and the like at the convention.

The Solar Arc Lamp company of New York was ably represented by Joseph Sachs, who had a sample of its new commercial arc lamp which not only attracted attention, but was purchased as well. The working of the lamp showed it to be as represented and indicating that its future was one of success.

The Shawhan-Thresher Electric company of Dayton, Ohio, appeared in the person of A. A. Thresher. Mr. Thresher ran up to the Hollenden to be with the "boys," but he frankly confessed that his personal friends in Cleveland placed many temptations in his way and stole a little of his time from the rotunda.

The Carpenter Enamel Rheostat company of Hoboken, N. J., had a full line of rheostats and novelties in the heating line. President H. Ward Leonard and Vice-president C. E. Carpenter were, as usual, gracious and accommodating to their many friends who desired to investigate their apparatus.

At the last moment Electrical Engineer B. J. Arnold of Chicago was prevented from joining the Chicago delegation en route to the Hollenden. Mr. Arnold had only recently returned from an extensive business trip and an accumulation of work prevented him from mingling with the crowd in Cleveland.

H. H. Cutler of the well-known and enterprising Cutler-Hammer Manufacturing company, Chicago, did the honors of his company, and his table full of high-class rheostats and a number of interesting storage battery accessories told the story better than volumes of pamphlets of excellency of manufacture.

The Bullock Manufacturing company of Chicago couldn't come, but it saw the wisdom of being represented in the WESTERN ELECTRICIAN'S 52-page convention issue. The striking Bullock "ad." of the Willans engine will doubtless lead to inquiries from those interested in direct connected electric lighting machinery.

Manager Hadley of the Commercial Electric company of Indianapolis represented his company at Cleveland. This company has been making remarkable progress throughout the West and South and no little credit is due to Manager Hadley for the company's rapidly increasing business and excellent prospects.

The Partridge Carbon company of Sandusky, Ohio, was very fittingly represented by President James Partridge. Mr. Partridge renewed many old Cleveland acquaintances, and although he did not come to Cleveland expecting to do business, nevertheless the well-known Partridge motor brushes made many new friends.

The Phœnix rubber insulating paint was shown by Elmer P. Morris of the firm of Morris & MacCurdy of Indianapolis, Ind., who showed by practical tests that it would not crack, blister or peel when under a direct heat, and also by other illustrations showed its general usefulness to the electrical business.

It was a very pleasant morning that greeted the New York delegates when they set out on their journey for Cleveland. All that could be done for their comfort by the New York Central & Hudson River Railroad company, through its traveling passenger agent, W. H. Welsh, was done in that free-handed manner for which this road is so well known. An equipment of three Wagner sleepers, dining car and a combination car was given the delegates, and very fast running time was made to Buffalo. Good service was also given by the Lake Shore railroad to Cleveland. An unanimous vote of thanks for the courteous manner in which both of the railroad companies treated the delegates was passed, as evidence of the New York and Boston delegates' appreciation.

The Stanley Electric Manufacturing company of Pittsfield, Mass., was ably represented at the convention by General Manager Henry Hine and Prof. John F. Kelly. Its well-known apparatus was a subject for discussion among central station men. Rumor says that a number of orders at the home office indicate no little increase in business from the trip to Cleveland.

The mast-arm model shown by J. J. Renehan of New Britain, Conn., was one of the novelties presented in exhibition hall. It showed a number of new improvements which central station delegates were prompt to observe, and by the number of orders left at headquarters they showed that they believed in what Mr. Renehan said.

Secretary Edward Dickie of the American Carbon company of Dayton, O., spent four or five days in Cleveland during the convention season. Mr. Dickie is one of the Ohio "pushers" and his "American" carbons are in use everywhere. Wm. H. McKinlock's company, the Metropolitan of Chicago, is one of Mr. Dickie's agents.

T. H. Bailey Whipple of Minneapolis was one of the hustling Buckeye men in attendance, who kept the electric light men continually reminded of the fact that the Buckeye lamp was the "largest" lamp at the convention in more senses than one. Mr. Whipple expects shortly to make an extensive business trip for his company.

E. H. Heinrichs, advertising manager of the Westinghouse Electric & Manufacturing company, managed to steal a moment or two from his "Westinghouse talk" to break bread with his many old newspaper friends who now and then pass through Pittsburg and always find him on hand with his hospitable welcome and courteous treatment.

The Brooklyn Electric Manufacturing company of Brooklyn, N. Y., was represented by Louis Winter, who had a very complete display of quick-break switches. One 600 ampere three-pole switch, near by the midget switch, was conclusive evidence of the company's ability in manufacturing all that is necessary in this line of goods.

The old and reliable Habirshaw wire was held up before the delegates constantly through its representatives, Manager of Sales J. W. Godfrey and his assistant, F. W. Harrington of New York. Their souvenir of a very neat pocket memorandum was eagerly sought after and will be in many pockets as a reminder of this well-known wire.

S. Bowman Wheeler, from the engineering department of Morris, Tasker & Co., Philadelphia, renewed old acquaintances among his many friends in the electrical business, and was very busy giving details relating to his company's new electric light pipe poles. It is a pleasure to record that a large amount of business was taken by Mr. Wheeler.

The Abendroth & Root Manufacturing company of New York, whose boilers are known from ocean to ocean among the electrical fraternity, was represented by General Sales Agent P. M. McLaren, who was "everywhere" that one could expect a man to be who was interested in boilers. It is said that a contract or two found its way into his pocket.

Ubiquitous Stanley Green, western manager of the Fuel Economizer company of Matteawan, N. Y., turned up on the second day of the meeting. Mr. Green wouldn't say positively, but a twinkle in his eye indicated that while he was glad to see his friends at the convention, a large Cleveland order, not quite landed but "dead sure," was also in mind.

General Manager F. S. Marr, of the Helios Electric company of Philadelphia was a welcome visitor to the convention. It was not expected that he would be present, but at the last moment he decided to come, and while in Cleveland took several large orders for his excellent lamp, and assisted very materially its Chicago representative at the convention.

"Insulators that Insulate," i. e., the Brodie insulators were kept before the convention by a strikingly illustrated circular. The Brodie insulator for supporting heavy aerial conductors is a device worth the study of electrical men interested in heavy work and high insulation. A line to General Manager Albert L. Clough, Manchester, N. H., will bring a "pointer."

C. D. Shain was one of the prominent figures about the Hollenden, and he was exceedingly busy in extending the hospitalities to the many visitors at his parlors, which contained a varied sort of Weston instruments, of which he is the general sales agent. Prof. R. O. Heinrich gave the inquiring delegates the desired scientific information relative to these celebrated instruments.

C. D. Wilkinson did the honors and did them well for the Western Electric company, Chicago. Mr. Wilkinson is a young man of energy and push and one that brings credit to his company wherever he goes. It is a well-known fact that the chief business at convention time is making friends, and the Western Electric company may feel that this time the work was particularly well done.

St. Louis came to the front with its contingent, and the General Electric company's hustling representative for that section, George D. Rosenthal, brought a smiling face and hearty handshake for old friends. Mr. Rosenthal is another of those hospitable St. Louis gentlemen to whose credit it may be said that the St. Louis convention will long be remembered as one of the best.

It was a hard matter to escape seeing the interesting little red "Convention Catalogue" distributed by the W. H. Elliott Electric company of Cleveland, O., throughout the various places frequented by the electrical men. The W. H. Elliott Electric company possesses superior facilities and has a long experience in the repairing of all kinds of electrical machinery. It will guarantee its work, and as

many realize the necessity of an electrical repair works of whose efficiency and integrity there can be no doubt, it is most reasonable to suppose that the future will bring them even greater success than is theirs at the present time.

General Manager J. H. Parker, for C. S. Knowles of Boston, was one of the attendants at the convention who examined very closely all the numerous electrical specialties that were to be seen around and about exhibition hall. It has been some time since Mr. Parker has been able to appear at an electrical convention; it is hoped that he will be seen at all future meetings.

N. S. Possons, president of the Universal Electric company, Cleveland, was one of the reception committee, and his genial and hospitable manner went a way toward contributing to the good time of many of his old friends among the delegates. Mr. Possons, at the present time, is "keeping quiet," but he is too energetic a man to wait long and we shall see what we will see before long.

President Joseph E. Lockwood exhibited "a good article at a reasonable price" in the shape of a 10 kilowatt 125 volt dynamo. Mr. Lockwood's company, the Michigan Electric company, is now handling the Detroit Electrical Works' type of generator and motor. It is making energetic and successful efforts toward securing a large bulk of Michigan and western supply business.

It was a pleasure to the large number of Sidney Short's old friends to feel the extent of the kindness and hospitality shown by him and his wife in looking after the personal comforts and entertainment of the delegates and their wives. Mrs. Short is a lady of some experience in the matter of convention entertainment, and her second effort in this direction compares can only be compared with that of some years ago.

One of the most curious signs that were suspended in the way of the wandering delegate to attract his eye was that of the American Circular Loom company of Boston. H. H. Brooks and J. S. Willson managed to twine their conduit most gracefully about their signboard, and somebody whispered that a certain flexible conduit had twined itself in another way about the inclinations of many a purchasing delegate.

The old convention stand-by, Geo. Cutter of Chicago, appeared accompanied by his bright and energetic business manager, Albert Scheible. Mr. Cutter, it is needless to say, was everywhere, and it must have given him much pleasure to have once more found himself with his old chief and the man from whom he received his early training, Prof. Elihu Thomson. Mr. Cutter had a fine display of specialties in his room.

The meeting in Cleveland this year completes the fifth year that Miss H. Cummings, the very able assistant of Secretary Porter, has been connected with the executive office. The ability shown by Miss Cummings to keep a cheerful feeling among the delegates, who were asking so many questions pertaining to the numerous things of the convention, and her unfailing courtesy amid all distractions, are really remarkable.

General Manager H. B. Cram of the Bernstein Electric company of Boston, Mass., was one of the old representatives who had been prevented from being in attendance for several years. Being one of the best posted and most progressive men in the electrical business of the East, the delegates were very glad to interview him regarding the many important subjects which have of late come up in the electrical trade.

Was the Chicago Cross Arm company at the convention? Well rather. At least one would have thought so had he found himself in the neighborhood of Messrs. Angle and Marshall, who held forth part of the time in their parlor. Cross-arms and other wooden things of interest to electrical people were their theme, and it is safe to say their good work will be felt in the shape of a handsome increase in orders at the Chicago office.

It is hard to make a good display of such a simple specialty as "Paragon" paint, but the "Paragon" was there just the same. This specialty has been working its way into the electrical fraternity in such a way that it indicates that its future is one of success. The Paragon company is desirous of increasing its already large trade among the electrical people, and it is safe to say the use of a sample of this paint wins it a friend every time.

Better late than never, but he wasn't so late after all. W. S. Bartholomew arrived on Wednesday, and he hadn't been in the hotel two hours before exhibition hall was in a fair way to be saturated with the subtle influence of the Mosher arc lamp, energetically pushed by Mr. Bartholomew, manager for the Union Brass Manufacturing company. Mr. Bartholomew is an old salesman and it is needless to say he knows how to get in "his fine work."

Parlor 108 of the Hollenden was one of the popular places of resort during the convention. A visitor upon entering was received by those genial managers of the Okonite company of New York, Capt. W. L. Candee and G. T. Manson, who, as usual, presented that well-known cordial reception which has made this company so widely known among the electrical fraternity, and of course their headquarters were crowded from morning until night.

E. Ward Wilkins of the Partrick & Carter company of Philadelphia, has missed only one electrical convention since its organization, and, of course, it was a "sure thing" that he would be in attendance. It was pleasant to note that during his stay in Cleveland he secured the largest business that he has ever done at a convention. He was much sought after, as his concern is well known as being always in the front in the production of electrical novelties.

An electric light convention would not be complete, it is safe to say, to two-thirds of the delegates of it did it not afford an opportunity for them to give that yearly hand-shake to William H. McKinlock of the Metropolitan Electric company of Chicago. Mr. McKinlock has been so long and successfully indentified with the electrical supply trade of the West, that, although a young man, he is entitled to the distinction of being one of the best known electrical supply men in the United States. He made no exhibit this time, but his quiet and dignified methods of doing business and his courteous treatment of everyone with whom he came in contact, without doubt will go a long way toward an increase in that kindly feeling now held by both sellers and buyers toward his thriving Chicago enterprise.

The Institution for the Home Study of Electricity and Mechanics appeared in the person of Manager F. D. Leslie. Mr. Leslie also represented the *Scientific Machinist* at the convention and was to be found daily among the boys in the rotunda. His school for the home study of electricity is now looked upon as one of Cleveland's strong institutions, and it has been brought to this condition mainly through the energetic and skillful efforts of its general manager.

The Akron Insulator & Marble company of Akron, O., exhibited a fine line of the "Standard" tubing for electrical purposes. Window and floor tubes, together with insulators and numerous other electrical specialties were displayed and their merits explained in a most clever and convincing manner by A. L. Daniels. Mr. Daniels, although he had but one line to present, made his tubing "standard" indeed with many members in search of high class wares.

The Standard Underground Cable company appeared in the person of Vice-president J. W. Marsh of Pittsburg; G. L. Wiley, eastern manager, New York; J. R. Wiley, western manager, Chicago, and H. W. Fisher, electrician, Pittsburg. The Standard Underground company's parlors were 236 and 237. J. R. Wiley, it will be remembered, was recently appointed as successor to Fred E. Degenhardt, deceased, the company's late Chicago representative.

Electric light and power men who visit Cleveland from time to time and requiring the services of an efficient stenographer and typewriter, will make no mistake if they call upon Miss Grace M. Forbes, 454 Arcade, Cleveland; the Arcade is only a step from the Hollenden. The WESTERN ELECTRICIAN takes pleasure in stating that Miss Forbes' "rush" work, for it was taken "under pressure" and during considerable turmoil, was of a character highly satisfactory.

Secretary J. P. McQuaide of the National Conduit Manufacturing company of New York, together with the Chicago agent, H. F. Tate, placed before the numerous delegates at the convention in a most convincing manner the merits of the well-known subway system, which is in use in a number of the larger cities in the country. Indications point toward a large amount of this concern's material being called for by a number of the delegates who investigated its merits.

President E. P. Roberts of the Correspondence School of Technology was a constant attendant at the convention. Mr. Roberts is an old Cleveland man, and the success which he has made with his Correspondence School of Technology has brought him prominently to the front throughout the United States. Himself a practical electrical engineer, and having surrounded himself with the very best talent obtainable, his work in this line is giving him an enviable reputation as an educator.

It is a matter of sincere regret on the part of Chicago delegates that J. H. McGill, representing the Peru Electric Manufacturing company of Peru, Ind., should have met with an accident which practically spoiled his pleasure at the Cleveland gathering. Mr. McGill was handling an incandescent lamp, which burst in his hands, and while although it did not destroy his eye, it injured it to an extent which his physicians say is quite serious. His many friends unite in expressing their sympathy.

The new circular of The American Engine company of Bound Brook, N. Y., showing its new multipolar generator, either belt driven or directly coupled, attracted no little attention. This is a new machine and possesses a number of striking improvements, which the delegates appreciated General Manager E. F. Spaulding was detained from being present at the convention, but it was noted that quite a number of inquiries were sent from Cleveland, asking more particulars about the new apparatus.

The R. Thomas & Sons company of East Liverpool, O., managed to do a neat piece of advertising through the energy of their hustling and popular representative "Tom" Grier. "Tom" was enterprising enough to see that those little knobs of white ware were well used in the temporary wiring of exhibition hall. Trust to "Tommy" Grier for ingenious and timely bits of advertising—he's an author, too, you know. J. E. Way, from New York, co-operated with Mr. Grier in his most excellent work.

A picture showing a neat and tasteful exhibit of alternating fan current motors made by the Holtzer-Cabot Electric company of Boston is presented in this issue on another page. The high class product of this company is now so well known, through persistent advertising and other methods of securing trade, that one could easily recognize on sight the highly-finished goods. The Holtzer-Cabot company is one of Boston's most conservative and prosperous firms and its goods are now becoming standard, even in the far West.

W. B. Cleveland of the Forest City Electric Works, Cleveland, O., spent many hours during the convention period at his exhibit in exhibition hall. Mr. Cleveland is now pushing most energetically his roll drop commutator bars and other copper specialties. It is not necessary to introduce Mr. Cleveland to the electrical trade, as the "Cleveland" switches have already made his name famous and given him a reputation which will undoubtedly redound to his credit in the prosecution of his copper business.

The solid old Central Electric company of Chicago, familiar to convention delegates for years past, appeared with its customary novel exhibition and a strong force of men to back it. President Geo. A. McKinlock was unable to leave Chicago with the western delegation on Monday night, but he turned up the following evening and found that his hustling representatives, C. G. Burton and P. B. Chaney, had "been there before" and in their very quiet but "get there" way had secured one of the choicest stands in exhibition hall for their display. The Central company made a special display this time of an arc lamp of the Helios Electric company, but it is safe to say that its well known line of specialties—Interior conduit, Okonite and Carpenter rheostats—were in no wise neglected. To illustrate the remarkably steady feed of the Helios lamp, a stereopticon was employed and the arc of the lamp was thrown upon a screen. Mr. Burton also used his stereopticon to display trade-marks, etc.

J. C. Hobart of the Triumph Electric company, Cincinnati, O., was in attendance, and received many congratulations on the rapid manner in which the Triumph dynamos have been introduced of late. The Triumph company recognized the large and legitimate demand for a distinctly low-priced dynamo and motor, and their motto is "Something cheap, but good." No little credit is due to Mr. Hobart for the rapid manner in which this company has placed itself before the electrical people of the United States.

J. E. Way of the R. Thomas & Sons company, manufacturers of hard vitreous porcelain electrical supplies, joined forces with Grier Brothers in presenting the merits of his company's high class goods. A representative of the WESTERN ELECTRICIAN recently visited the works of the R. Thomas & Sons company in East Liverpool, Ohio, and found this concern overwhelmed with work to such an extent that it was a matter of positive loss to them that the new addition to the works now under way was not then complete.

The "big switch" of the Perkins Electric Switch Manufacturing company of Hartford, Conn., was one of the greatest attractions of the convention. No progressive central station man left Cleveland without knowing all about it; and it was all due to General Manager J. J. Gates, assisted by the western representative, G. W. Conover of Chicago, who was on hand at all hours to explain its details. This concern is nothing if not original, and at this convention it was, as usual, at the "head of the procession."

Secretary and Treasurer Edwin O. Waymire of the Dayton Fan & Motor company, Dayton, O., ran into Cleveland to see the "boys." Mr. Waymire made no exhibition at the Hollenden, but many of the delegates accompanied him over to the W. D. Graves Electric Manufacturing company's establishment, where he introduced them to his improved electric ceiling fan. Mr. Waymire's goods have rapidly increased in popularity during the last year and the spring will, without doubt, find his factory crowded with orders.

The Wallace Electric company of Chicago did not make any exhibit, but its personality was felt. The Chicago enterprise of J. B. Wallace and Wm. S. Hine is now looked upon as one of the West's leading supply houses, and the energy and persistent work of these gentlemen not only in pushing their general line of supplies but the Stanley agency as well, holds for them trade of the most desirable class. It was hoped that Secretary Max Berg would make a trio of Wallace representatives, but Mr. Berg was prevented at the last moment from coming.

What would a convention be without popular Sales Agent James Wolff? Mr. Wolff was "there" and no mistake. It was a matter of regret, however, to his large circle of friends that he was compelled to leave the convention earlier than would otherwise have been the case had he not been obliged to make a flying trip East. Mr. Wolff is a western man in every sense, but it is safe to say if he has as many warm friends in the East, as are those always ready to greet him in the country of which Chicago is the center, his sales of wire would be astonishing.

President Cutter of the Cutter Electrical & Manufacturing company of Philadelphia knew that there would be no convention held without his presence. He therefore gave up a large share of his valuable time to go to Cleveland and present for inspection his new magnetic circuit breaker for dynamo and motor circuits, and also for the new protected terminal fuse cut-outs, which attracted continuous attention among the delegates. The company was also represented by the well-known inventor of electrical specialities, W. E. Harrington.

The Electric Selector & Signal company appeared in the persons of General Manager C. P. Mackie, P. H. Alexander and A. L. Searles. This company exhibited new and highly improved designs of its valuable instruments, and its table was continually surrounded by central station men in search of devices whereby station economy and efficiency can be greatly increased. The parts of this company's system are the transmitter, the selector and the switch. These were fully explained, and their great merit and simplicity excited much favorable comment

Manager Winter of the Sintz Gas Engine company of Grand Rapids, Mich., expected to be able to make an exhibition of his double-acting gas engine adapted for incandescent lighting service, but his factory being worked to its fullest capacity to fill rushed orders in other lines, it was impossible to prepare the engine he wished to show. Those interested in the application of the gas engine to electric lighting work will be surprised to note the perfection in operation, that is, steady power, of the Sintz gas engine. This engine is worth a careful inspection.

The very complete display of the Electric Engineering & Supply company of Syracuse, N. Y., in the shape of what was a fine specimen of a high class switchboard, attracted its share of attention. It was a matter of regret, though, that General Manager H. J. Goerke of the company did not put in an appearance, although he was expected. He was ably represented by J. D. McIntyre, H. C. Hodgkins and J. L. Hines. The company, through its, representatives, presented a very complete catalogue "No. 6," which is well worth a purchaser's reading.

Pres. T. F. Morrin of the Clonbrock Steam Boiler company of Brooklyn, N. Y., had several large photographs of the immense plant of boilers now in process of erection in the station of the Cleveland Electric Illuminating company, which is to be the model plant of the central states. These photographs were passed from hand to hand and did most excellent work for the Climax boiler. In order to appreciate the extent of this installation, it is necessary to say that the boilers now in operation at this plant contain over 32,000 feet of 3 inch tubes, and if placed in one con-

tinuous line would reach over six miles. When it is realized that there are to be 4,000 horse power of Climax boilers in this station and that it will require thirty cars to transport this equipment to the station, the reader will have an idea as to the magnitude of this important installation. On Wednesday morning ten carriages loaded with delegates inspected this plant.

The "wax wheel lamp" told its own story, but energetic Carl K. MacFadden, manager of the Nutting Electric company, its manufacturer, made a strong impression as to the lamp's extreme simplicity and other merits. As is now pretty thoroughly known through the company's advertising, the wax wheel lamp is a departure among its class of electrical devices. The value of this device is best told by the repetition of the wording on the company's World's Fair diploma: "The method of regulation is novel and gives most excellent results on circuits of all classes."

Master of Transportation C. O. Baker of New York was the same personification of good nature and executive ability. His management of the special train from New York to Cleveland and the general detail pertaining to the other quarters of the country which sent their delegates to the convention added another laurel to his wreath of many successes, and the fact that the large amount of time and attention which was given by him to this important business of the association was complimentary shows his deep interest in the welfare of the electrical fraternity.

If a warm and generous greeting is a criterion of the personal popularity of a gentleman in business, surely H. L. Shippey, the New York manager for the John A. Roebling's Sons company, should feel complimented. There are but few gentlemen who have a more wide and extended acquaintance in the electrical trade than Mr. Shippey, and the well-known brands of Roebling wire have been thoroughly impressed upon the trade through his efforts. It is hoped that Mr. Shippey will be an attendant upon many future meetings and lend his personal strength to the organization.

Among the newspaper men present were W. J. Johnston, M. J. Sullivan, C. P. Poole, R. L. Weithas, *Electrical World*; Geo. M. Phelps, T. C. Martin, A. C. Shaw, Carl Kammeyer, *Electrical Engineer*; Stephen L. Coles, H. G. Tuckerman, *Electrical Review*; B. E. Greene, N. W. Perry, *Electricity*; E. L. Powers, W. A. Remington, *Electrical Industries*; C. B. Fairchild, *Street Railway Journal*; C. E. Stamp, *Street Railway Gazette*; F. D. Leslie, *Scientific Machinist*; H. M. Swetland; *Power*; H. J. Allen, *Dixie*; Fred DeLand, *Electrical Engineering*; W. F. Collins, W. F. Osborne, F. L. Perry, W. E. Keily, WESTERN ELECTRICIAN.

One could not miss seeing the apparatus of the Interior Conduit & Insulation company of New York at the Hollenden. In the exhibition hall a large display was made of its motors, one of which of 10 horse power, 230 volts, excited not a little attention from its compact construction and handsome finish. On the parlor floor, or in more properly "newspaper row," the Interior Condnit company had another parlor in which were exhibited various types of Lundell motors. One of the fan motors in this parlor ran in a manner that excited the highest admiration among those appreciative of absolute noiselessness in machines of this character.

General Manager Herbert Lloyd of the Electric Storage Battery company of Philadelphia, stopped in Cleveland just long enough to take up the cudgel in a very interesting discussion at the convention. But the merits of the Chloride accumulator were kept continually before the people in a most energetic manner by J. R. Williams of Philadelphia. Mr. Williams exhibited a large chloride cell (capacity 4,000 ampere hours). This type and size of cell is the same as that of the batteries for service in the New York Edison Illuminating company's station. Mr. Williams explained that this cell might be discharged at a rate as high as 1,000 amperes.

The Electrical Engineering company of Minneapolis-Minn., made friends on all sides by its thoughtful distribu, tion of its new "National Code," a little pamphlet containing the rules and requirements for installation of wiring and apparatus for electric light and power. This little book is a reprint from the company's catalogue "No. 3." It may be mentioned in this connection that the Electrical Engineering company has recently established a connection with the Buckeye Lamp company of Cleveland for handling its lamp in the former's territory in the West and Northwest. A short while ago it made a remarkable record in the way of a large lamp sale of which both the home company and the Engineering company feel justly proud.

"Better late than never" was the motto of the Elliott-Lincoln Electric company of Cleveland. Secretary W. A. Crawford and Treasurer J. E. Crawford made a special exhibit of their slow-speed multipolar generator and motor in convention hall during the last days of the meeting. In this type of machine of 600 light capacity, the base was cast in one piece, securing great strength and rigidity; the bearings are ball and socket; the armature is of the slotted or toothed pattern, well ventilated and runs remarkably cool. An especial winding is used through which an absolute equality in resistance in each coil is secured. These are but a few of the good points of the Elliott-Lincoln company's machine, but the concern's catalogue contains other matter of considerable interest to prospective buyers.

It is safe to say that there was no switch man in attendance at the Hollenden who did better work than can be placed to the credit of the representatives of the Perkins Electric Switch manufacturing company of Hartford, Conn. Messrs. J. J. Gates of the home office and Western Manager G. W. Conover were indefatigable in their successful efforts to continually remind the large number of purchasers that congregated about their display that the Gibbs switch and Perkins lamp were "good things," and worth not only "pushing along," but purchasing. Messrs. Gates and Conover displayed considerable originality, not only in their newspaper advertising but likewise for their amusing way of advertising the Gibbs switch throughout the hotel. In the illustration of this concern's exhibit presented elsewhere in this issue, to the left will be seen a small boy pushing a wheelbarrow containing a pyramid plastered over with a representation of the "good thing," clipped, by the way, from the WESTERN ELECTRICIAN. This hustling little representative pushed his "good thing" not only about exhibition hall, but around the rotunda of the Hollenden and secured for his employers a reputation for ingenious convention advertising.

President A. W. Mayers of the Multifuse Switch company, 131 Society for Savings building, Cleveland, Ohio, was in personal attendance at his company's exhibit. Mr. Mayers' courteous explanation of his switch's many advantages will doubtless lead to a rapidly increasing sale when it is finally launched on the market. At the present time the Multifuse Switch company is busily engaged in perfecting it in a few lesser details, and shortly the device will be introduced. It is practically perfect now, but the company wishes to have it absolutely so before making sales.

The Crescent Oil company of 155 St. Clair street, Cleveland, came to the convention in the person of James H. Clark, Jr., and made its presence known by the distribution of its "Worth Knowing" pamphlet. This concern handles lubricatidg oils and greases and is also general agent for tri-sodium phosphate, the great chemical water purifier. This phosphate prevents and removes scale in boilers and neutralizes acids. The little pamphlet, "Worth Knowing," is a comprehensive treatise on water purification and contains a number of interesting facts and figures of practical value to steam users. A postal card to this concern will bring returns.

It was a matter of regret that that Secretary A. D. Newton of the Eddy Electric Manufacturing company of Windsor, Conn., could not be present at the convention; and but few gentlemen were more asked after than he, and it is hoped that he can be present at the next meeting. General Sales Agent M. E. Baird, however, represented the meritsof this old and popular company. There is nothing that could be added, therefore, that would show the popularity of the apparatus which this company manufactures. The company did not have any exhibit at the convention, but the large number of motors in operation in and about Cleveland was its "card."

S. F. B. Morse, whose remarkably original "Kerite' advertising scheme at the recent Milwaukee convention made his name famous as a nnique advertiser, was a familiar figure among the "boys." Everyone looked for another startling novelty which would put "Kerite" once again in everyone's mouth, but Mr. Morse seemed contented to rest on his heavy supply of laurels secured at Milwaukee. It is hard to say which of the names "Morse" or "Kerite" is best known throughout the West, bnt there is one thing certain, whatever the specialty is that has "Morse" behind it "something" will have to get ont of the way, for he usually arrives at his destination.

One of the simplest, yet one of the most taking exhibits from its suggestion of great usefulness, was that of the Vulcan company of New York city. General Sales Agent Howard Romeyn Smith kept a "Vulcan" gasoline torch burning in a manner highly suggestive of the midnight student. It did not burn, however, throughout the entire night, bnt just long enough to make a large number thoroughly believe that Mr. Smith's claim that he had the best torch in the world for electrical men, was a perfectly just one. The Vulcan torch must be seen to be appreciated, and any car painter or practical electrician once testing a sample, it is safe to say would forever after be its friend.

Herbert A. Wagner, designer of the Wagner transformer, and Eugene H. Abadie represented the Wagner Electric Manufacturing company of St. Louis at the Hollenden. Mr. Abadie in his exhibit cleverly illustrated and demonstrated the merits of the new method of suspension of Wagner transformers over the old. This company also exhibited a new automatic cut-out, through which, when a fuse blows, a new one is automatically thrown in to take its place. A new line switch was also shown. The Wagner company for the past two years has pushed its product steadily to the front, and now these well-known transformers are considered second to none in the market.

President F. H. Prentiss of the Manhattan General Construction company, in company with S. Marsh Young, vice-president and general manager, and Stuart W. Wise, did the honors for their company and made a very handsome exhibit of the new Manhattan lamps. This concern has been working for a long time, perfecting its lamps, and its appearance in exhibition hall made a sensation, especially as it was prepared to demonstaate that those using the Manhattan lamp had only to put in a new carbon and trim the lamp "once every 100 hours." President Prentiss tried hard to stay away from the convention, bnt Wednesday found him seated on the railing of his exhibition.

President E. G. Bernard of the E. G. Bernard company of Troy, N. Y., found his way into Cleveland dnring the convention, but he made no especial display. His concern and specialties, however, were kept before the delegates through his special advertising methods. Mr. Bernard distributed, in addition to illustrated circulars covering his specialties, a very neat "long green" case. While Mr. Bernard did not believe that the average delegate would have any use for his souvenir until empty pockets had been refilled at home, still he had an eye to the future. Mr. Bernard's circulars described his well-known arc light cut-out, and also his highly efficient dynamos and motors.

President W. W. Low of the Electric Appliance company of Chicago is certainly entitled to be called an "expert" at "doing" a convention. He has the knack of bringing his company before you in a way which causes yon to remember it, and at the same time leaving a most pleasant impression without necessarily continually talking "shop" to you. It is generally agreed that Low is a good fellow. The Appliance company did not make any exhibit to speak of, but Mr. Low co-operated with the Packards at their interesting lamp stand in exhibition hall in company with C. J. Butler, the popular "Paranite" man, in pnshing this celebrated rubber covered wire and in "talking up" the Appliance company's innumerable other specialties. It was a matter of regret, however, that Treasurer and Secretary Thos. I. Stacey could not join forces with Messrs. Low and Butler and shake the hands of the Appliance company's many friends. There are without doubt a large number of the Appliance company's customers who have done business with the concern for years that would have liked to meet all the men with whom their pleasant relations have been established. Eastern Agent Chas. J. Wells also did good work with Mr. Low.

The Eureka porcelain cleat was there in all its "largeness," and so was its courteous and genial designer, M. M. Wood. As is now well known, Mr. Wood is in business for himself and is pushing his high class and very ingenious specialties most energetically. Mr. Wood has a private laboratory and his devices are "sellers" in every sense of the word, as may be readily appreciated after a glance at his printed matter which will be furnished on application. It was a matter of regret, however, that a slight illness kept him away from the gatherings for a day during the meeting. He was on hand at the last, however, and not only placed some large orders for material, but likewise did some handsome selling.

General Manager Louis Nahm of the American Electrical Manufacturing company of St. Louis appeared on Wednesday morning. Mr. Nahm came on with a number of men from St. Louis and was warmly welcomed. It would be hard to forget the hospitable manner in which Mr. Nahm and his charming sister joined with the St. Louis people in their whole-souled and successful efforts to entertain the electrical men during the never-to-be-forgotten St. Louis convention of two years ago. The American lamp, which Mr. Nahm has pushed to its present state of perfection, is an electrical specialty now standard in many sections and it is safe to say that his recent trip to Cleveland did not diminish those ever increasing sales.

The American Electrical Works of Providence, R. I., sent representatives to the convention in the persons of General Sales Agents P. C. Ackerman and F. E. Donohoe. Mr. Donohoe has made himself familiar in the West in a very creditable manner. It has been but about a year since his company opened and placed him in charge of its large and handsome store in Chicago, and the success with which he has managed the western branch and secured more than his share of western business would indicate that the American Electrical Works were wise in their conclusion that what the large and now rapidly increasing western territory needed was stock from which quick and satisfactory shipments could be made.

Away down at the end of "newspaper row," but kept well before almost every delegate was the very handsome exhibit of the Reliance Gauge company of Cleveland. This display, in charge of President C. D. Wright and H. S. Higgins, although strictly speaking not an electrical one, was of such a character as to be of paramount interest to every man interested in fine and complete station steam equipment. It was a matter of regret, however, to many of the friends of Mr. Wright that he has been for some weeks a little under the weather with rheumatism. He came to the front nobly, though, during the excitement, and it is to be hoped that his hospitable efforts in entertaining the strangers will in no wise impede his speedy and complete recovery.

Of conrse the great Fort Wayne Electric corporation of Fort Wayne, Ind., was represented in its usual strong manner. The following named representatives of the company were present: C. S. Knight, vice-president, Fort Wayne; G. A. Wilbur, Philadelphia; Thomas Cooper, Columbus, O.; C. E. Wilson, Chicago; Mr. Ryan, Cincinnati; Mr. Bradley, Baltimore, Md.; S. A. Douglas, manager, New York. Each delegate to the convention was favored with a miniatnre model of the company's 500 light Wood transformer to be used as a paper weight and a reminder of the sterling worth of this company and its very valuable apparatus. A genial welcome was offered to all who chanced to enter the portals of the headqnarters at the Hollenden.

The Phoenix Glass company had a large line of choice patterns of electric and gas shades in room 306 at the Hollenden, and E. H. Fox, the popular Chicago representative of the company, was kept busy entertaining his many friends and patrons. Mr. Patterson's genial countenance was missed, and many regrets were expressed at his unavoidable absence. Sympathy was extended on the recent loss of the npper factory by fire, but when the visitors heard that, Phoenix-like, before the ashes were cold, the bnsiness had been established in a new place, and that the company had leased the old Dithridge factory at New Brighton, Pa., which, with its other factory, enables it to keep np with the orders, congratulations were in order.

The Butler Manufacturing company of 46 S. Clinton street, Chicago, was not in a position to send a representative to the convention, owing to the factory being over-crowded with work; but this concern "got there" just the same in the shape of an interesting little pamphlet entitled "Some Electrical Specialties," distributed by friends throughont the hotel and exhibition hall. This concern during the past few years has progressed in its electrical branch in a remarkable manner, and its goods, of which there is a large variety, are now recognized as "standard" by many large supply houses and other buyers throughout this conntry. The Butler company's page "ad." in the WESTERN ELECTRICIAN mentions a considerable number of these specialties, but not all by any means.

Elmer P. Morris of Indianapolis, Ind., created quite a sensation with his Phœnix insulating paint. This product is manufactnred exclusively by Morris & MacCurdy and possesses a number of very valuable properties, especially for electrical use. The paint is made from a newly discovered and valuable mineral. The advantages claimed for it are that it contains a quick dryer, makes a lasting gloss equal to varnish, does not crack or peel off and it can be used successfully on high heated surfaces, Mr. Morris claims, than any known paint, as it loses none of its qualities under 550 to 600 degrees Fahrenheit. It will also withstand the action of acids and alkalies. Without enumerating its further advantages, it may be said that Mr. Morris made a number of interesting tests in exhibition hall, which convinced the

central station men that he had a valuable product. His experiments with a blow pipe on an electro-magnet and also with a piece of iron pipe covered with the composition and subjected to the extreme heat of the blow pipe, showed some remarkable properties well worth investigation.

W. D. Packard, J. W. Packard and H. M. Willson came up from Warren, Ohio, and the exhibit they made was indeed a "light" in the path of the wayward delegates. The Packards exhibited everything conceivable in the line of incandescent lights—little Packards, medium Packards, big Packards and gigantic Packards, as well as a special focusing lamp for theatrical purposes. The Packard transformer was also on exhibition, and Mr. Packard made a very unique display through his utilization of a stream of water passed through and around the columns of the transformer, as an illustration of its superior insulation. The above are the chief specialties presented by the New York & Ohio company, and the Packard Electric company, but the exhibition, as a whole, was one of the most attractive in exhibition hall.

Of course W. C. Bryant and Thos. G. Grier of the Bryant Electric company appeared to represent respectively the Bridgeport, Conn., and Chicago ends of this enterprising concern. Friends of Mr. Grier have doubtless, by this time, received his very interesting little booklet containing what he modestly calls "Ancient Relics of Conventions Past and Gone," but which is, in reality, a very interesting compilation of stories that maybe "you have told or heard before," or may be you haven't. Grier Bros., Thos. G. and Edward R., are looked upon as "all around hustlers" in the West, and an electric light convention would hardly be complete without their appearance with the now thoroughly popular Bryant specialties.

President Gerald W. Hart and Western Representative Geo. S. Searing of the Hart & Hegeman Manufacturing company of Hartford, Conn., told of the ever increasing merits of Hart's switches. When Mr. Hart started in business for himself as a switch manufacturer, some years ago, his intimate friends and those who knew him best, who were familiar with his enviable record in Kansas City, prophesied success. It is fair to assume, though, that few realize the excellent record that has been made. The Hart & Hegeman company now stands in the foremost rank of switch manufacturers. The Hart switches are known all over this country and abroad. It is needless to say, too, that no little credit for the rapidly increasing sales of this specialty is due to Western Manager Geo. S. Searing.

Secretary and Manager C. J. Butler of the Indiana Rubber & Insulation company of Marion, Ind., came from no one knows where, but he was "there" just the same, and his very useful and handsome little souvenir of "Paranite" wire in the shape of Roberts' wire calculator in Russia leather, prepared for him by the Cleveland Electrical Manufacturing company, will keep his own name and that of his well-known Paranite wire ever green in the minds of his many firm friends. It is a pleasure to record the fact that Mr. Butler is one of those men of whom everyone has a good word to say. A "good fellow" and a thorough business man, it's no wonder that "Paranite" has become the standard wire it is.

The Tucker Electrical Construction company of New York was ably represented by Thomas McCoubray, inventor of the auto-telephone system which it manufactures. Mr. McCoubray had a complete working system installed in Army and Navy Hall, comprising a house set covering two stations, and an inter-communicating system of five stations, talking through 300 feet of cable. This system attracted much attention and favorable comment on account of its extreme simplicity and distinctness and volume of sound when talking. It is also noteworthy that while any number of pairs may talk together without overhearing or interrupting, the system is so flexible that a conference can be held between several people, all remaining at their desks, and just as easily as if all were assembled in the same room.

Electrician S. Barns, of the Sweet Electric Manufacturing company of Grand Rapids appeared to tell of the merits of the Sweet station limit switch. It is a matter of regret to General Manager Kritzer's friends that he likewise could not be in attendance. The Sweet manufacturing company, however, is so busily engaged now turning out its automatic limit switches that its two leading men could not leave the factory at the one time. The Sweet switch made a good impression, and one man went so far as to say that if he had had it in his station he would now be the richer by about twelve armatures. Mr. Barns came to the convention more or less a stranger, but it is needless to say he left it not only well known himself but with the merits of his switch indelibly impressed upon the minds of the majority of those who would be likely to become purchasers.

The headquarters of the Westinghouse Electric & Manufacturing company was in the parlor of the Hollenden at the left of the main entrance. The exhibit consisted of a large lamp board and the standard lightning arrester made by the company. On the lamp board were tastefully displayed the various styles of incandescent stopper lamps. This exhibit presented a fine effect and showed the perfection to which the manufacture of stopper lamps has been brought. One hundred volt and 50 volt lamps of candle power ranging from 6 to 32, were displayed, the steadiness and brilliancy of the light being especially noticeable. Attention was drawn to the high grade of glass employed in making these lamps and the glass shades of various patterns. The display of ornamental lamps made was very brilliant. The exhibit of lightning arresters proved of special interest to the convention delegates. The various types of the well-known Wurts non-arcing metal arrester and the Wurts non-arcing railway arrester were mounted on a panel at one side of the parlor. The style of choke coil used on car equipments was also shown, and experiments made showing its action. Experiments illustrating the principles of lighting protection for alternating and direct current circuits were continually in progress during the convention. The souvenir of the convention was a very artistically arranged pamphlet giving a view of the new Westinghouse works at East Pittsburg, Pa., together with illustrations of some of the large machines installed by the company. The staff of representatives comprised the following named gentlemen: C. F. Scott, Calvert Townley, A. J. Wurts, E. N. Sanderson, P. D. Mershon, H. P. Davis, William Lamme, H. D. Shute, G. B. Dusenberre, F. S. Smith, H. A. Craigin, P. F. Brady, J. A. Rutherford, E. H. Heinrichs, W. D. Crumpton, G. H. Lewars and C. A. Bragg.

The Diamond Electric company of Peoria, Ill., was represented by A. M. Searles, manager of its Chicago sales department. Mr. Searles is now pushing those famous high class Schieffer recording wattmeters. These meters may be used on alternating currents and their main points of excellence are that they register directly the actual power consumed; have no commutator, no brushes, no wire on the armature. Their makers claim them to be perfectly accurate on one lamp as well as on the full load and absolutely reliable. The Diamond transformer is another of the company's specialties that sells well and gives much satisfaction. These converters have subdivided and ventilated coils, are safe to handle and contain a remarkably simple fuse device. Mr. Searles was in constant attendance at his post, and his hard work will, without doubt, be felt in the near future by his company.

President J. S. Humbird, Secretary J. S. Crider, A. H. Mustard and L. W. Washington appeared to remind the electrical people that the Washington Carbon company of Pittsburg, Pa., was after business among the buyers of high class carbons, and meant to have it. The only samples shown by these gentlemen were of the Helios cored carbons, suitable for direct and alternating currents. As is now pretty clearly appreciated through this concern's extensive advertising, the Helios carbon is a most successful competitor with foreign brands and the Washington company's standing offer relative to prices is now so well-known and of such an interesting nature that Mr. Crider's samples were more or less an object of curiosity. The Washington company is certainly "in" for business, and from the energetic character of its campaign it would seem that it is likely to get it.

The Walker Manufacturing company, although not yet thoroughly in the electric light busines, saw its opportunity to increase its already wide circle of friends. The Walker factory, too, is one of the sights of Cleveland. Such an establishment as that of the Walker company, with its great facilities for turning out immense machinery and high class electrical work, is one of the points which every delegate of an investigating turn of mind made it his duty to visit. H. McL. Harding appeared from New York to add one more to the long list of Walker men who stood ready to "hold up the end." It was a matter of regret, however, that Vice-president Frank Billings could not appear. As is well known, W. H. Bone, manager of this company, through his energetic efforts, has shown competitors that the Walker company is after business and propose to equip numerous roads in the United States.

The large number of delegates that were gathered about the Jewell Belting company's exhibit indicated that the table devoted to this company's display carried something of a novel nature. Treasurer C. E. Newton and Sales Agent C. L. Tolles explained a very simple device for illustrating their superior adhesive qualities of the Jewell pulley covering. Two wheels, one provided with this covering and one without it, operating in connection with an attached weight, made it perfectly clear to belting purchasers that the Jewell covering was a "stayer" in more senses than one. A souvenir of Jewell belting in the form of a pocketbook was distributed among the delegates. The Jewell company has, in previous years, made itself exceedingly popular by its generosity in the distribution of handsome souvenirs and its action at the convention of '95 was no exception.

The Brush Electric company had a fine display in the main parlor, which was very attractive. Among the Brush-Adams arc lamps on exhibition were the single ornamental constant potential for two in series across 110 volt circuits; the standard arc series lamp; the double constant potential lamp, two in series across 110 volt circuits; standard double lamp with Detroit style of casing. Of the last named type the Brush company has just booked an order for 1,500 for municipal lighting in Detroit, the style of casing having been adopted by the Detroit officials in order to avoid trouble from the so-called "Canada soldiers" which invade all cities near the lakes during the hot nights of midsummer. The globe is insect-proof and the casing obviates the necessity and expense of hoods. There was also exhibited the first arc light machine built by C. F. Brush, built in 1876 at Mr. Brush's house, which was hauled in the rear end of his buggy from his residence to the works of the Telegraph Supply company on Champlain street, where it was set up and run as a one-light 2,000 candle power machine. It was in constant use until the World's Fair year, when it was purchased as a relic from the Viaduct Manufacturing company of Baltimore and taken to World's Fair and run. It is now carefully preserved by the Brush company and is a valuable curiosity. The great resemblance of the first and last Brush machines is very marked. The members of the association practically made the Brush parlor their headquarters, a large number being in the room at all hours. Col. W. S. Rogers, special agent of the Brush company, and A. B. Calhoun were in constant attendance at the parlors, Col. Rogers, especially, having a very extended acquaintance among electrical men, and being a very congenial gentleman and entertainer. Other Brush men in attendance to look after the comfort of visitors were S. M. Hamill, general manager; L. H. Rogers, assistant general manager; W. B. Bolton, general counsel; A. H. Hough, secretary; A. D. Dorman, manager sales department; C. W. Phipps, superintendent; C. N. Black, assistant superintendent; T. E. Adams, inventor of Brush-Adams arc lamp; I. R. Prentiss, superintendent of electrical experts. The Brush company did not make an extensive display on account of its great works being located in the city. To the factory all friends were welcome. Here a practical exhibit of all the latest apparatus in the electric line was viewed by large numbers. Two special cars were constantly run between the Hollenden and the works for conveying delegates. One of the company's new 125 light arc dynamos was in service, with 135 2,000 candle power arc lamps in circuit. This machine was short-circuited, cut in and out from nothing to full load and full load to nothing; in fact any competent electrician was allowed to "play" with it to suit himself, to prove that under no circumstances could the machine be injured.

Without doubt one of the handsomest and most attractive exhibits at the convention was that of the Buckeye Electric company of Cleveland. This concern engaged Parlor B, opposite that of the WESTERN ELECTRICIAN, and some idea of its tasteful and unique exhibit may be had from the illustration presented elsewhere in this issue. As will be seen from this picture, the company's display was made in the shape of two large pyramids containing 6,000 and 1,000 lamps respectively and a buck's head adorned with lamps of "special" small types. The Buckeye men were out in full force. The exhibit proper was in charge of George R. Lean, assisted by Bailey Whipple and John R. Massey. President Potter of the Buckeye company and also Treasurer Rockwell and Superintendent Spiller were present from time to time to extend the hospitalities of Cleveland to the strangers. The Buckeye company was complimented, especially upon its originality in advertising, and its ingenious method of making the Buckeye lamp the "biggest" at the convention in more ways than one was remarked upon by almost everyone.

Wm. Curtis Thayer of 1027 Garfield building, Cleveland, O., in company with L. E. Thayer, made excellent use of the opportunity offered by the gathering of such a large body of electrical people in Cleveland to advertise the fact that he proposed in the future to push most energetically the supply business in Cleveland vicinity, as well as throughout the western and middle states. Both the Thayers are young men and "hustlers" in every sense of the word. For some time W. C. Thayer has been acting as consulting electrical engineer as well as construction and supervising contractor for electric light and power stations, etc. He has also done a large business in drafting and designing. It is his present purpose to launch out into the supply business, making the store his chief feature. He has already secured a number of valuable agencies, and his work at the convention went not a little way toward increasing this connection. With Mr. Thayer's large acquaintance and high standing in Cleveland, it is nothing more than reasonable to believe that his new venture will prove highly successful.

Manager Ward S. Arnold of the Pumpelly-Sorley Battery company, Chicago, was detained from joining the Chicago delegation owing to pressure of business in Chicago. Mr. Arnold is one of Chicago's most energetic young electrical men and mainly through his hard and skillful efforts, the Pumpelly-Sorley Battery company has been brought to its present prominent position among battery manufacturers. As is well known, the Pumpelly battery has of late been brought to a high degree of perfection, and being a Plante cell made through a quick and highly efficient process, its merits have of late been highly appreciated by telephone companies and others favoring the introduction of well made Plante batteries. In the management of the Pumpelly-Sorley Battery company Mr. Arnold has his hands full, in that he not only has full charge of the selling interests of his company, but he likewise has a general supervision of the factory. It may be stated in this connection that extensive improvements in manufacture and an enlargement of plant is now under way at the Pumpelly-Sorley factory in Chicago.

President James F. Cummings of the Cummings & Engelman Conduit company of Detroit attended the convention, although he was suffering from the grip, and really should have been home and in bed. Mr. Cummings, although a young man, is one of the most skillful electrical mechanics in the country, and he has a long list of patents to his credit. For the last few years he has devoted himself to electrical conduit work of all kinds—interior, underground and street railway. On trolley conduits alone he has twelve patents. The Cummings & Engelman company is capitalized at $300,000 and is entering the campaign for business with vim and vigor. One of its latest products is an iron armored conduit for interior wiring, a sample of which Mr. Cummings exhibited in the Hollenden. The sample excited lively interest among all electrical men privileged to see it, and Mr. Cummings received several flattering offers from supply dealers for the privilege of handling it. The prospects for the company appear to be flattering, and Mr. Cummings, who is widely known and well liked in the electrical trade, is receiving congratulations. W. H. Yawkey also represented the Cummings & Engelman Conduit company at the convention.

The General Electric company's exhibit was one of the most complete and comprehensive made at this convention. It occupied the entire second floor of the station of the Cleveland Illuminating company, located in the handsome new building on Canal street, and besides a display of supplies was principally devoted to a working exemplification of the operation of the monocyclic system. Arranged in a line down the center of the room was a complete monocyclic plant, consisting of a 60 kilowatt 60 cycle monocyclic generator, running at 900 revolutions, and furnishing current to induction motors, incandescent lamps and arc lamps. The generator was driven by belt from a 50 kilowatt 230 volt four-pole slow-speed, direct current motor of the type which the General Electric company has recently developed, and in which it has embodied many important improvements. This motor was driven by direct current taken from the circuits of the Cleveland Illuminating company. Current for the monocyclic generator at 1,040 volts was taken through two 7,500 watt transformers to a 15 kilowatt induction motor, also running at 900 revolutions, and this in turn was belted to an Edison bipolar 12 kilowatt generator supplying direct current to a number of incandescent and arc lamps, the latter of the already well-known Thomson '93 type. The current from the monocyclic generator was led through a 1,000 watt and a 15,000 watt transformer to a number of incandescen

lamps and Thomson '93 alternating arc lamps, and these burned brightly and without flicker. In addition a five horse power induction motor was also driven by current from the monocyclic generator—the current in each case being measured by a Thomson recording wattmeter. The system was thus shown to the delegates in detail and the claim made for it that it solved the problem of operating lights and motors of a perfect type from a single alternating generator. A small two horse power direct current motor of a new and peculiarly compact design was also shown in operation, and its small size and efficiency attracted considerable attention. Two handsome alternating focusing arc lamps and two direct current focusing arc lamps were also to be seen lending their light to increase the brilliancy of the surroundings of the exhibit. The alternating current used was taken from the primaries of the Illuminating company. The exhibit of lighting supplies occupied the end of the room back of the plant. It comprised a fine display of the porcelain specialties—switches, cut-outs, etc.—manufactured by the General Electric company at its own works, a complete line of punched clip station switches, primary alternating, railway, power and direct current two-wire and three-wire recording wattmeters, several of which were in operation, an arc wattmeter and a Thomson portable ammeter. In addition a supply of the new General Electric key sockets with porcelain bases was shown, and one was bestowed as a souvenir to each of the visiting delegates. The exhibit was rounded off by a handsome specimen of railway switchboard work, the controlling instruments being mounted on a fine panel of Tennessee marble and by a 12 inch searchlight projector. Visitors were taken to the exhibit in conveyances furnished by the company, and had an opportunity of inspecting at the same time one of the latest direct connected central stations—that just erected by the Cleveland Illuminating company. At the headquarters in the banquet room of the Holleaden the General Electric company had a complete supply of catalogues and pamphlets for the visiting members to take home with them and study at their leisure, and an elaborate display of decorative miniature and candelabra lamps. On the second day of the session an informal reception was held in the banquet room, and was for the time being the center of attraction, from which the ladies departed loaded with flowers and the gentlemen with good cigars. On Thursday morning the ladies availed themselves of the company's invitation to visit the station of the Cleveland Illuminating company and view the exhibit. Altogether, by the united efforts of the Cleveland Illuminating company and the General Electric company, the visitors were provided with an especially instructive exhibit. The representatives of the General Electric company were: Prof. Elihu Thomson, and Messrs. S. D. Greene, E. W. Rice, Jr., Charles P. Steinmetz, Dr. Louis Bell, J. R. Lovejoy, B. E. Sunny, W. L. R. Emmet, A. D. Page, Wilson S. Howell, C. D. Haskins, H. C. Wirt, under whose special care the exhibit was installed; W. F. Hays, T. Beran, F. M. Kimball, C. E. Harthan, G. F. Rosenthal, L. D. Tandy, Edgar Mix, and Messrs. Bostwick, Benbow and Greenwood.

## Members and Visitors.

The following is believed to be an approximately complete list of the members of the National Electric Light association and visitors in attendance at the Cleveland convention.

Abadie, E. H., Wagner Electric Manufacturing company....St. Louis, Mo.
Ackerman, P. C., American Electrical Works.....New York
Adams, H. C., Philips Insulated Wire company. New York
Adams, T. E., Brush Electric company.....Cleveland
Afosworth, F. F. A. Lovell & Co.....Chicago, Ill.
Alberger, Louis R., Beory R. Worthington.....New York
Alexander, P. H., Electric Selector & Signal company.....New York
Allen, J. H.....Atlanta, Ga.
Almstead, J. A., Citizens' Light & Power company.....Rochester, N. Y.
Angle, H. M., Chicago Cross-arm company.....Chicago.
Armstrong, E. A., Camden Lighting & Heating company.....Camden, N. J.
Atkins, W. H., Edison Electric Illuminating company.....Boston, Mass.
Austin, M. B., Safety Ins. Wire & Cable company.....Chicago
Ayer, Jas. I., Marks-Ayer Electric company.....New York
Babcock, C. A., Falls Rivet & Machine company.....Cuyahoga Falls, O.
Babcock, E. L., Falls Rivet & Machine company.....Cuyahoga Falls, O.
Babcock, J. D. A.....Cuyahoga Falls
Badger, F. H., Montmorency Electric Power company..Quebec
Bagoall, F. J.....St. Louis, Mo.
Baird, M. E., Eddy Electric Manufacturing company.....New York
Baker, Jr., C. O., Baker & company.....Newark, N. J.
Baker, Jr., Mrs. C. O.....New York
Baker, W. C.....Cleveland, O.
Bakewell, Allen C., Interior Conduit & Insulation company.....New York
Barker, Forrest E., Massachusetts Commission..Boston, Mass.
Barnes, Samuel, Sweet Electric Manufacturing company.....Grand Rapids, Mich.
Baylis, R. N., Walker Manufacturing company.....Cleveland, O.
Beal, M. A., Forest City Electric Light & Power company,.....Rockford, Ill.
Bean, W. Worth, St. Joe & Benton Harbor Electric Railway & Light company.....St. Joe, Mich.
Bearn, E. E., Barberton Electric company.....Barberton, O.
Beggs, John I., Cincinnati Edison Electric company.....Cincinnati, O.
Belden, A. J., Belden & Seely.....New York
Bell, Louis, General Electric company.....Chicago, Ill.
Belote, James S., Electric company of Virginia..Norfolk, Va.
Benbow, W. C.....Cincinnati, O.
Benedix, Hugo.....Chicago
Beran, T., General Electric company.....New York
Bergtheil, Edward.....London
Beroard, E. G., E. G. Bernard company.....Troy, N. Y.
Billiogs, Miss Harriet.....New York
Black, C. N., Brush Electric company.....Cleveland
Blaxter, G. H., Allegheny County Light company.....Pittsburg, Pa.
Boardman, Jr., T. A., Swan Lamp Manufacturing company.....Cleveland, O.
Bolton, W. B., Brush Electric company.....Cleveland
Bowmao, W. P., John A. Roebling's Sons Co.....Cleveland, O.
Boyce, Jas., Heat, Light & Power company.....Muncie, Ind
Bradley, Charles S.....New York
Brady, Paul T., Westinghouse Electric & Manufacturing company.....Syracuse, N. Y.
Brady, T. H.....New Britain Conn.
Bragg, Miss.....Philadelphia
Bragg, C. A., Westinghouse Electric & Manufacturing company.....Philadelphia
Bragg, Mrs. C. A.....Philadelphia
Brintnall, H. L, The Swift Electric Light company..Saginaw.
Brinthall, Harold L., Swift Electric Light company.....Saginaw, Mich.
Broeck. William M., Edison Electric Illuminating company.....Paterson, N. J.
Brooks, H. B., Piqua Electric company.....Piqua, O.
Brooks, H. H., American Circular Loom company.....Boston, Mass.
Brown F. Wayland, Osborne Manufacturing company.....Cleveland, O
Brush, C. F., Brush Electric company.....Cleveland
Bryant, W. C., Bryant Electric company...Bridgeport, Conn.
Bucholz, C. W.....New York
Burghardt, J. H., Page Belting company.....Boston, Mass.
Burke, J., Herrick & Burke.....New York
Burleigh, J. J., Camden Lighting & Heating company.....Camden, N. J.
Burns, Charles T.....Rochester, N. Y.
Burns, W. J., West Side Railroad company.....Pittsburg, Pa.
Burton, Charles G., Central Electric company.....Chicago
Cabot, J. A., city electrician.....Cincinnati, O.
Calhoun, A. B., Brush Electric company.....Cleveland
Candee, W. L., Okooite company.....New York
Carnes, S. T., Memphis Light & Power company.....Memphis, Tenn.
Carpenter, C. E., Carpenter Enamel Rheostat company.....Hartford, Conn.
Case, William M.....Hoopeston, Ill.
Casper, C.....Springfield, O.
Catabish, N. C., National Carbon company.....Cleveland, O.
Caulkins, W. R., Commercial Electric company ...Clevelaod.
Caven, J., Indianapolis Light & Power company.....Indianapolis, Ind.
Chaney, P. B., Central Electric company.....Chicago. Ill.
Chase, A.....Detroit, Mich.
Chase, O. D, Commercial Electric Engineering company ...Detroit, Mich.
Chase, Samuel A., Western Electric company .....New York
Chesley, C. C., Stanley Electric Manufacturing company.....Pittsfield, Mass.
Cleveland, W. B., electric expert.....Cleveland, O.
Colby, Edward A., Baker & Co.....Newark, N. J.
Colby, J. A., Des Moines Edison Light company.....Des Moines, Iowa
Colby, Mrs. J. A.....Des Moines, Iowa
Coleman, S. G., Badger Illuminating company, Milwaukee, Wis.
Coles, Stepheo L., *Electrical Review*.....New York
Collins, W. F., WESTERN ELECTRICIAN.....Chicago
Colvin, F. R., Interior Telephone company.....New York
Conner, H. S.....St. Paul.
Conover, A. B., Jr., J. A. Roebling's Sons Co.....Chicago
Conover, G. W., Perkins Electric Switch Manufacturing company.....Chicago, Ill.
Cooke, Henry E., Home Security company.....Cleveland, O.
Cooper, Thomas, Fort Wayne Electric corporation.....Columbus, O.
Corriveau, A. J.....Montreal
Coughlin, W. F., Worcester Electric Light company .....Worcester, Mass.
Cowling, J. T., Powelton Electric company..Philadelphia, Pa.
Cox, Samuel E., The Swan Lamp Manufacturing company.....Cleveland, O.
Craigin, H. A., Westinghouse Electric & Manufacturing company.....New York
Cram, Henry B., Bernstein Electric company.....Boston, Mass.
Creaghead, Thos. J., Creaghead Engineering company.....Cincinnati, O.
Crouse, J. B., Crouse-Tremaine Carbon company..Fostoria, O.
Crider, John S., Washington Carbon company...Pittsburg, Pa.
Crossman, T. E., stenographer.....New York
Cruikshank, L. B., The Hazelton Boiler company. New York.
Crumpton, W. D., Westinghouse Electric & Manufacturing company.....Pittsburg
Cumminga, J. F., Cummings & Engelman Conduit company.....Detroit
Cutter, Henry B., Cutter Electrical & Manufacturing company.....Philadelphia, Pa.
Cutter, Mrs. Henry B.....Philadelphia, Pa.
Cutler, H. H., Cutler-Hammer Manufacturing company.....Chicago
Cutter, George.....Chicago
Dailey, Chas. J.....Cleveland, O
Davis, D. L., Salem Electric Light & Power company.....Salem. O.
Davis, H. M., *Electric Power*.....New York
Davis, H. P., Westinghouse Electric & Manufacturing company.....Pittsburg
Davis, J. J., Orr & Howe Electric company.....Pittsburg, Pa.
Dee, A. V., (Jute Yarns.).....Philadelphia, Pa
Dee, Jas. A., Peninsula Electric Light & Power company.....Houghton, Mich.
Dee, Jas. R.....Philadelphia, Pa.
Deland, Fred, *Electrical Engineering*.....Chicago, Ill.
DeRonde, F. S., Standard Paint company.....New York
DeRonde, Mrs. F. S.....
Dickey, Edmund, American Carbon company.....Dayton, O.
Donohoe, F. E., American Electrical Works.....Chicago
Dorman, A. D., Brush Electric company.....Cleveland
Douglass, H. A.....Chicago
Douglass, S. A., Fort Wayne Electric corporation..New York
Dubold, P., Orr & Howe Electric company.....Pittsburg, Pa.
Duffie, —Jr.....New York
Dusenberre, G. B., Westioghouse Electric & Manufacturing company.....Pittsburg
Eberhard, C. F., Eberhard & Wright.....Cleveland, O.
Edgar, C. L., Edison Electric Illuminatiog company.....Boston, Mass.
Edgar, H. T., Georgia Electric Light company....Atlanta, Ga.
Erner, John A., Bissell & Dodge.....Toledo, O.
Ernst, Charles F., Standard Carbon company....Cleveland, O.
Fairbanks, H. H., Worcester Electric Light company.....Worcester, Mass.
Fairchild, C. B., *Street Railway Journal*.....New York
Farrand, H. M., W. C. Thayer.....Cleveland, O.
Field, A. W., Columbus Edison Electric Light company.....Columbus O.
Field, H. G., Field & Hinchman, Electrical Engineers.....Detroit, Mich.
Fisher, George E., Commercial Electric company.....Detroit
Fisher, Henry W., Standard Underground Cable company.....Pittsburg, Pa.
Fitzgerald, W. H., Detroit Electric Light & Power company,.....Detroit
Flanagan, T. F, Portsmouth Gas Light company.....Portsmouth, N. H
Flanagan, Thomas J., Rutland Electric Light company.....Rutland, Vt.
Flick, D. T, New Castle Electric company.....New Castle, Pa.
Foote, J. B., Battle Creek Electric Light company.....Battle Creek, Mich.
Foote, W. A., Jackson Electric Light company Jackson, Mich.
Foster, Charles F.....Chicago
Foster, R. G.....Cleveland, O.
Fox, E. H., Phoenix Glass company.....Chicago
Francisco, Don C., Rutland Electric Light company.....Rutland, Vt.
Francisco, I. H.....Rutland, Vt.
Francisco, M. J., Rutland Electric Light company.....Rutland, Vt.
Francisco, Mrs. M. J.....Rutland, Vt.
Francisco, Jr., M. J., Rut and Electric Light company.....Rutland, Vt.
Freshney, Samuel A., Muskegon Electric Light and Power company.....Muskegon, Mich.
Gallaher, C., National Conduit Manufacturiog company.....New York
Galloway, John R.....Washingtoo, D. C.
Gans, John L., C. N. D. L. Street Railway ..Connellsville, Pa.
Gardner, F. F., Newark Electric Light & Power company.....Newark, N. J.
Gardner, W. H., Pittsfield Electric company..Pittsfield, Mass.
Gartland, C. C., Buffalo General Electric company Buffalo.
Gates, C. A., Russell Eogioe company.....Massillon, O.
Gates, J. J., Perkins Electric Switch Manufacturing company.....Hartford, Conn.
Gerleman, J. F., American Electrical Manufacturiog company.....St. Louis, Mo.
Gessner, G. A., American Carbon company.....Dayton. O.
Gibson, C. L.....Cleveland, O.
Gilbert F. A., Boston Electric Light company..Boston, Mass.
Glover, Samuel W., The Post-Glover Electric company.....Cincinnati, O.
Godfrey, J. W., India Rubber & Gutta Percha Insulating company.....New York
Gore, Aaron.....Denver
Gould, J. Edgar.....Philadelphia, Pa.
Greene B. E., *Electricity*.....New York
Greene, L. W., city electrician.....Hillsdale, Ia.
Greene, L. W., Brooklyn Electric Light company.....Brooklyn, Mich.
Greene, W. J., Cedar Rapids Electric Light & Power company.....Cedar Rapids, Ia.
Greenwood, W.....Schenectady
Gregory, C. E., Charles E. Gregory company.....Chicago
Grier, Thomas G., Bryant Electric company.....Chicago
Gwynn, J., Steubenville Gas & Electric company.....Steubenville, O.
Hackenberg, H. E., National Carbon company....Cleveland, O
Hadley, J. C., Pana Electric Light, Power and Street Railway company.....Pana, Ill.
Hamhey, J. D., Beacon Vacuum Pump & Electrical company.....Boston, Mass.
Hamill, S. M., Brush Electric company.....Cleveland
Hanley, W. J., General Electric company.....Cincinnati, O.
Harding, H. McL., Walker Manufacturing company.....New York
Harrington, F. W., India Rubber & Gutta-percha Insulation company.....New York
Harrington, Walter E., Cutter Electrical & Manufacturing company.....Philadelphia, Pa.
Harris, W. T.....Washington
Hart, Gerald W., Hart & Hegeman Manufacturiog company.....Hartford, Conn.
Harthan, C. E.....Lynn
Harthan, H. C., General Electric company.Schenectady, N. Y.
Hatch, Edward B., H. W. Johns Manufacturing company.....Hartford, Conn.
Hayden, M. M., National Carbon company.....Cleveland, O.
Hayes, George B. R, The Brush Electric company.....Cleveland, O.
Hayes, Webh C., National Carbon company.....Cleveland, O.
Hedges, Wm. C.....Mausfield, O.
Heinrichs, E. H., Westinghouse Electric & Manufacturing company.....Pittsburg
Heinrich, R. O., Weston Electrical Instrument company.....Newark, N. J.
Herrick, Albert B., Herrick & Burke.....New York
Herrick, Charles B., W. S. Hill Electric company.....Boston, Mass.
Higgins, E. N., Citizens' Illuminating company, Rochester, N. Y.
Hill, H. P., Hill Clutch Works.....Cleveland, O.
Hill, C. I., Columbia Incandescent Lamp company.....Chicago
Hinds, J. L., Electric Engineering & Supply company.....Syracuse, N. Y.
Hinds, P. A., Peninsular Electric Light company.....Detroit, Mich.
Hine, Henry, Stanley Electric Manufacturing company.....Pittsfield, Mass.
Hine, William S., Wallace Electric company.....Chicago
Hobart, J. C., Triumph Electric company.....Cincinnatti, O.
Hoag, George M., city electrician.....Cleveland, O.
Hodgkins, H. C., Electric Engineering & Supply company.....Syracuse, N. Y.
Holmes, B. P., Youngstown Electric Light company.....Youogstown, O.
Holmes, Welles E., Newton & Watertown Gas Light company.....Boston, Mass.
Holtzer, Charles W., Holtzer-Cabot Electric company.....Boston, Mass.
Boppin, Albert, Edward P. Allis company.....Chicago
Hotchkiss-Electric Engioeering & Supply company.....Syracuse, N. Y.
Hough, H., Brush Electric company.....Cleveland
Houghton, F. C. & C. Electric company ....Cleveland, O.
Humphrey, C. B., Heine Safety Boiler company...Pittsburg.
Houston, Edwin J., Houston-Kennelly.....Philadelphia, Pa.
Howell, Weston G.....Harrisoo, N. J.
Howell, Wilson S., Edison Lamp Works.....Harrison, N. J.
Hudson, H. W., Brush Electric company.....Cleveland, O.
Hunt, W. J., *Electrical Age*.....New York
Huntley, C. R., Buffalo General Electric company.....Buffalo, N. Y.
Hurd, G. A., Crane company.....Chicago
Jackson, F. E., Aylesworth & Jackson.....Orange, N. J.
Jenney, C. D., Jenney Electric Motor company.....Iodianapolis, Ind.
Jennings, John J., Wilkinsburg Electric company.....Wilkinsburg, Pa.
Johns, S. A, Cleveland Electric Illuminating company.....Cleveland, O.
Johnston, W. J., *Electrical World*.....New York
Johnston, Mrs. W. J.....
Jones, A. B., Suburban Electric company....Philadelphia, Pa.
Jones, A. J., Edison Illumioating company.....New Brunswick, N. J.
Kammeyer, Carl, *Electrical Engineer*.....Chicago
Kammerer, J. H., The Royal Electric company.....Montreal, Canada.
Kearfoot, W. D, Henry R. Worthington.....Cleveland, O.
Keily, W. E., WESTERN ELECTRICIAN.....Chicago
Kelly, John F., Stanley Electric Manufacturing company.....Pittsfield, Mass.
Kennedy, James, Keonedy & Du Perow ....Washingtoo, D. C.
Kennelly, A. E., Houston-Kennelly.....Philadelphia, Pa.
Kimball, Fred M., General Electric company ....Boston, Mass.
Kitle, E. B., Pettingell-Andrews Co.....Boston
Lamme, Wm., Westinghouse Electric & Manufacturing company.....Pittsburg
Langton, John.....Toronto, Canada
Lasell, Edward.....Chicago, Ill.
Latham, C. A., Loraine County Light & Power company.....Elyria, O.
Laughlin, Homer, Wellsville Electric Light company.....Wellsville, O.
Lean, George R., Buckeye Electric company....Cleveland, O.
Learned, Charles A., Hudson County Electric company.....Jersey City, N. J.
Leonard, H. Ward.....New York
Lewars, G. H., Westioghouse Electric & Manufacturing company.....Pittsburg
Lewis, Chas. F.....Cleveland, O.
Lilley, Luke, underwriters' electrician.....Cincinnati, O.
Liodsley, Stuart, Essex County Electric company, Orange, N. J.
Little, E. W., Interior Conduit & Insulation company.....New York
Livesey, J. H., General Electric company.....Detroit
Lockwood, J. E., Michigan Electric company.....Detroit
Lockwood, Joseph E., Michigan Electric company.....Detroit, Mich.
Loucitz, J., Geo., Saviogs & Trust company.....Cleveland, O

Lonthan, B. M., William Brunt Pottery company.....East Liverpool, O.
Lovejoy, J. R., General Electric company..Schenectady, N. Y.
Low, W. W., Electric Appliance company.....Chicago
Lyman, H. M., Canton Electric Light & Power company.....Canton, O.

Mace, Romaine, Interior Conduit & Insulation company.....New York
Mackay, W. H., Imperial Electric Lamp company....New York
Mackie C. P., Electric Selector & Signal company..New York
Manson, George T., Okonite company.....New York
Manwaring, A. H., Brush Electric Light company.....Philadelphia, Pa.
Manwaring, Mrs. A. H.....Philadelphia, Pa.
Marks, L. B., Marks-Ayer Electric company.....New York
Marlatt, Walter.....Galion, O.
Marr, Frank S., Helios Electric company....Philadelphia, Pa.
Marsh, Joseph W., Standard Underground Cable company, Pittsburg, Pa.
Marshall, Charles S., Chicago Cross-arm company.....Chicago
Marshall, Norman, Andover Electric Light company.....Andover, Mass.
Martin, A. J., Complete Electric Construction company.....New York
Martin, John K., James J. Murray & Co.....Philadelphia, Pa.
Martin, T. C., *Electrical Engineer*.....New York
McBrier, D. N., Ball Engine company.....Erie, Pa.
McBrier, Jr., D. N.....Erie, Pa.
McConnell, W. J., American Electrical Manufacturing company.....St. Louis
McCoubray, Thomas, Tucker Electrical Construction company.....New York
McDonald, L., Duquesne Electric company..Duquesne, Pa.
McDonald, W. B., Calumet Gas company.....Chicago
McDonough, T. P.....Cleveland, O.
MacFadden, Carl K., Notting Electric company.....Chicago
McGhie, J. H., General Electric company.....New York
McGill, J. H., Peru Electrical Manufacturing company.....Peru, Ind.
McGraw, F. H., Pennsylvania Industrial Reformatory.....Huntingdon, Pa.
McIntire, C. H., The C. McIntire Co.....Newark, N. J.
McIntire, Mrs. C. H.....Newark, N. J.
McIntyre, J. D., Electric Engineering & Supply company.....Syracuse, N. Y.
McIntyre, Mrs. J. D.....Syracuse, N. Y.
McKnight, E. H., Middletown Electric Light & Power company.....Middletown, O.
McKnight, F. H., Electric Light company.....Middletown, O.
McKinlock, Geo. A., President Central Electric company.....Chicago
McKinlock, W. H., Metropolitan Electric company....Chicago
McLaren, P. M., Abendroth & Root Manufacturing company, New York
MacLeod, W. S.....Washington, D. C.
McQuaide, J. P., National Conduit Manufacturing company, New York
Melton, A. H., Brush Electric company.....Cleveland, O.
Mershon, R. D., Westinghouse Electric & Manufacturing company.....Pittsburg
Millett, C. W., Dolgeville Electric Light & Power company..Dolgeville, N. Y.
Millett, Mrs. C. W.....Dolgeville, N. Y.
Mix, E. W., Cie. Francaise Tomson-Houston.....Paris
Moore, A. T., Walker Manufacturing company..Buffalo, N. Y.
Morris, Elmer P.....Indianapolis
Morris, Wm. L., J. F. Randall & Co.....Cleveland, O.
Morse, S. F. B., S. F. B. Morse & Co.....Chicago
Mnirhead, James G., Batesville Electric company.....Batesville, Ind.
Munder, C. F., Bryan-Marsh Co.....New York
Murphy M., Second Avenue Railroad company..Pittsburg, Pa.
Mnstard, A. H., Washington Power company..Pittsburg, Pa.
Mustard, John, Wagner Electric Manufacturing company.....Philadelphia, Pa.
Myers, George M.....Kansas City, Mo.
Myers, Mrs. George M.....Kansas City, Mo.

Nahm, Louis, American Electrical Manufactnring company.....St. Louis Mo.
Nash, E. L., Swan Lamp Manufacturing company.....Cleveland, O.
Nashold, E., Nashold Cleat company.....Chicago
Newton, C. E., Jewell Belting company.....Hartford, Conn.
Nicholls, Frederic, Toronto Incandescent Electric Light company.....Toronto, Canada
Nold, L. S.....Schenectady
Nunn, P. N., San Miguel Construction & Mining company.....Telluride, Colo.
Nunn, Paul N., San Miguel General Mining company.....Telluride, Colo.

O'Dea, Thomas, Edison Electric Light & Power company.....Erie, Pa,
Osborne, W. F., WESTERN ELECTRICIAN.....New York.
Outwater, J. F., Edison Electric Illuminating company.....Brooklyn, N. Y.

Pabst, A., Mahoning Electric Light company..Youngstown, O.
Packard, W. D., New York & Ohio company.....Warren, O.
Packark, Mrs. W. D.....Warren, O.
Paiste, H. T., H. T. Paiste company.....Philadelphia, Pa.
Partridge, James, Partridge Carbon company....Sandusky, O.
Peck, E. F., Citizens' Electric Illumating company..Brooklyn.
Peck E. H., Citizens' Electric Illuminatiog company.....Brooklyn, N. Y.
Penn, Jerome, Washington Gas & Electric company.....Washington, O.
Perry, F. L., WESTERN ELECTRICIAN.....Chicago
Perry, Nelson W., *Electricity*.....New York
Phelps, George M., *Electrical Engineer*.....New York
Phipps, E. H., Connecticut Pipe Manufacturing company.....New Haven, Conn.
Powers, E. L., *Electrical Industries*.....Chicago
Purinton, A. J., Stamford Gas & Electrical company.....Stamford, Conn.
Pentz, James A., U. S. Electric Light company.....Philadelphia, Pa.
Perry, Nelson W., *Electricity*.....New York
Perry, J. C., Indianapolis Light & Power company.....Indianapolis, Ind.
Phelps, Geo. M., *Electrical Engineer*.....New York
Phipps, C. W., Brush Electric company.....Cleveland
Poole, Cecil P., *Electrical World*.....New York
Porter, George F., Secretary N. E. L. A.....New York.
Possons, N. S., Universal Electric company.....Cleveland, O.
Pratt, H. T., Washburn & Moen Manufacturing company.....Worcester, Mass.
Prentiss, I. R., Brush Electric company.....Cleveland
Prentiss, S. H., Manhattan General Construction company..New York
Price, Charles R., New Bedford Gas & Edison Light company.....New Bedford, Mass.
Purinton, A. J., Stamford Gas and Electric company.....Stamford, Conn.
Pyle, J. E.....West Chester, Pa.

Randolph, R. J., Excelsior Electric company.....Chicago
Redman, George A., Brush Electric Light company.....Rochester, N. Y.
Redman, Mrs. George A.....Rochester, N. Y.
Remington, W. A., *Electrical Industries*.....Chicago
Renehan, J. J.....New Britain, Conn.
Rhette, J. E., Salem Electric Light & Power company.....Salem, Ind.
Richardson, Jr., S. O., Libbey Glass company.....Toledo, O.
Richmond, C. T., Thomson-Houston Carbon company.....Fremont, O.
Riggs, C. D., Electric Engineering & Snpply company.....Syracnse, N. Y.
Ritchie, James, Manufacturers' Electric company.....Philadelphia, Pa.
Roberts, C. A., Electric Belt company.....Sandusky, O.
Roberts, E. P.....Cleveland
Rodman, Charles E., Globe Carbon company..Ravenna, O.
Rogers, L. H., Brnsh Electric company.....Cleveland
Rogers, W. S., Brush Electric compay.....Cleveland
Root, S. N., Partridge Carbon company.....Sandnsky, O.
Rossman, James G., Georgia Electric Light company.....Atlanta, Ga.
Royce, Fred W.....Washington, D. C.
Rutherford, P. F., Westinghouse Electric & Mannfacturing company.....Pittsburg
Sachs, Joseph, electrical engineer.....New York
Sanderson, E. N., Westinghouse Electric & Mannfacturing pany.....Boston
Scheible, Albert, "George Cutter".....Chicago
Schmidt, Emil G., Sandusky Electric Light company.....Sandnsky, O.
Schuyler, H. P., General Electric company..Schenectady, N. Y.
Scott, C. F., Westinghouse Electric & Manufacturing company.....Pittsburg
Searing, George S., Hart & Hegeman Manufacturing company.....Chicago
Searles, A. L., Electric Selector & Signal company..New York
Searles, A. M., Diamond Electric company.....Peoria, Ill.
Seely, John A., Complete Electrical Construction company..New York
Seymour, J. Alward, McIntosh, Seymour & Co., Auburn, N. Y.
Shain, Charles D., manufacturers' agent.....New York
Shainwald, J. C., Standard Paint company.....Chicago
Shaw, A. C., *Electrical Engineer*.....Boston
Shay, J. H.....Chicago
Shay, M. D., Raymond Disinfection company....Cleveland, O.
Shepard, Irwin.....Winona, Minn.
Shippy, H. L., John A. Roebling's Sons Co.....New York
Short, S. H.....Cleveland, O.
Shute, H. D., Westinghouse Electric & Mannfacturing company.....Pittsburg
Sloat, Frank J. J.....Sandusky, O.
Smith, C. D., National Carbon company.....Cleveland, O.
Smith, F. S., Westinghouse Electric & Manufacuring company.....Pittsburg
Smith, George L.....
Smith, Harrison J., Edison Electric Illuminating company.....New York
Smith, Mrs. Harrison J.....New York
Smith, Mrs. H. J.....
Smith, J. Brodie, Manchester Electric Light company.....Manchester, N. H.
Smith, R. B., Belknap Motor company.....Philadelphia, Pa.
Smith, T. Carpenter, Keystone Light & Power company.....Philadelphia, Pa.
Spencer, Lieut. E. J., Safety Insulated Wire & Cable company.....St. Louis
Spencer, Thomas, Helios Electric company...Philadelphia, Pa.
Stearnes, R. S., Cincinnati General Electric company.....
Steinmetz, Chas. P., General Electric company.....Schenectady, N. Y.
Stetson, George R., New Bedford Gas & Edison Light company.....New Bedford, Mass.
Stieringer, Luther.....New York
Stine, Prof. W. M., Armour Institute.....Chicago
Stump, Clarence E., Columbian Equipment company, *Street Railway Gazette*.....New York
Sullivan, M. A., Charles A. Schieren & Co.....Chicago
Sullivan, M. J., *Electrical World*.....Chicago
Sullivan, Mrs. M. J.....Chicago
Sunny, R. E., General Electric company.....Chicago
Swaney, F. R., Ceramic City Light company. East Liverpool, O.
Swetland, H. M., *Power*.....New York

Taltavall, J. B., *Electrical Age*.....New York
Tandy, L. D., General Electric company....Schenectady, N. Y.
Tate, H. F., National Conduit Manufacturing company.....Chicago
Taylor, J. W.....Peterboro, Canada
Terry, F. S., Sunbeam Lamp Manufacturing company, Chicago
Thayer, William Curtis.....Cleveland, O.
Thomas, Prof. B. F., Ohio State University.....Columbus, O.
Thomson, Elihu, General Electric company, Swampscott, Mass.
Th esher, A. K., Shawhan-Thresher Electric company. Dayton, O
Thullen, L. H.....Leetonia, O.
Thullen, J. C.....Leetonia, O.
Toil, Edward C., Sterling Cycle Works.....Chicago, Ill.
Tolles, C. L., Jewell Belting company...Hartford, Conn.
Townley Calvert, Westinghouse Electric & Manufacturing company.....Pittsburg
Turner, Alfred.....Rutland, Vt.
Turner, Oscar C., Georgia Electric Light company.....Atlanta, Ga.

Ullman, J., Meridian Gas Light company...Birmingham, Ala.
Uptegraff, J. M., Sewickley Electric company...Allegheny, Pa.
Urqnhart, D. F., Thomson-Houston Carbon compaoy.....Boston, Mass.

Van Trump, C. R., Wilmington City Electric company.....Wilmington, Del.

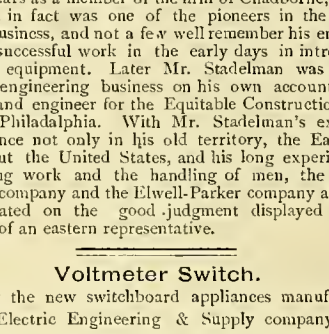
Wade, E. E., El Paso Electric company, Colorado Springs, Colo.
Wallace, J. B., Wallace Electric company.....Chicago
Walter, H. H., American Carbon company.....New York City
Walton, Allyn B., "W. C. Thayer,".....Cleveland, O.
Washington, L. W., Washington Carbon company.....Pittsburg, Pa.
Waymire, E. O., Dayton Fan & Motor company.....Dayton, O.
Wehrly, E. J., Arbnckle, Ryan & Co.....Toledo, O.
Weierbach, William, Standard Paint company.....New York
Welch, J. W., New York Central Railroad.....New York
Wells, C. J., Electric Appliance company.....Chicago
Welscher, F. H., Citizens' Electric company.....Battle Creek, Mich.
Weithas, R. L., *Electrical World*.....New York
Whalen, John B., J. B. Whalen & Co., W. P. Wire.....Sycamore, Ill.
Wheeler, S. Bowman, Morris, Tasker & Co...Philadelphia, Pa.
White, C. P.....Evansville, Ind.
Whipple, Bailey S., Buckeye Electric company. Cleveland, O.
Wilberg, C. A., Fort Wayne Electric corporation.....Philadelphia, Pa.
Wiley, George L., Standard Underground Cable company.....New York
Wilkins, E. Ward, Partrick & Carter company.....Philadelphia, Pa.
Wilkinson, E. T.....Philadelphia, Pa.
Williams, F. A., Safety Insulated Wire & Cabla company.....New York
Wilson, Charles E. Ft. Wayne Electric corporation...Chicago
Wilson, Jas. S., American Circular Loom company.....Boston, Mass.
Wilmerding, C. H., Chicago Edison company.....Chicago
Wintner, St. Louis, Brooklyn Electric Mannfacturing company.....New York
Wirt, H. C.....Schenectady, N. Y.
Wise, Jacob, Akron General Electric company...Akron, O.
Wise, Stuart M., Manhattan General Construction company..New York
Wolff, J., New York Insulated Wire company.....Chicago
Wood, E. E., *Electrical Industries*.....New York
Wood. M. M.....Chicago
Woodbury, C. J. H., American Bell Telephone company.....Boston, Mass.
Wright, C. F., Eberhard & Wright.....Cleveland, O.
Wright, Peter, United Gas Improvement company.....Philadelphia, Pa.
Wurts, A. J., Westinghouse Electric & Manufacturing company.....Pittsburg
Yawkey, W. H., Cummings & Engelman Conduit company, Detroit
Young, E. P., Sewickley Electric company.....Sewickley, Pa.
Young, Mrs. E. P.....Sewickley, Pa.
Young, Richard, Faraday Heat, Light & Power company.....Morton, Pa.
Young, S. Marsh, Manhattan General Construction company, New York

## Mr. Stadelman's Appointment.

The many friends of W. A. Stadelman of Philadelphia will be pleased to learn that he has once more entered the electrical field and this time in a way that will not only make him a most prominent factor in eastern electrical and mechanical circles but also afford him a splendid opportunity to add to a business record that is already one to be envied. As is well known to the majority of heavy tool and machinery men in the United States and Canada, Mr. Stadelman has been with the Niles Tool Works company of Hamilton, O., for the last three years as manager of that company's Pittsburg branch, and his excellent work for his house is too well known to need mention here. On March 1st, however, he severed his relations with the Niles Tool Works to assume the management of the eastern business of the Brown Hoisting & Conveying Machine company of Cleveland and the Elwell-Parker Electric company of America, under the title of general eastern manager. Mr. Stadelman's offices will probably be in the Central Railroad building or Havemeyer building, New York. Old electric railway and power men will recall the fact that Mr. Stadelman was with the Sprague Electric company for three or four years as a member of the firm of Chadborne, Hazelton & Co. in fact was one of the pioneers in the electric railway business, and not a few well remember his energetic and very successful work in the early days in introducing electrical equipment. Later Mr. Stadelman was in the electrical engineering business on his own account, being manager and engineer for the Equitable Construction company of Philadalphia. With Mr. Stadelman's extensive acquaintance not only in his old territory, the East, but throughout the United States, and his long experience in engineering work and the handling of men, the Brown Hoisting company and the Elwell-Parker company are to be congratulated on the good judgment displayed in the selection of an eastern representative.

## Voltmeter Switch.

Among the new switchboard appliances manufactured by the Electric Engineering & Supply company, Syracuse, N. Y., is that of a voltmeter switch, shown in the accompanying cut, and described in brief as follows: From the front of the switchboard nothing is visible but a two and one-half inch dial plate, similar to that of a safe lock, and upon which are numbered graduations corresponding to the respective number of circuits. A movable dial, carrying a pointer, is rigidly fastened to a fiber or hard rubber



VOLTEMETER SWITCH.

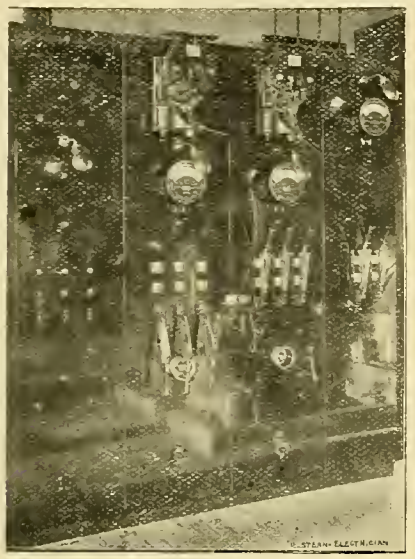
crossbar that sweeps over the surface of the switch base. It will be noted that there are two metallic rings embedded in the base. To these the voltmeter leads are electrically connected. The line contact points are spaced around the outer edge of the base. All wire connection of contact points and both rings radiate from the edge of the base, the connector of the inner ring being insulated by a hard rubber tube where it passes through the outer ring. The crossbar carries on each radius a pair of plungers, connected together in pairs with fuse wire, held under thumb nuts, to protect the voltmeter against possible rise in potential. This combination completes the circuit between the voltmeter and the lines terminating in the diametrically opposite contact points, upon which the outside plungers rest. The standard size of switch is adjustable to boards varying in thickness from three-fourths to an inch and five-eighths. To eliminate accidental short-circuiting of contact points, because of wiping of plungers over the base, two cuts are made in the base between each pair of contacts and in the path of the plungers. The chief merit of this switch is that it is compact and self-contained, the only labor necessary in applying it to a switchboard being that of boring an inch hole, screwing the parts together and making the electrical connections at the back of the board.

## American Institute of Electrical Engineers.

It is announced that the paper entitled "Notes on Recent Engineering Developments in France and England," which was prepared by H. Ward Leonard, to be read Wednesday evening at the Institute meeting, will deal with rotary transformers, the Parsons steam turbine, the Loval steam turbine, English and French central stations and the Heilmann locomotive. This paper is based upon personal observations of the author during several months abroad, which were devoted to examination of electrical conduction and shop practice. Mr. Leonard is a keen observer, an experienced engineer and an entertaining writer and his paper will doubtless be an important contribution to the proceedings of the Institute.

## Railway Switchboard.

An example of high class construction work in railway switchboard is shown in the accompanying illustration, representing a new board built by J. Grant High & Co., Philadelphia, for the Roxboro Inclined Street Railway company and installed in the power house at Shawmount, Pa. This board is made up of four panels of black



RAILWAY SWITCHBOARD.

enameled slate, one inch thick, eight feet high and 20 inches wide. It is fitted with eight 400 ampere single pole Eyanson quick-break switches, and one 30 ampere field switch; on the top of the board are two General Electric circuit breakers, two Weston ammeters and one Weston voltmeter, with four pilot lamps, while on the bottom of the board there are two Westinghouse lightning arresters, and on the back two Carpenter enamel rheostats, with the dial on the face of the board. This board is fairly repre-

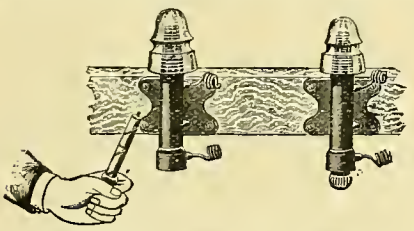


FIG. 2. NEW WAGNER TRANSFORMER.

sentative of the standard type of construction adopted by this company, and the universal approval with which it has been received indicates that the board fills the requirements.

## Utica Specialties.

The Utica Electrical Manufacturing company of Utica, N. Y., is placing on the market two excellent specialities in the form of an arc light knife switch and a fuse box. These devices are illustrated in the accompanying cuts. Fig. 1.

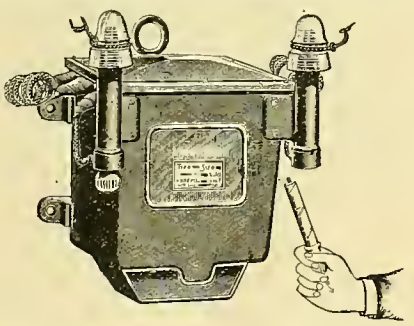


FIG. 1. NEW WAGNER TRANSFORMER.

represents the arc light knife switch, which has a carrying capacity of 50 amperes. There are no springs in this switch to break, and the company claims for it unusual reliability The fuse box, shown in Fig. 2, is made both single and double pole, and its special features will be readily seen by reference to the accompanying cut.

## Loomis Multipolar Generator.

The accompanying cut illustrates a 43 kilowatt generator, built for the *Kansas City Journal*, by the American Engine company of Bound Brook, N. J. The machine was designed by Osborn P. Loomis, and at 550 revolutions develops 350 amperes at 125 volts. It has a slotted armature. The frame is of cast-iron, made in one piece without joint. The series and shunt coils are all removable. The journalls self-niling, and are constructed of Hecla bronze sleeves, which do not cut the shaft, even if accidentally heated. The series coils are made of copper strips, 80 mils in area and 2¾ inches wide.

## Gate City Soldering Furnace.

The device illustrated is called the Gate City soldering furnace, owing to the fact that it was invented in the "Gate City to the Black Hills," Rapid City, S. D. It is designed

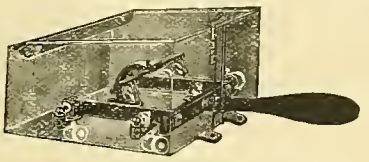
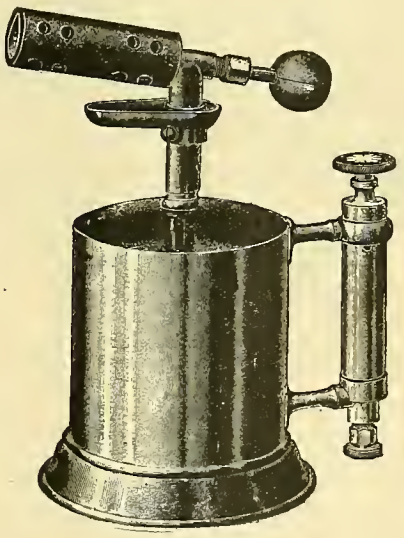


FIG. 1. UTICA SPECIALTIES.

for use by conduit, electric light and telephone workers. It is a gasoline stove or furnace that can be used readily out of doors in any kind of weather. It can be regulated to almost any degree of heat and can be used for melting pots of lead or paraffine, for heating soldering irons or for heating joints in piping. The burner is unique and simple in design, being a perfect mixer as well as burner, thus insuring complete combustion and no odor. It is also noiseless and has a fixed pump, which is a great advantage over the old-fashioned bulbs. It is claimed to effect a great saving of fuel, which appeals directly to the contractor. Cornice makers are adopting it, and they say that it enables them to use gasoline on roofs for the first time. It is giving general satisfaction in all branches of trade where such a device can be used. Nicholas & Barr of 28 West Washington street, Chicago, are putting this furnace on the market.

## Imperial Blow Pipe.

The accompanying cut illustrates the White Manufacturing company's imperial hot blast blow pipe for gasoline. The claims made for this device by the makers are that the burner has a generator of great strength; that it can be regulated to furnish any size flame by a simple turn of the knob, and that it will burn four hours; that it gives a hotter blast than any other where needed, hence does quicker work; that it has renewable seat for needle valve, which when worn out, can be easily and cheaply replaced; that the reservoir is made of one piece of specially rolled brass, rendering it leak-proof; that it is one-third lighter in weight than others, while fully as strong and more easily handled; that the air valve is at the bottom of the pump, conveniently placed,



IMPERIAL BLOW PIPE.

thus dispensing with the various outside tubes and trappings encumbering other torches, and the pump is simplicity itself, supplies a stronger blast than any other and drains every drop of gasoline. All joints are re-inforced and packed.

In short, the "Imperial" is convenient, durable, reliable and safe and adapted to a hundred purposes. It is a complete tool for soldering, brazing, burning paint, melting metals, heating soldering coppers, frozen pipes, heavy soldered joints. The company is located in Chicago.

## New Wagner Transformer.

One of the most attractive exhibits at the Cleveland convention last week was that made by the Wagner Electric Manufacturing company of St. Louis. This display is described elsewhere in this issue, but the new type D transformer deserves more than passing mention, as it formed

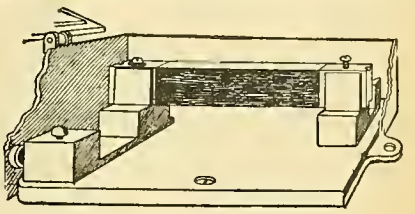
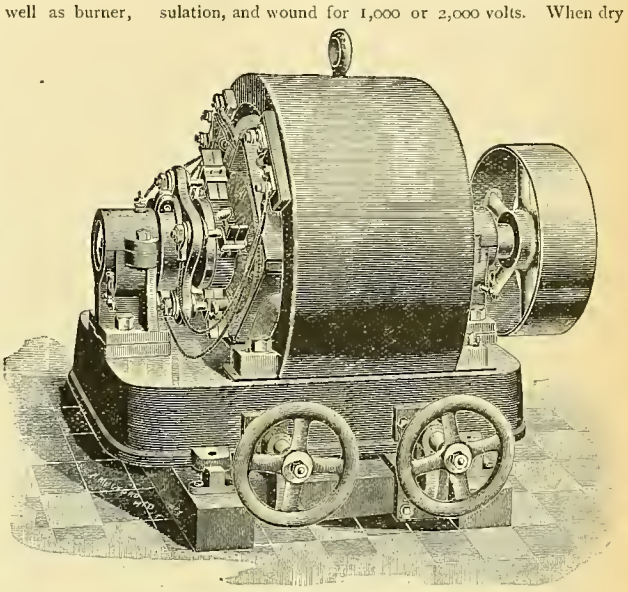


FIG. 2. UTICA SPECIALTIES.

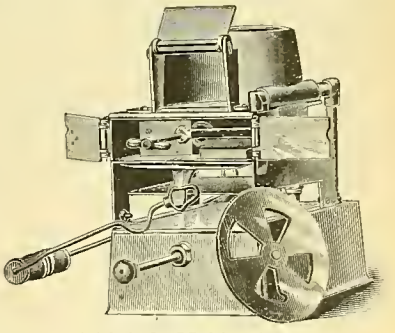
the central feature of the exhibit. Central station men were very much interested in this new transformer, which possesses many novel features. The general appearance is shown in Fig. 1. It is a modification of the company's type C, with several improvements. It is furnished with oil insulation, and wound for 1,000 or 2,000 volts. When dry



LOOMIS MULTIPOLAR GENERATOR.

insulation is preferred the same transformer is made, the only departure being in having the box ventilated instead of oil tight.

The difficulties attending the use of primary fuse cut-outs in the transformer box have led some manufactures to entirely abandon them as it seemed impossible to design a fuse block which would not arc at times when the fuse blew. This arc would in turn cause a short-circuit between the two blocks, and usually burn out the whole cut-out as well as the transformer. In the present arrangement



GATE CITY SOLDERING FURNACE.

these objections have been overcome. The fuses can be readily replaced without tools of any kind, as there is no cover or lid to remove or raise in order to reach them. The end of the plug extends below the protecting shell, and three or four turns of this knobbed end releases the plug, which may then be withdrawn. The transformer is provided with cross-arm and wall hooks to be bolted to the transformer lugs, and brackets for service wire attachments are also fixed to the box. By this arrangement a combination of transformer, box, primary fuses and service wire brackets is secured in one compact piece, as shown in Fig. 1. For use with transformers placed inside of buildings and for any other purposes desired, the combination cut-out brackets are made separate, as shown in Fig 2.

## BUSINESS.

J. Grant High & Co. of Philadelphia have recently installed several large switchboards for electric railway plants and in every instance complete satisfaction has been given. At the present time the company is building a large board for the Pikesville, Rochester & Emory Grove Railroad company, Baltimore.

The Syracuse Storage Battery company is now prepared to place its system of electric lighting in private residences and public buildings. Already a number of plants have been put in operation, and the success attained has been most satisfactory, both to the company and its patrons. A plant will soon be placed in the building of Dey Bros. & Co. and will be one of the most extensive in the country. This is but one of several plants now in operation or course of construction in Syracuse. C. L. Pack, secretary of the company, announces that the company will engage in street railway work and that it is now prepared to equip cars for commercial work. The company has a number of testimonials from persons and firms that have had experience with its batteries.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

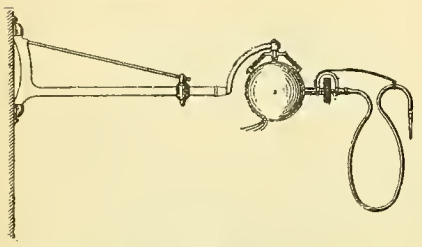
*Issued February 19, 1895.*

534,269. Electric Light Switch. Harry W. Lawrence, Denver, Colo. Application filed May 31, 1894,

The first claim reads as follows: The combination in a switch of a base provided with resilient contact terminals adapted to engage the teeth of a ratchet cylinder, having its teeth divided by one or more collars interposed between the said contact terminals, and every other tooth of which is provided with a conductor passing through the said collars, and adapted by resilient contact with said terminals to close the circuit, and a push-button and mechanism for imparting therewith to said ratchet cylinder a predetermined partial rotative motion.

534,281. Electric Current Distributing System. Geo. B. Pennock, Boston, Mass. Application filed June 1, 1894.

The combination is claimed of an electric source, a voltage distributer comprising a rotary member provided with a conductive segment, and a member provided with a number of contact brushes disposed in position for contact with said segment during the rotation of said rotary member, separate consuming circuits connected with said brushes, a negative pole step-back comprising a member provided with brushes, to which said consuming circuits are connected, and a rotary member provided with a contact segment adapted for contact with said brushes, and conductors connecting said source with the voltage distributor and step-back.



NO. 534,374.

534,288. Magneto-electric Machine. Henry J. Smith, Pompton Lakes, N. J. Application filed June 8, 1894.

In a dynamo-magneto electric machine there is the combination with the armature-operating device, and a switch located relatively to the armature-operating device to have mechanical connection established with and to be actuated by the movement to rotate the armature of the operating device, and adapted to pass the developed current from the circuit in the machine in which the current is generated and condensed to an outside or working circuit by the mechanical connection of the device with the switch of an additional switch or switches, terminal or terminals, one or more, adapted to successively pass the current from the first working circuit to an additional independent working circuit or circuits, one or more, and located to have electrical contact successively established with the first switch and with each other by a continuance of the movement of the armature-operating device before the potentiality successively imparted by the current to the ignitible devices interposed respectively in the several circuits is exhausted.

534,289. Art of Blasting. Henry J. Smith, Pompton Lakes, N. J. Application filed June 8, 1894.

The improvement in the art of blasting described consists in locating blast holes in the rock, or other material to be dislodged, at progressively increasing distances successively from the surface or outward face of the rock wall, constituting a series of independent electric circuits, extending severally from an electrical generator to the blast holes respectively with the fuse or other ignitible devices of the blasting charges in the several holes, interposed in the circuits respectively, and causing a single electric current to successively traverse the several circuits before the potentiality thereby imparted successively to the blasting charges, interposed in the several circuits, is therein respectively exhausted, whereby the blasting charges in the holes nearest to the rock surface may be initially fired, and the charges in the holes which are progressively farther distant from the rock surface may be subsequently successively fired.

534,318. Electric Winding and Synchronizing Device for Clocks. Charles M. Crook, Chicago, Ill. Application filed June 23, 1894.

This combination comprises a train and a mechanical motor for the same and winding mechanism therefor, a fixed electro-magnet having its poles in juxtaposition, a vibrating armature for such magnet connected to the winding devices and operating the same by its vibration, the armature comprising a portion adapted to pass between the poles of the magnet, and a portion rigid with the first portion and extending beyond it at the ends in position to pass the ends of the poles as the armature vibrates.

534,319. Electric Clock Synchronizer. Charles M. Crook, Chicago, Ill. Application filed July 2, 1894.

The last claim follows: In a clock, in combination with the driving train, having the shafts which carry the minute and second hands and all the shafts of the intermediate wheels of the train protruded through the forward frame plate, a similar train of gears mounted loosely on the protruding shafts in front of the frame, the minute and second hands connected to and carried by the proper wheels of such loosely mounted train, one or more of the wheels of said train being frictionally connected to the shaft on which it is loosely mounted, whereby the loosely mounted train is frictionally driven by the main train and adapted to be operated independently thereof to set the hands.

534,320. Electric Winding Mechanism for Clocks. Charles M. Crook, Chicago, Ill. Application filed December 15, 1894.

A winding-up shaft, drum or barrel, a lever pivoted concentrically therewith, and a pawl and ratchet device by which it rotates the shaft, drum or barrel, the lever being provided with a cam track eccentric to the shaft, the electro-magnet and its armature and the lever which carries the latter having an abutment adapted to engage the cam track at the inner point of the latter when the armature is remote from the magnet, and to sweep across the eccentricity of the cam track as the armature approaches the magnet, the angular extent of the cam track being greater than the angular movement of the abutment-carrying lever which is measured by the eccentricity of the cam track.

534,330. Electric Bell. William A. Harvey, Scranton, Pa. Application filed October 19, 1894.

In this signaling apparatus there are a plate of magnetic material, two projections thereon, an electro-magnet supported at one extremity of its core upon one of the projections and free to vibrate, and having the opposite end of its core extending in front of the other projection, and a spring carried by the magnet for alternately opening and closing circuit through its coil.

534,359. Switch Device for Telephone Circuits. Charles Clamond, Paris, France. Application filed July 5, 1894.

In a telephonic system comprising a transmitter, a receiver, an alarm, a suitable alarm and speaking circuit, the combination is claimed of a movable switch mounted within the receiving casing and in permanent connection with the line wire, the switch being adapted in its normal position to establish the speaking circuit only, and when shifted to break the speaking circuit and present a terminal for contact with the alarm circuit, a rigid support in electrical connection with the alarm circuit, and means whereby engagement between the receiver and the support forces the switch to break the speaking circuit and establishes connection between said arm and said terminal.

534,364. Signaling System. William E. Decrow, Boston, Mass. Application filed December 31, 1892.

A local circuit including a bell, a short-circuiting loop shunting the bell at the receiving station, a train controlling the loop and a magnet for releasing the train by two movements of its armature, the releasing magnet being included in the local circuit which may or may not be closed through the bell when a signal is received, are the features of the invention.

534,373. Telephone and Signaling Circuit. Frank A. Pickernell, Newark, N. J. Application filed May 3, 1894.

This system comprises a trunk line extending between two stations, and having two conductors adapted to form portions of the going and return conductors of a metallic conversation circuit, means at the terminals of the trunk line for connecting them at will with any subscriber's station, an independent instruction circuit including operator's telephones, and an independent signaling circuit including suitable signal sending and receiving devices, the two conductors of the trunk line constituting jointly the main line or direct conductor of the instruction and signaling circuits.

534,374. Electrical Apparatus for Operating Dental Implements. Oscar H. Pieper and Alphonse F. Pieper, San José, Cal. Application filed April 30, 1894.

The apparatus illustrated comprises an adjustable supporting ring or main frame, to which the elements of the motive apparatus are attached, the ring or frame made in two parts, separable at the center without disconnecting any of the contained parts therein, so as to permit convenient adjustment or repairs of the contained mechanism,

534,405. Electric Signaling Apparatus. Jonathan D. Price, Chicago, Ill. Application filed May 5, 1894.

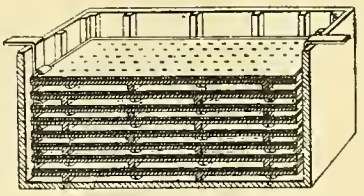
In an electric signaling apparatus a signaling device in circuit with an electric current generator, and a receiving instrument on the main line, contact-making and breaking means between the signaling device circuit and the main line circuit, and primary actuating means controllably connected with the contact-making and breaking means, and operating by pressure in one direction successively to break the shunt around the generator, excite the generator to operate the signal, open the generator and signal circuit and close the receiver circuit, and by release of the pressure successively to open the receiver circuit, close the signal circuit and actuate the signal.

534,411. Trolley Wire Support. Marmaduke F. Van Buren, Philadelphia, Pa. Application filed October 5, 1894.

Claim 1: In a trolley wire support, the combination of the U-shaped hanger provided with the screw threaded lug, the nut and the clamping piece fitting into the U-shaped hanger, and having on the under side an opening for the reception of the enlarged or bent-up ends of the trolley wires.

534,424. Reflector for Arc Lamps. Carl Coerper, Cologne, Germany. Application filed May 15, 1894.

In the lamp there is a central main reflector supported within the globe by the supporting rods of the carbons in connection with an annular auxiliary sectional reflector surrounding the central reflector and located within the globe of the lamp.



NO. 534,603.

534,475. Conduit Electric Railway System. William L. Hedenberg, New York, N. Y. Application filed June 5, 1894.

Two separate parallel conduits are provided, one closed and the other having an opening or slot. There are a main conductor in the closed conduit and sectional conductors or plates over the closed conduit, a circuit closer in the closed conduit to make electrical connection between the main conductor and the sectional conductors or plates, and mechanism in the open conduit for operating the circuit closer to close the circuit between the main conductor and the sectional conductors or plates.

534,481. Electric Rotary and Revolnble Air Circulating Fan. Sherman M. Pierce, Kansas City, Mo. Application filed October 20, 1894.

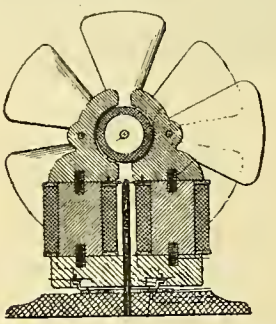
The cut shows a rotatory and revolnble air circulating fan. The features of the combination are a motor, a pivot support on which the motor revolves, a fan wheel rotatable with the motor armature or rotatable part or shaft of the motor, and a propeller vane fixed to revolve with the motor and fan wheel, and located within the current of air flowing toward or leading to the fan wheel, whereby the current of air is made to revolve the propeller vane, the motor and fan wheel.

534,495. Conduit Electric Railway. Octavus Cohen, New York, N. Y. Application filed May 15, 1894.

A rail section having an exteriorly opening and upwardly extending groove below its tread and wheel engaging flange, an upwardly inclined bracket in the groove for supporting a line wire, a further rail section, both sections having irregular and vertically disposed interlocking faces, and means for securing both sections together to form a single rail.

534,519. Conduit Electric Railway. Alfred Rosenholz, San Francisco, Cal. Application filed May 22, 1894.

A conduit electric railway having the slotted tube or tunnel, a main insulated conducting wire extending from the source of power parallel with the tube or tunnel, having branch wires permanently connected therewith and extending therefrom into the tube or tunnel at intervals, a wire made up of independent sections extending continuously through the tube or tunnel, a sectional insulating coupling between the sections of wire, having the ends of the wire fitted therein, tilting switch mechanism to which the wire is suspended, and movable devices whereby electric current is transferred from the main conductor to each of these sections successively during the passage over the section.



NO. 534,481.

534,536. Electrically Operated Dental Engine. William E. Wheeler, Dayton, Tenn. Application filed October 6, 1893.

The combination includes the armature shaft of a motor, having a friction wheel with a plane face, an insulated arm held on the motor to swing laterally over the friction wheel, the arm being held spring-pressed toward such wheel, the drill shaft journaled in the arm, and a friction wheel on such shaft having a rubber rim, said wheel being held in contact with the armature friction wheel.

534,547. Telephonic Apparatus. Norval L. Burchell, Washington, D. C. Application filed September 20, 1894.

The first claim is as follows: In a telephone, a pivoted arm adapted to vibrate in a vertical plane and provided with a supporting arm extended in the same axial line, and having a lateral bracket arm carrying the transmitter, and a support for the receiver at or near the end of the supporting arm, the latter being capable of a limited rotary or swiveling movement upon its own axis to shift the transmitter to either side of the supporting arm, and to give a corresponding adjustment to the receiver, whereby the latter may be applied to either ear.

534,595. Electrical Alarm or Bell. George F. Atwood, Orange, and Jonas W. Aylsworth, Newark, N. J. Application filed May 28, 1894.

This is an electric trembler or tap bell having a carbon resistance connected in series with the energizing coil or coils of the actuating magnet, and wound about the core or cores thereof in combination with means for closing the circuit through the carbon resistance and around the energizing coil or coils.

534,596. Electrical Conductor. George F. Atwood, Orange, and Jonas W. Aylsworth, Newark, N. J. Application filed May 28, 1894.

A flexible carbon conductor surrounded with a flexible coating of insulating material.

534,597. Electrical Alarm for Street Cars. George F. Atwood, Orange, Jonas W. Aylsworth, Newark, and Walter H. Miller, Orange, N. J. Application filed May 28, 1894.

This device is intended for regulating the speed of the car, and includes an electrical alarm having two sets of circuit connections with the speed regulating mechanism, the circuit connections being such that when the speed regulating mechanism is turned in one direction a moderate alarm is sounded, and when turned in the other direction a loud alarm is sounded, and when left in a central position no alarm is sounded.

534,603. Storage Battery. George A. Ford, Cleveland, O. Application filed August 11, 1894.

The battery illustrated consists of a series of porous non-conducting pans, active material applied to the inner surface of the pans, an open work conductor spread upon the active material in each pan, and means between the bottom of each pan and the conductor next beneath to support the pan on the conductor, whereby the weight of the pile is brought onto the conductors, and the pans and conductors constructed over their opposed surfaces to afford a free circulation between the parts and the outside thereof, thereby affording a free escape of gas.

534,605. Trolley Wire Crossing. Charles S. Hersh and Edwin F. Weaver, Philadelphia, Pa. Application filed March 13, 1894.

In a trolley crossing, a bridge having an open base, a rotatable bridge piece supported in said open base, and a pivoted arm on said bridge piece adapted to be engaged by a trolley, and normally standing in position to permit the trolley on a crossing conductor to pass without obstruction.

# Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, MARCH 9, 1895. No. 10


MASSACHUSETTS INSTITUTE OF TECHNOLOGY. DEPARTMENT OF PHYSICS

## Lubricating and Bearing-cooling Devices in the Niagara Falls Power Plant.

By Frank C. Perkins.

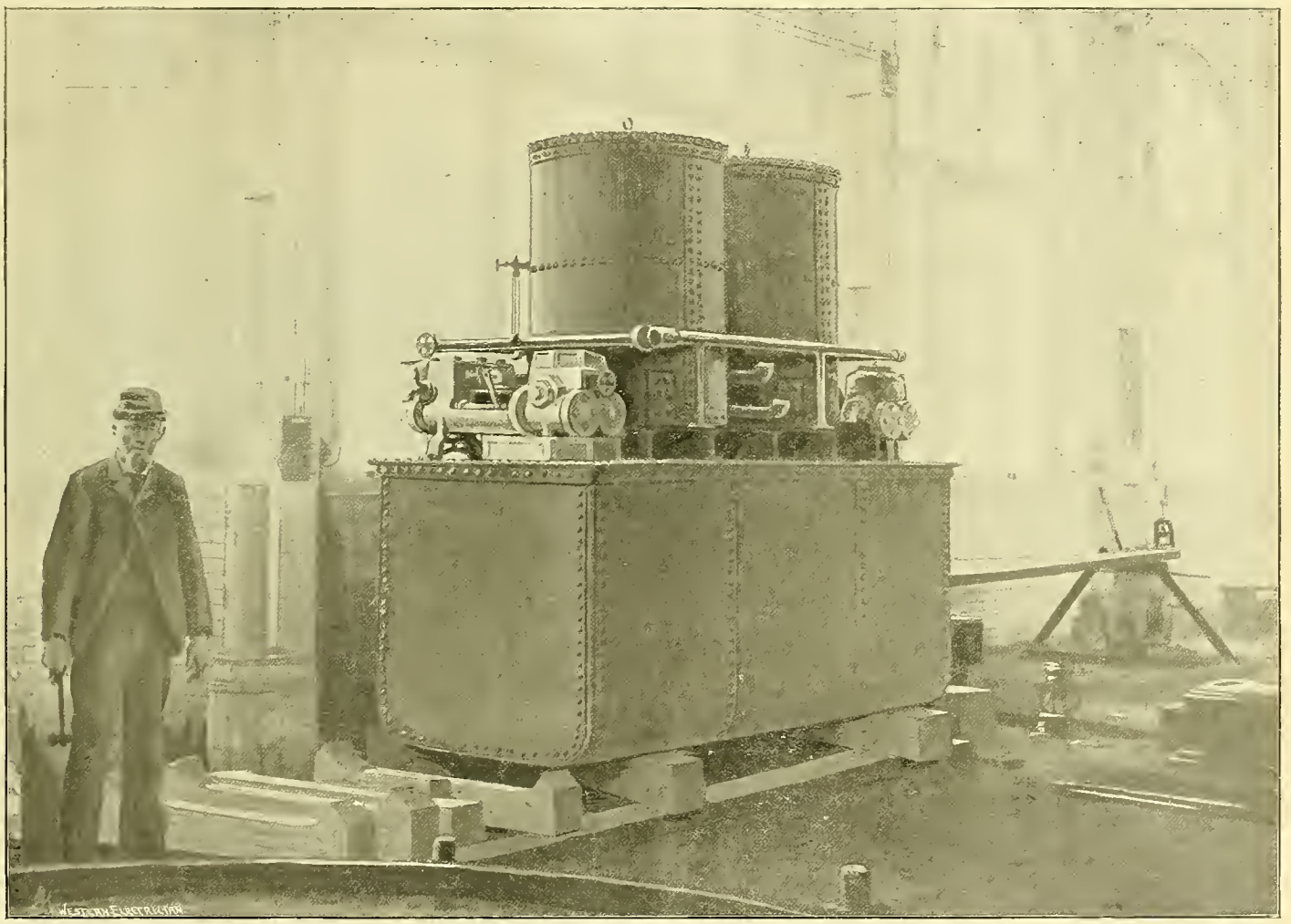
As was stated in my article on "The Niagara Power Plant as It is To-day" in the Western Electrician of February 23d, the lubricating and cooling apparatus for the great turbines and alternators at Niagara Falls is of especial interest. The following brief note in relation to it should be coosidered as supplementing the general data in the former article:

The illustration presented herewith shows the oil tank, with filtering cylinders, oil pumps and pipes placed in position upon it. This piece of machinery is of especial interest, as the lubricating system in the Niagara plant is very novel and complete. The oiling apparatus shown is to be placed at the bottom of the wheel-pit, and the pumps are to be operated by water power, the waste water being collected in the wheel-pit and nsed for this purpose.

There will be placed near the roof of the power house, directly over the door, a large steel tank, which will be filled with clean oil. The tank will hold 200 cubic feet of lubricating oil. Iron pipes will connect this tank with the oil pumps in the wheel-pit and also run from the tank to the dynamo and shaft bearings, although the latter have a separate and independent means of lubrication. After having accomplished its purpose in lubricating the dynamo bearings, the oil is conducted into the filtering cylinders, and, after the dirt has been extracted, the clean oil passes into the tank below the pumps and cylinders. From this tank the pumps force the oil back to the large steel tank above the door, near the roof of the power house. The oil, when it reaches the filters, is first washed by passing through water and then forced through felt, only one filter being used, while the other is held in reserve.

The main shaft bearings have a system of lubrication quite novel and interesting. Each bearing has independent means of lubrication. A cast-iron cup, which is several feet in diameter, is attached to the revolving turbine shaft below the bearing. This cup is filled with clean lubricating oil. A pipe dips into the cup in such a way that as the cup and oil revolve (the pipe remaining stationary) the oil is carried upward to the top of the bearing by the centrifugal force. After thoroughly lubricating the bearing, the oil finds its way back into the revolving cup. In order to supply the cup with clean oil and remove the old oil, it is only necessary to open the various valves of the oil pipes and allow the dirty oil to pass into the filtering apparatus in the bottom of the wheel-pit and let the fresh oil fill the cup from the tank above in the power house.

A very complete system has been devised for cooling the bearings of the dynamos and the turbine shaft bearings, in case the oiling apparatus fails or the bearings become heated from any cause. The upper and lower generator bearings and each separate turbine shaft bearing are provided with separate chambers, which are connected by piping to the mains of the city water works. In case it is found necessary, by opening the proper valves, a current of cold water may be caused to pass through each of the chambers of the bearings, keeping it cool until the faults may be located.



LUBRICATING AND BEARING-COOLING DEVICES IN THE NIAGARA FALLS POWER PLANT.

## Philadelphia's Telephone Scandal.

Every member of the Common Council of Philadelphia who attended the meeting at which the franchise for the Mutual Automatic Telephone company was granted has been examined by the investigating committee on the charge of accepting stock or other consideration.

The only councilmen who materially deviated from the stereotyped "I received no consideration" were Thomas Meehan, a member from the Twenty-second ward, and Fred C. Simon, a Twenty-fifth ward member. Mr. Meehan testified that he did not vote for the ordinance because he was suspicious of it. "When I saw a large number of members flocking in when the bill was called up," he said, "I thought there was some private interests at stake. For this reason and because the debate upon the measure did not satisfy me, I did not vote at all." Mr. Meehan further stated, like the other councilmen, that he did not receive any of the stock of the company, $362,000 worth of which is alleged to have been distributed. Mr. Simon, who is also an attorney, after denying that he had received any consideration for his vote, admitted that he bought six shares of the telephone company's stock from the administrator of the estate of Hugh T. Pigott, the latter being a member of the common council when the ordinance was passed. Mr. Simon declared that he had acted in a professional capacity in so doing and refused to divulge the name of his client. Counselor Etting, who is nominally the prosecutor, suggested that Chairman Roberts of the committee submit to the court, for legal settlement, the question of compelling Mr. Simon to reveal the identity of his client. This the chair-

man, with the concurrence of the committeemen, decided to do. Lawyer Simon supplemented his testimony with a statement that his client was not a councilman or an officer of the Mutual Automatic Telephone company, and that the Pigott administrator, who was a brother of the deceased councilman, was the only person whom he had approached for the purpose of getting the stock.

After the meeting had adjourned Judge Finletter in the Common Pleas Court issued an order directing Mr. Simon to disclose to the investigating committee the name of the person for whom, as an attorney, he purchased six shares of the stock of the Mutual Automatic Telephone company from the administrator of Hugh T. Pigott, a late common councilman. This will, it is believed, have an important bearing upon the investigation of the allegation that $362,000 worth of the stock was distributed among councilmen.

State Senator Charles A. Porter and Republican National Committeeman David Martin were called as witnesses. When the stock registry of the company was recently placed in evidence it was shown that 1,525 shares each were recorded in the names of Messrs. Martin and Porter, and it was to explain this evident ownership that the well-known Republican "bosses" were called. Mr. Martintestified that the stock was placed in his name without his authority; that he never became interested in the company, although the refusal of from 1,000 to 2,000 shares at $10 per share had been given to him, and that he did not assist directly or indirectly in getting the Mutual ordinance through the councils. He said that he was asked in July last by John P. Persch, the treasurer of the concern, to take an interest in the company, and that the stock was then given to him. After consulting with Mr. Porter, however, and also being advised by Thomas H. Martindale, a well-known member of the Trades League, to have nothing to do with the company, Mr. Martindale saying that the patents could not be operated in Pennsylvania, Mr. Martin notified Treasurer Persch that he would not become interested. The witness declared that he had never seen or held any of the stock. The testimony of Senator Porter was largely corroborative of Mr. Martin, except that the use of his name in connection with the company was said to have been brought about by Treasurer Persch asking him to bid for the construction of a telephonic line. The witness, who is a contractor, testified that as the terms mentioned by Treasurer Persch were "partly cash and bonds and stock," he did not entertain the proposition and gave the company no further consideration. Like Mr. Martin, Senator Porter declared that the stock was entered in his name without his knowledge, and that he did not aid in the passage of the ordinance. The witness was also advised by Mr. Martindale to have nothing to do with the company, or he might "get himself into trouble," because of the alleged patent irregularity.

Charles R. Arlen, a Pinkerton detective, related his futile endeavor to engage board at the residence of Mrs. Simmons, where Julian C. Gale made his home, and that Mrs. Simmons told him that Gale had gone away to avoid giving testimony that would be damaging to the telephone company. Gale was employed as a clerk by Persch, and the blocks of stock for alleged distribution were made out in his name.

Charles W. Bergner, whose name appeared as a director of the company, was sworn, and testified that he never was a director. He never held any stock and did not know who held the shares of stock registered in the name of Julian C. Gale.

On February 21st the committee on law of the city councils decided to report favorably to the councils an ordinance repealing the franchise granted to the Mutual Automatic Telephone company. The immediate cause of the committee's decision was that the company had failed to file a bond of $50,000 as provided in the ordinance. Chairman Roberts of the investigating committee told the committee on law that the ordinance alone constitutes 99 per cent. of the company's assets.

## Telephone Litigation.

The Interior Telephone company of New York has issued a circular announcing that on February 12th it commenced suit in the United States Circuit Court for the Southern District of New York against the Tucker Electrical Manufacturing company of 14 Whitehall street, and against James R. Strong and Thomas McCoubray as individual co-defendants, for alleged infringement of Colvin patents No. 513,305 and No. 524,524. It is further asserted in this circular that the Tucker company is a licensee under McCoubray and controls a detailed transmitter patent which the Interior company claims infringes. The circular concludes:

Their patent upon carbon powder is also of a later date than ours and covers identically the same powder which we have used since we went into business. Their patent was issued by the office through error and under a misapprehension, and, being a later patent than ours, is therefore an infringement.

The Tucker apparatus also infringes the Roosevelt patent No. 215,837 and the Gilliland patent No. 242,195, besides the Scribner system patent No. 356,427, on which patents the Tucker company will also have either to stand suit or make an accounting to the Western Electric company and stop infringing.

The Interior Telephone company, which has begun this action, is said to control and manufacture the telephone system covered by the patents of Frank R. Colvin, known to the trade principally through his long connection with the *Electrical Engineer*. The company is understood to have been organized several years ago by Mr. Colvin and his associates on the *Electrical Engineer*, and it has been actively engaged in exploiting the system since the expiration of the Bell company's fundamental patents. Mr. Colvin is now devoting considerable time to the telephone business and is thought to be meeting with fair success.

The Tucker company has also published a circular replying to that issued by the Interior company, in which it agrees to furnish a guarantee to its patrons against the attacks of the Interior company. In this circular there are several abstracts from a letter of the commissioner of patents, dated January 4, 1895, in which the examiner reports favorably upon the efficiency of the McCoubray transmitter. Concerning the relative merits of the Colvin and McCoubray claims, the following abstracts from the same letter are quoted:

The patent to Colvin does not disclose a recarbonized powder. Neither does it disclose an electrically conducting powder. It seems then that if applicant (McCoubray) will limit his claims to a telephonic electrode composed of the carbon residuum of an oil which has been rendered electrically conducting, he will be claiming something not shown or described in the Colvin patent. Further than this, the applicant will be covering an operative thing, which Colvin's claims do not cover, and the applicant will do this by specifying that his powder is electrically conducting, which is absolutely necessary for a microphone powder.

The Tucker company also signifies its intention to bring actions against users of the Colvin transmitter, and from present indications the litigation between these telephone companies promises to be as interesting as the old warfare conducted by the Bell company against its rivals.

## Electricity at the Atlanta Exposition.

Elaborate preparations are making for the Cotton States and International Exposition to be held in Atlanta, Ga., from September 18th to December 31st, this year. Especial attention will be given to electrical appliances, and the exhibits in this department will be classified in 17 groups and 63 classes. As at the World's Fair, one building will be devoted entirely to the display of electrical apparatus and machinery. A cut of the proposed structure is herewith given. The exposition was heartily favored by the National Electric Light association at the recent convention in Cleveland, the essential language of the resolutions being as follows: "The National Electric Light association, in its eighteenth convention assembled, hereby urges its members to attend the Cotton States and International Exposition, and to avail themselves of this opportunity to exhibit electrical products especially devoted to the electric lighting industry in the electricity building set aside for that purpose." There is a promising field for electrical development in the progressive sections of the South, and the electrical industry will doubtless be well represented.

The Detroit Motor company has commenced action in the United States District Court against the Jenney Electric company of Indianapolis, Ind., for alleged infringement of the automatic release covered by patents owned by plaintiff.

## The Storage of Energy Essential to Economy of Working in Central Stations[1]

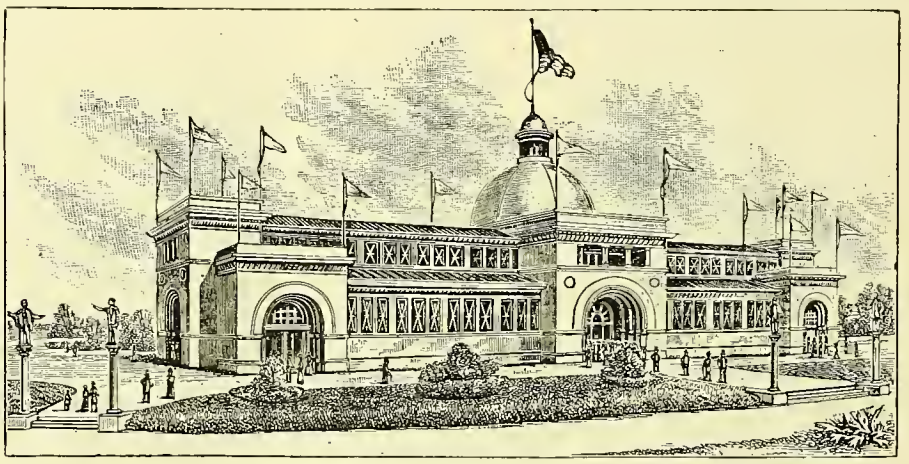
By N. W. Perry, E. M.

The committee on data reporting at the Washington meeting stated that 1.5 pounds of coal per indicated horse power, with a combined engine and dynamo efficiency of eighty-one per cent., would produce 402.84 watt hours per pound of coal. In the tabulated statement of data collected by this same committee the highest results of practice given were 208 watt hours per pound of coal. The next highest was 192, the lowest 25, and the average 91.7 watt hours, or only 22.7 per cent. of that which the best practice under favorable conditions should give.

By far the larger number of stations reporting are small ones, in which the highest economies would not be expected, and we find, as a matter of fact, that most of these report results below the average. Discarding all results based on a consumption of less than 10,000 pounds of coal, we have an average for the largest stations of 127.7 watt hours per pound of coal. This is equivalent to a consumption of about five pounds of coal per indicated horse power. The best results given (208) are equivalent to about three pounds per indicated horse power, or more than twice as much as the machinery involved requires for the best results. Bad as this showing is, it seems to compare favorably with foreign practice, for Prof. Unwin[2] says: "Probably up to the present (1893) the consumption has in no case been less than 3.3 pounds per indicated horse power."

When we consider how enormously short the results of actual practice in lighting stations are of those which are obtainable under the most favorable conditions with the same machinery, it behooves us to inquire into the cause of this deficiency and to see how far we can remedy it.

Prof. Kennedy has made some very careful tests to indicate the effect of variable load upon coal consumption.



ELECTRICITY AT THE ATLANTA EXPOSITION.

Dividing the day into three portions, he determined the fuel consumption, the feed water evaporated and the indicated and electrical horse power developed during each period in an English lighting station. It will be seen that during the periods of light load the fuel consumption per horse power is very large.

COAL CONSUMPTION IN BOILERS WITH VARIABLE LOAD.

| | 11 A. M. to 6 P. M., 7 hours. | 6 P. M. to Midnight, 6 hours. | Midnight to 11 A. M., 11 hours. | Mean for 24 hours. |
|---|---|---|---|---|
| Total indicated horse power hours | 562 | 1,366 | 407 | ..... |
| Total electric horse power hours | 400 | 979 | 260 | ..... |
| Coal per indicated horse power hours, pounds | 6.88 | 3 26 | 6 26 | 4.65 |
| Coal per electric horse power hours, pounds | 9 67 | 4.55 | 9 80 | 6.62 |
| Pounds water evaporated per pound coal | 5.92 | 9.60 | 9.27 | 8.21 |
| Pounds water per indicated horse power hour | 40.7 | 31 3 | 57 7 | 38.3 |
| Pounds water per electric horse power hour | 57.2 | 43 8 | 91.0 | 54.4 |

Comparing the consumption of steam and coal during mean load with that during the hours of heavy load (6 P. M. to midnight) we find that the mean steam consumption per electric horse power hour was twenty-four per cent. greater and the mean coal consumption per electric horse power hour was forty-six per cent. greater—the difference of twenty-two per cent. being attributable to waste at boilers, due to irregular working. During the whole twenty-four hours the mean evaporation in pounds of water per pound of coal was only eighty-five per cent. of the evaporation during the period of maximum load.

Captain Sankey has applied Mr. Willans' formula to find the steam consumption of one or more engines working against a variable load in an electric lighting station. He takes a normal midwinter load curve and examines how the necessary current could be supplied during the twenty-four hours (1) with an engine capable of exerting the maximum power required; (2) with smaller engines. The results, rearranged and a little modified, are given by Unwin in the following table. It is assumed for conven-

1. Read before the National Electric Light association, Cleveland, O., February 19–21, 1895.

2. "On the Development and Transmission of Power," page 28.

ience that the maximum load is 500 electric horse power and that the engines are non-condensing.

STEAM CONSUMPTION IN ENGINES WORKING WITH A VARIABLE LOAD.

| | Average load factor. | Steam consumption in pounds per average electrical horse power hour. | Per cent. increase of steam consumption due to variable load. |
|---|---|---|---|
| I. 500 electric horse power engine | .22 | 50 | 103 |
| II. 200 electric horse power engines | .49 | 34.5 | 44 |
| III. 100 electric horse power engines | .65 | 29.5 | 23 |

We thus see how closely these results agree with Prof. Kennedy's figures, derived from direct tests, which gave twenty-four per cent. increased consumption at mean load over that at maximum load.

The efficiencies of engines and dynamos in lighting stations are maintained quite high, notwithstanding the variable output of the establishment, by throwing in and out units as the load varies, so that at most only one unit need be working at less than its best load, and the variation in efficiency of this one unit is chiefly due to the larger proportion of the whole that the friction losses bear at light load. Almost the whole loss of the efficiency, due to variable load, is, therefore, attributable to the boiler.

There is still another class of losses which is not amenable to calculation, viz., those due to leaks from boiler fittings and steam pipes, with condensation losses in the steam pipes, and due to the wasteful use of steam by all present known means of boiler feed. As these losses continue practically constant throughout the twenty-four hours, they assume especial importance where the load factor is low.

To show more clearly at what relative cost we produce power in our lighting stations, with their variable loads and under other commercial conditions where the load is fairly constant, I quote Prof. Unwin:

1. *Engines working on a very regular load, in conditions similar to those of an engine pumping to a reservoir.* Here for one effective horse power exerted during 7,884 hours annually, engines of 1.47 indicated horse power must be provided. Such engines may be taken to use fourteen pounds of steam per indicated horse power hour in test trials, but in ordinary work seven and one-half per cent. more must be allowed for leakage, working auxiliary engines and less careful attention; this makes the consumption fifteen pounds per indicated horse power, or $15 \times 1{,}176$ ($\frac{1}{8}$) = eighteen pounds per effective horse power hour. At nine pounds of steam per pound of coal, allowing also five per cent. for lighting and banking fires, the engine would use 2.1 pounds of coal per effective horse power hour.

COST OF INSTALLATION PER EFFECTIVE HORSE POWER.

| | |
|---|---|
| Cost of engines or with reserve 1.47 ind cated horse power = 1.47×$44.5 | $65 42 |
| Cost of boilers = 1.47×$24 | 35 28 |
| Cost of buildings = 1.47×$3 | 44 10 |
| Total | $144 80 |

ANNUAL COST OF WORKING PER EFFECTIVE HORSE POWER.

| | | |
|---|---|---|
| Interest on $144.80 at 4 per cent. | $5.79 | |
| Maintenance and depreciation buildings at 2 per cent | .88 | |
| Machinery at 7½ per cent. | 7.61 | |
| Total fixed annual cost | | $14.28 |
| Coal 2.1 pounds for 8,760 hours at $1.75 per ton | $16.10 | |
| Petty stores | 1.64 | |
| Driving, stoking and cleaning. | 11.67 | |
| | | 29.41 |
| Total annual cost | | $43.69 |

STEADY WORKING COST OF ONE ELECTRICAL HORSE POWER.

| | | |
|---|---|---|
| Cost of engines, 1.547 at $44 5 | $68.84 | |
| Cost of boilers, 1.547 at $24 | 37.13 | |
| Cost of dynamo, 1 at $30. | 30 00 | |
| Cost of buildings, 1 547 at $30 | 46.41 | |
| | $182.38 | |
| Interest on $182 38 at 4 per cent | 7.30 | |
| Maintenance and depreciation—buildings at 2 per cent | .93 | |
| Machinery at 7½ per cent | 10.20 | |
| Total fixed annual cost | | $18.43 |
| Cost of coal, 2.21 pounds, 8,760 hours, at $1.75 per ton | $16.94 | |
| Cost of petty stores | 1 64 | |
| Cost of driving, stoking and cleaning | 11.67 | |
| | | 30.25 |
| Total annual cost per electric horse power. | | $48 68 |

2. *Engines working with variable load under conditions similar to those of an electric lighting station.* Here for one effective horse power supplied on the average throughout the year engines of 5.87 indicated horse power have to be provided. On account of the inefficiency and waste, due to variation of the load, it is best to estimate the steam and coal from experience in similiar cases. Probably no electric lighting station at present works with quite so low a consumption as six pounds of coal per hour per electrical unit supplied. A consumption of nine pounds is probably much more common in the best managed stations. Six pounds of coal per electrical unit corresponds to 3.8 pounds per effective horse power hour.

COST OF INSTALLATION.

| | |
|---|---|
| Cost of engines for one average effective horse power with reserve, 5.87 indicated horse power = 5.87×$44.5. | $261.22 |
| Cost of boilers = 5.87×$24. | 140.88 |
| Cost of buildings = 5.87×$30. | 176.10 |
| Total. | $578.20 |

ANNUAL COST OF WORKING PER EFFECTIVE HORSE POWER.

| | | |
|---|---|---|
| Interest on $578.20 at 4 per cent | $23.13 | |
| Maintenance and depreciation machinery at 7½ per cent | 30.25 | |
| Buildings at 2 per cent | 3.50 | |
| Total fixed annual cost. | | $56.88 |
| Cost of coal, 3 8 pounds for 8,760 hours, at $1.75 per ton | $26.00 | |
| Cost of petty stores | 1.64 | |
| Cost of driving, stoking and cleaning | 11.67 | |
| | | 39.31 |
| Total annual cost. | | $95.19 |

In other words our power costs us 2.138 times as much in an electric light station as it should. If we figure out the relative costs per electrical horse power, the disparity will be still greater.

Using these same data, but carrying the results out to electrical horse power, assuming a dynamo efficiency of ninety-five per cent., we have four pounds of coal per electrical horse power.

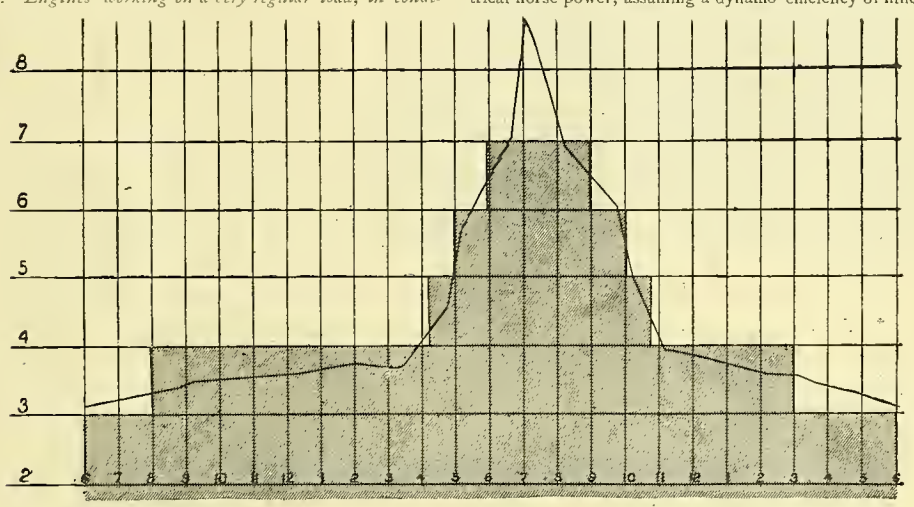



FIG. 1. THE STORAGE OF ENERGY ESSENTIAL TO ECONOMY OF WORKING IN CENTRAL STATIONS.—ADJUSTING BATTERY STORAGE TO ELECTRIC LIGHT LOAD LINE.

COST OF INSTALLATION PER ELECTRICAL HORSE POWER.

| | |
|---|---|
| Cost of engines, 6.17×$44.5. | $274 56 |
| Cost of boilers, 6.17×$24 | 148.08 |
| Cost of buildings, 6.17×$30. | 185.10 |
| Cost of dynamos, 4, at $30. | 120.00 |
| Total. | $727.74 |
| Interest on $727.74 at 4 per cent. | 29.11 |
| Maintenance and depreciation machinery, $542 64, at 7½ per cent | 40.70 |
| Buildings, $135.10, at 2 per cent | 3 70 |
| Total fixed annual cost. | $73.51 |
| Cost of coal, 4 pounds for 8,760 hours, at $1.75 per ton | $ 0.63 |
| Cost of petty stores | 1.64 |
| Cost of driving, stoking and cleaning | 12 00 |
| | 44.27 |
| Total annual cost electric h rse power. | $117 78 |

When we compare this with the cost resulting from steady working, viz., $48.68, we see what an effective method of storage means in our central stations. If our storage costs us nothing, it would result in a saving for each electrical horse power generated per year of $117.78 — $48.68 = $69 10. But any system of storage which we may employ will involve expenditures, both in the way of losses in storage, which will have to be provided against by an increased plant to provide for the same ultimate output, and in the way of interest on the additional investment required by the storage plant. As a matter of fact, these additional costs must in all cases be less than the saving otherwise effected, else we are paying more for our economy than it amounts to. In the present case, our storage must cost us less than $69.10.

If we could take the variable load off between the boiler and engine, viz., devise some means by which the same amount of energy could be supplied by the continuous operation of a boiler plant working at its most economical rate, we would at once do away with one of the most serious losses due to irregular working. Let us see how much the saving would be if the irregular working of the boilers could be obviated without cost.

| | |
|---|---|
| Cost of engines, 6.17 at $44.5 | $274.56 |
| Cost of boilers, 1.547 at $24 | 37.13 |
| Cost of buildings, 4, at $30. | 120.00 |
| Cost of dynamos, 4, at $30 | 120.00 |
| Total | $551.69 |
| Interest on $551.69 at 4 per cent. | 22.07 |
| Maintenance and depreciation machinery, $431.09, at 7½ per cent. | 32.38 |
| Buildings, $120, at 2 per cent | 2.40 |
| Total fixed annual cost. | $56. |
| Cost of coal, 2.21 pounds for 8,760 hours, at $1.75 per ton | $16.93 |
| Cost of petty stores | 1.64 |
| Cost of driving, stoking and cleaning. | 11.67 |
| | 30.24 |
| Total annual cost per electrical horse power. | $87.09 |

If the storage cost us nothing, and was applied between the boiler and the engine, it would effect a saving of $117.78 — $87.09 = $32.69. The limited expense, therefore, to which we can go for storage at this point is $30.69 per annual electrical horse power.

If we move our storage forward one step and introduce it between our engine and dynamo, so that everything previous to the dynamo would work continuously at its maximum economy, the account would stand thus:

STORAGE BETWEEN ENGINE AND DYNAMO. COST OF ONE ELECTRICAL HORSE POWER.

| | | |
|---|---|---|
| Cost of engines, 1.547 at $44.5 | $68 84 | |
| Cost of boilers, 1.547 at $24 | 37 13 | |
| Cost of dynamos, 4, at $30. | 120.00 | |
| Cost of buildings, 4, at $30 | 120.00 | |
| Total. | $346.97 | |
| Interest on $346 97 at 4 per cent. | 13.86 | |
| Maintenance and depreciation, machinery, $226.97, at 7½ per cent | 17.02 | |
| Buildings, $120, at 2 per cent | 2.40 | |
| Total fixed annual cost. | | $33 28 |
| Cost of coal 2.21 pounds, 8,760 hours, at $1.75 per ton | $16.94 | |
| Cost of petty stores. | 1.64 | |
| Cost of driving, stoking and cleaning | 11.67 | |
| | 30.25 | |
| Total annual cost per electrical horse power. | | $63.53 |

The saving by introducing storage at this stage would be $117.78 — $63.53 = $54.25, or a gain by moving the storage forward one step of $54.25 — $30.89 = $23.56. If we move it forward still another step, and bring it between the dynamo and distribution, we have an additional possible gain of $69.10 — $54.25 = $14.85.

Recapitulating, we have possible gains by introducing the storage by successive steps forward.

| | | Cost of horse power at this stage. |
|---|---|---|
| Between boiler and engine | $30.69 | $48.68 |
| Between engine and dynamo | 23 56 | 87.09 |
| Between dynamo and distribution | 14.85 | 117.78 |
| Total. | $69.10 | |

BATTERY STORAGE

Supposing, in the case assumed, we endeavor to equalize the load by means of the storage battery. This will allow the boilers, engines and dynamos to work continuously at their most economical rate and would seem to provide ideal conditions of working. We are not, however, storing the product we have to sell, as is the gas manufacturer—we are not storing electrical energy, as some suppose, but, chemical energy, which must be transformed again into electrical energy before we can distribute it. These two transformations, of course, involve a loss of energy which must be provided for in boilers, engines and dynamos and also in coal. To be entirely fair with the storage battery, let us assume that its efficiency under all conditions is seventy-five per cent. Then in order that we may have at average working one electrical horse power, we must provide:

| | |
|---|---|
| Boilers, $\frac{1.547}{.75}$ = 2.07 at $24 | $49.68 |
| Engines, $\frac{1.547}{.75}$ = 2 07 at $44.5 | 92.12 |
| Dynamos, $\frac{1}{.75}$ = 1.333 at $30 | 40.00 |
| Buildings, say. | 125.00 |
| Total investment, without storage battery.. | $306.80 |

If we are to produce an average of one electrical horse power per hour, we will produce twenty-four horse power hours during the twenty-four hours, half of which must be stored, viz., we must have storage battery capacity for twelve horse power hours. Of course, the rate of discharge will have some bearing upon the cost of this storage battery capacity, but taking an abstract case, we may assume, I think, without being unfair, that it will cost $35 per electrical horse power hour capacity erected. We must, therefore, add to our former figures, 12×$35 = $420, which is more for the batteries than we have allowed for all the rest of the plant put together, including the buildings.

| | | |
|---|---|---|
| The total fixed investment therefore becomes | | $726.80 |
| Interest on $726 80 at 4 per cent | $29.07 | |
| Maintenance and depreciation | | |
| Buildings, $125 at 2 per cent | 2.50 | |
| Machinery, $181.80 at 7½ per cent | 13.64 | |
| Storage battery, $420 at 10 per cent | 42.00 | |
| Total fixed annual cost | | $87.21 |
| Coal, 2 95 pounds for 8,760 hours, at $1.75 per ton | $22.61 | |
| Petty stores, attendance, etc | 13.37 | 35 98 |
| Total annual cost per electrical horse power. | | 123.13 |

which would be an actual loss over that of irregular working of $123.13—$117.78=$5.35. It will cost with storage battery thus used, $123.13—$48.68=$74.45 more than the same machinery working continuously on a steady load could produce it for.

If we assume coal to cost $3.50 instead of $1.75, the cost per electrical horse power will be:

| | |
|---|---|
| Steady load without storage battery | $ 52.31 |
| Variable load without storage battery | 148.40 |
| With storage battery | 145.74 |

This does not condemn its use in central stations in other ways, however, for there are many cases in which its use may contribute to economy, but these cases cannot be determined by any general rational formula. Each case must be deter-

mined for itself, and the result will depend, primarily, upon the shape of the load line, and secondarily, upon the ability of the battery to rise above normal discharge rate economically. In the case of a station previously equipped, without storage, so that the units are already determined, the question of economy of introducing storage batteries will be determined in some cases entirely by the sizes of those units.

In some cases where the day load is exceedingly light, it will not warrant the operation of the plant at all—the load costs more than it will bring in. In such cases there can be no question as to the economy of the storage battery, since it can be charged during the night by power that would otherwise be practically wasted, and during the daylight hours it may carry the whole load. In such cases it will effect an economy in another way also, viz., by carrying up to its capacity the peak of the load. The economy in this direction will be the greater the sharper the peak and will disappear as this flattens out.

But the manner in which the storage battery is most frequently employed to advantage in a central station is by changing the load line from the irregular one, due to the natural load, to one which would be formed by a series of rectangles which would in the aggregate have about the same area.

I have endeavored to illustrate this in the accompanying diagram, Fig. 1. The irregular black line represents the natural load line. The spaces between the horizontal lines represent the units into which the equipment is divided, and the vertical lines the time at intervals of two hours.

Beginning at 6 A. M. the load is a little above the best output for three units, but without too much overloading these three units can carry it. The line gradually rises, however, until at 8 A. M. it becomes too much of an overload for three units. If a fourth unit were thrown in it would at first have to operate at only about one-third load, and hence very uneconomically. A storage battery load sufficient to make up a full load for this unit would, therefore, be thrown in at 8 A. M., and the new unit would thus work economically from the start. The part of the load furnished by the battery is represented by the shaded portion outside the natural load line—that is to say, this much energy is being absorbed by the battery and will be available at another time—less the loss due to inefficiency of the battery. I have assumed a battery efficiency of seventy-five per cent. We see from the diagram that the battery is charging 8 A. M. to about 4 P. M. Twenty-five per cent. of the energy thus stored will therefore be lost. It will be apparent that this bears no relation whatever to the total amount of energy being generated at the time, for units 1, 2 and 3 are working directly into the feeders and are not affected at all. The energy thus lost bears an exceedingly small ratio to the total energy generated.

At 4 P. M. the natural load consumes all the energy of the third unit, and in about twenty minutes has increased so as to be an overload. Now it depends upon circumstances whether we will bring our stored energy to the assistance of the fourth unit to carry the increasing load further or not. For the purpose of illustration I have assumed that we will not, but will throw in our fifth unit and complete its load by charging the battery. At ten minutes to five the load line crosses the fifth unit line, rising very rapidly, and the same question arises again, but I throw in my sixth unit at once, throw in an eighth unit and let the battery take care of only the tip of the peak beyond that, or let the battery take the whole of the peak beyond the seventh unit line. In the diagram I have assumed that the latter is more advantageous. The battery, therefore, discharges until 8:20, when it begins to recharge, supplementing the seventh unit load until 9 P. M., when the seventh unit is thrown out entirely, and the battery carries the remaining seventh unit load until 9:25, the battery load being represented by the unshaded triangle within the load line. And so the battery and the units continue supplementing each other throughout the remaining hours.

In this way the battery will prove economical with some

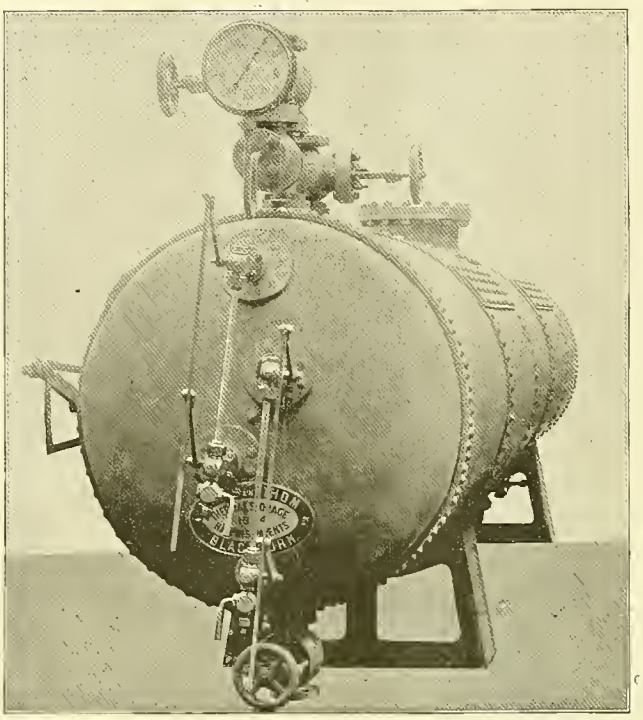


FIG. 2. THE STORAGE OF ENERGY ESSENTIAL TO ECONOMY OF WORKING IN CENTRAL STATIONS.—HALPIN'S THERMAL STORAGE TANK.

curves. In others it may not, but whether or not it will depends upon so many contingencies that it is utterly impossible to state *a priori*. There are other considerations than economy that might balance its absence, such as convenience as a regulator of potential, the facility it affords for distribution to sub-stations at high potential, resulting in an economy of copper, and the subsequent transformation down for local distribution; and some others which will suggest themselves. Some of these might be controlling in special cases.

Then, on the other hand, the employment of the storage battery is limited entirely to the storage of energy when generated in the form of electricity; not only this, but it is still

FIG. 3. THE STORAGE OF ENERGY ESSENTIAL TO ECONOMY OF WORKING IN CENTRAL STATIONS.—HALPIN'S THERMAL STORAGE TANK.

completing its load; the shaded area outside the natural load line again being the energy taken by the battery, seventy-five per cent. of which will be available. At 5:30 the load exceeds the normal capacity of all six units, but the diagram represents them as carrying the increasing load until 6 P. M., when the seventh unit is thrown in, and the load completed by the storage battery until 6:40, when the natural load requires the whole attention of all seven units.

Now the question arises, will it be necessary to add first an eighth and then a ninth unit to take this peak? If so, it will add considerably to the fixed charges on our power account. Will it be cheaper to supply battery capacity to carry this peak? That is a question to be decided separately for each individual case. Storage batteries will stand an abnormal discharge for a short time without serious injury. Some will stand it better than others. If it be too rapid the depreciation charge will be increased, also if this abnormal discharge is continued too long. Then, too, at rapid discharge the battery becomes less efficient and the loss will become greater than twenty-five per cent. It is only by balancing these losses against the advantages that the question can be decided whether it will be more advantageous to

further limited to direct currents, and is therefore of no avail in stations sending out alternating currents.

### GAS STORAGE AND GAS ENGINES.

For strictly power purposes the use of gas engines is now, more than ever before, attracting attention, and abroad the gas engine has already found its way into the central station and it has made it bow here also.

On purely theoretical grounds at least the gas engine deserves our consideration at this point for the following reasons: In the first place, we may replace the wasteful standby losses of steam boilers under the variable central station load by the ideally simple and economical system of gas storage. The use of the gas engine, therefore, comes legitimately within the province of this paper, since it permits of employing a substitute for the boilers, which may be operated continuously at the most economical load, and yet supply with equal efficiency the most variable load that can possibly be thrown upon it.

Comparing the relative theoretical advantages of the gas engine and the steam engine, Professor Kennedy states that the maximum theoretical efficiency of the steam engine is thirty per cent. Its obtained efficiency is about ten per cent. The theoretical maximum efficiency of the gas engine is eighty per cent. It efficiency obtained in practice is twenty-five per cent. These facts have led Mr. Thwaite to say that the practical efficiency of the gas engine is equal to the theoretical efficiency of the steam engine. As a matter of general experience, however, under usual working conditions with large engines, very little if any advantage in efficiency is shown by the gas engine over that driven by steam, but if this statement is disputed, as I am not at all sure that it cannot be successfully, the burden of proof lies with the gas engine. At any rate for our purposes it will be proper to assume that the two are on a par as regards ultimate efficiency, and that so far as this is concerned the two types of engines may be inter-changed in any installation which we may consider without affecting the result.

The gas engine has this practical advantage, that it may be started and stopped when required, thereby avoiding the standby losses so fatal to economy where boilers are used. These standby losses for boilers are given by Dowson[1] as ten per cent; that is to say, that boilers that are standing idle and furnishing no steam will require 10 per cent. of the fuel they will take when working at their rated capacity. The gas plant, however, where gas storage is employed, has no standby losses of this kind, but in many cases where fuel gas is manufactured to be used on the premises, adequate storage is not provided and in times of light load part of the plant is banked. Under these conditions, Dowson states that the standby losses will not exceed 2.8 per cent. The advantages in favor of the gas engine in this respect, even under the most unfavorable circumstances, are therefore as 10 to 2.8 or 3.

As to fuel consumption in gas engines, foreign practice furnishes considerable data. Messrs. Crossly guarantee one brake horse power hour, on a consumption of one pound of anthracite coal, using Dowson gas. Under test conditions[2] the gas engine plant at Chateau Say, supplying 650 lamps, consumed 1.2 pounds per indicated horse power hour. At Leven Tweed Mills, four gas engines, aggregating 200 horse power, used in six days' trial one and one-quarter pounds anthracite per brake horse power hour, or one and three-quarters pounds gas coke per brake horse power hour. At the Godalming mills gas engines, aggregating 400 indicated horse power, averaged one pound of fuel (character not stated) per indicated horse power. At the Chelsea flour mill a sixty nominal horse power, twin cylinder gas engine, with Dowson gas, under full load test, used 0.87 pound coal per indicated horse power. But, as we are all aware, the fuel consumption under test conditions is no criterion to judge by, and especially misleading when we have under consideration an electric lighting plant. Furthermore, as I think has been conclusively shown, the fuel is by no means the only expense attending the production of power. Mr. Dowson places the cost of a Dowson gas plant of 80 horse power at $20.31 per horse power, and for a plant large enough to supply 530 horse power at $10.37 per horse power. The wages of firemen for a gas plant are no more than for a steam plant, and a much cheaper fuel may be used. But let us assume that the fuel in both cases costs the same per ton, that the gas plant costs $20 instead of $10, so as to cover the cost of extra land required. Then our account would stand something like this:

| | | |
|---|---|---|
| Cost of engines, 6.17 at $50 | $308 50 | |
| Cost of gas plant, 1.547 at $20 | 30.94 | |
| Cost of buildings | 120 00 | |
| Cost of dynamos | 120.00 | |
| Total fixed investment | $579.44 | |
| Interest on $579 44 at 4 per cent | 23.18 | |
| Maintenance and depreciation of machinery, $159 44 | 34.06 | |
| Buildings, $120 at 2 per cent | 2.40 | |
| Total fixed annual cost | | $59.64 |
| Cost of coal, 2 pounds, 8,760 hours, at $1.75 | $15 33 | |
| Cost of petty stores | 1.64 | |
| Cost of driving, stoking and cleaning | 11.67 | |
| | | 28.64 |
| Total annual cost per electric horse power | | $88.28 |
| With coal at $3 50 the total cost | | $103.61 |

Saving over present methods, with coal at $1.75=$117.78—$88.28=$29.50; with coal at $3.50=$148.40—$103.61=44.79.

### THERMAL STORAGE.

Druitt Halpin of England has devised a method of thermal storage which has attracted wide attention abroad and is likely to attract great attention in this country as soon as its efficiency becomes better understood. [This subject was very thoroughly discussed by Mr. Perry in his paper on "Thermal Storage" in the WESTERN ELECTRICIAN, January 5, 1895. In the present paper Mr. Perry quotes freely from the former article and then proceeds to apply the data to the case already described.]

Let us see how the data here presented, when interpolated in the case we assumed in starting out, affect the results.

WITH FEED STORAGE.

| | | |
|---|---|---|
| Engines | $274 56 | |
| Boilers | 113 47 | |
| Buildings | 120.00 | |
| Dynamos | 120.00 | |
| Tanks | 29.32 | |
| | $657.35 | |
| Allowing 10 per cent for interest, depreciation and maintenance on the investment, exclusive of tanks—which is the same as before—and only 5 per cent on the tanks we have (boilers) $628.01 at 10 per cent | $62.89 | |
| (Tanks) $29 32 at 5 per cent | 1.47 | |
| Total fixed annual cost | | $64.27 |

1. "Gas Power," a paper by Emerson Dowson in the *Engineering Review*, November 30 and December 20, 1894.
2. Bryan Donkin, before Incorporated Institute Gas Engineers.

| | | |
|---|---|---|
| Coal | $20.00 | |
| Other expenses as before | 13 31 | |
| | | 33.31 |
| Total annual cost per electrical horse power | | $97.58 |

WITH STEAM STORAGE.

| | | |
|---|---|---|
| Engines | $274.56 | |
| Boilers | 37.13 | |
| Tanks | 236.70 | |
| Buildings | 120.00 | |
| Dynamos | 120.00 | |
| | $994.39 | |
| $757.69 at 10 per cent | 75.77 | |
| $236.70 at 5 per cent | 11.83 | |
| Total fixed annual cost | | $87.60 |
| Coal, 2.21 pounds at $1.75 | $16 93 | |
| Other expenses | 13 31 | |
| | | 30.24 |
| Total annual cost per electrical horse power | | $117.84 |

COMBINED FEED AND STEAM STORAGE.

| | | |
|---|---|---|
| Engines | $274.56 | |
| Boilers | 37.13 | |
| Tanks | 180.37 | |
| Buildings | 120.00 | |
| Dynamos | 120.00 | |
| | $732.06 | |
| $551.63 at 10 per cent | 55.16 | |
| $180.37 at 5 per cent | 9.02 | |
| Total fixed annual cost | | $64.18 |
| Coal, 2.21 pounds at $1.75 | $ 6.93 | |
| Other expenses | 13.31 | |
| | | 30 24 |
| Total annual cost per electrical horse power | | $94.42 |

The above calculations show that with coal at $1.75 per ton and a load line such as that assumed, there will be an annual saving with the feed water storage of $20.20 per horse power annually; by steam storage, a loss of six cents, and by combined feed and steam storage an economy of $23.36.

If, on the other hand, we assume coal to cost double this, or $3.50, which would perhaps be nearer the average conditions obtaining in this country our energy without storage would cost us $148.40 per annual electrical horse power.

With feed storage, $117.58, saving $30.82; with steam storage, $134.77, saving $13.63; with combined, $111.35, saving $37.05.

Being aware that Mr. Halpin had already put into practice his system of thermal storage, immediately upon the receipt of the invitation from your president to address you upon the subject of storage of energy, I solicted from Mr. Halpin information in regard to the results obtained. The time allowed for a reply was exceedingly limited, but he was kind enough to send me a letter, together with the two photos and diagrams which are reproduced. The cuts, Figs. 2 and 3, represent small feed storage tanks used in a plant already erected, represented in the sketch, Fig. 4. The two boilers shown in the sketch are "Cornish," five feet by six inches diameter, by twenty-six feet six inches long, and have flues two feet nine and one-half inches diameter and five feet six inch grates, with heating surface of 500 square feet, and a grate area of fifteen by thirty-five square feet. Best Welsh coal is used, containing about 15,000 Board of Trade units, and the plant drives the laundry, the electric lighting, duplex pump for elevators, the whole of the radiators, provides steam for cooking in the kitchen, and supplies the hot water service of a large hotel.

The feed is delivered from the town's water supply into the tank under the feed water heater, and by means of duplex pumps it is passed through the feed water heater, where it is raised to a temperature of about 200 degrees Fahrenheit, and from there it is forced into the top of the thermal storage vessel, where the feed pipe delivers horizontally into the steam space, toward the back end of the vessel, or away from the firing end of boilers. The blow-out for the dirt deposited in the thermal storage vessel is also at the back end, and this blow-out is connected directly with the main blow-out in front of the boilers.

The feed passes along the thermal storage vessel, and is led out near the firing end of boilers by a pipe standing about nine inches above the bottom of the vessel. From here it gravitates into the boilers, the quantity being regulated by these valves.

There is a pipe from the steam space of boiler direct into the top of the thermal storage vessel, so that there is always the same steam pressure between the boiler and the thermal storage vessel, and the feeding into the boiler is effected by the head of water in the thermal storage vessel above the boiler.

He writes:

"I was obliged to start the plant before the makers had completed the thermal storage vessel and its connections, and when the boiler working then was emptied, it was found to contain 35 buckets of sediment and incrustation. After the feed storage was got to work, one boiler ran 22 days and nights continuously, and on opening out it was found absolutely devoid of scale or dirt. I caused two tests to be made of 18 hours each, during which the coal was accurately weighed and the water measured through a meter I had previously checked, with the following results: When working without thermal storage, the evaporation reduced to 'from and at 212 degrees Fahrenheit' was equal to 10.95 pounds of water per pound of coal, and on the second test, when the thermal storage was at work, the evaporation was raised to 12.21 pounds. Of course, you must bear in mind that this particular apparatus was only designed for feed storage, as steam storage was not required under the special conditions which had to be dealt with in this case. Fig. 5 is an illustration of the storage vessels, to work in connection with refuse destructors, and shows four thermal storage vessels, the number required in this case. You will, of course, observe, that any possible effect of radiation, about which I am not at all frightened, is minimized, as the cylinders here radiate against each other, so that only one-quarter of the total surface, or say, one cylinder, will be under the influence of losses from radiation. I have arranged this plant so that there is a wooden gallery in the roof, and into this gallery all the various handles are brought for working the apparatus. I have taken this precaution so that should any joint break the men in change are perfectly safe, and being in the gallery they can control the valves and blow the vessel off, any escaping steam passing out through louvres in the roof. The boilers for this plant are not shown. You will observe the thermal storage vessels are completely finished in the riveting machine, not a single rivet being put in by hand, and owing to the form of the dished ends, there is not a single stay in the whole vessel, so that they are absolutely free to expand in any direction without doing injury by tearing themselves to pieces. All the valves, etc., are arranged so that any one, or all vessels, can be cut out of use."

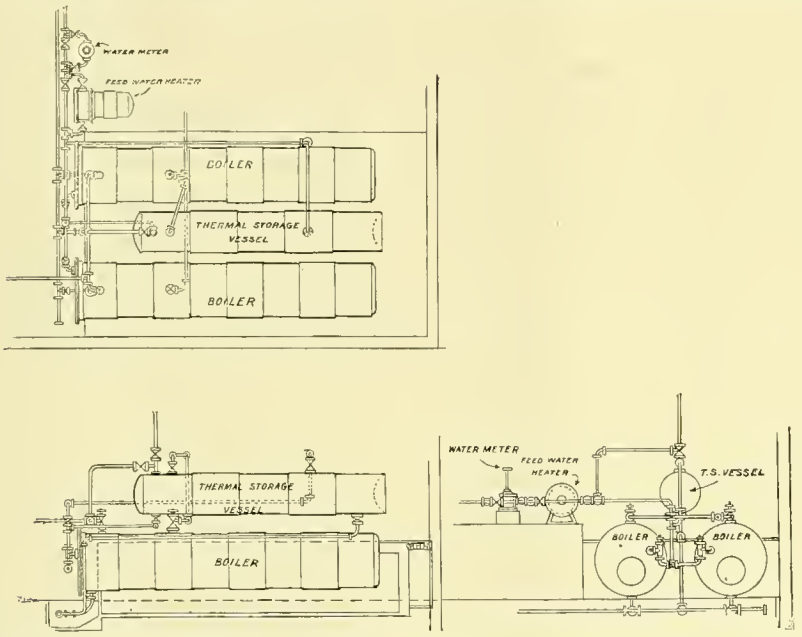



FIG. 4. STORAGE OF ENERGY ESSENTIAL TO ECONOMY OF WORKING IN CENTRAL STATIONS.—ARRANGEMENT OF STEAM PLANT WORKING UNDER HALPIN'S FEED STORAGE SYSTEM, SUPPLYING STEAM FOR LIGHTING, HEATING, COOKING, ETC., IN LARGE ENGLISH HOTEL.

In conclusion I will say that, of all the methods of storage available, the storage battery would, on theoretical grounds, be the best because of its forming the last link in the chain, thereby giving the economies of continuous working to all that precede. Unfortunately, it involves such large losses in itself as to nearly if not quite nullify the advantages it would otherwise present. And, again, its extreme cost above all other methods renders it unavailable in any complete storage project, unless fuel is dear.

We are therefore compelled to go back of the engine for our equalization schemes and put up with the losses due to variable load upon all that follows. Fortunately, the losses which we can overcome at this early stage are quite considerable, and we have a number of methods at hand. Of these the gas engine—involving a gas storage—seems to give the best results. Very closely following this comes Halpin's combined feed and steam storage, followed by feed storage and steam storage. Below is given, in tabular form, the cost to produce for one year one electrical horse power, with coal at $1.75 per ton and at $3.50 per ton; also, the saving effected by the various methods over present methods in a station having a mean load 25 per cent. of its maximum:

| | RECAPITULATION. | | SAVING EFFECTED. | |
|---|---|---|---|---|
| | Coal $1.75 per ton. | Coal $3.50 | Coal $1.75 | Coal $3.50 |
| Present method, steady load | $ 48.63 | $ 65.62 | ..... | ..... |
| Present gas engine | 88.28 | 103.61 | $29.50 | $ 44.79 |
| Combined feed and steam storage | 94.42 | 111.35 | 23.36 | 37 05 |
| Feed storage | 97.58 | 117.58 | 20.20 | 50.82 |
| Without storage, load factor 25 per cent. | 117.78 | 148.40 | ..... | ..... |
| Steam storage | 117.84 | 134.77 | —00.06 | +13.63 |
| Complete battery storage | 123.13 | 145.74 | — 5.35 | + 2.66 |

DISCUSSION.

PROF. W. M. STINE, Chicago: It is well known that Europe has far excelled America in the development and applications of the storage battery. This has not been due entirely to apathy manifested in this country toward the storage battery, but rather to positive prejudice. This prejudice has been so marked in the past that those interested in the development of the storage battery have been accorded derision instead of encouragement. In such bad repute have they been held that no scientist dared risk his reputation in thorough investigation of this class of electrical apparatus. As a consequence, the development has rested largely with a class of well-meaning men who have lacked the proper scientific knowledge and experience to do justice to their work. Their efforts, being so largely of a hit-and-miss style and so little scientific, have caused the history of storage battery development to be filled with chapters of failures rather than successes. What real good has been accomplished by these persevering but untrained workers through years of toil and failure could have been more quickly and easily accomplished had men of competent scientific ability taken hold of the subject, as they should.

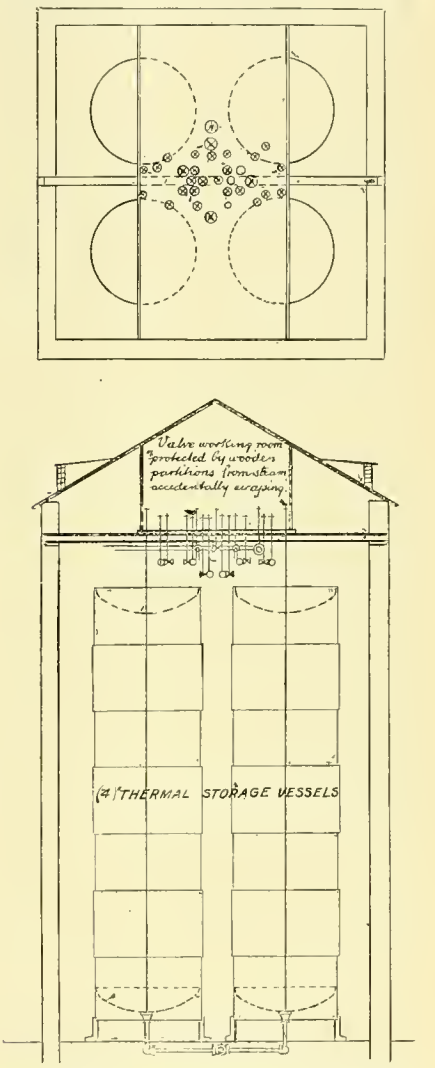



FIG. 5. STORAGE OF ENERGY ESSENTIAL TO ECONOMY OF WORKING IN CENTRAL STATIONS.—HALPIN'S COMBINED FEED AND STEAM STORAGE SYSTEM, IN CONNECTION WITH REFUSE DESTRUCTORS, TO SUPPLY STEAM TO A MUNICIPAL LIGHTING STATION (BOILERS NOT SHOWN).

But a change seems to be occurring. The storage battery is rapidly becoming an important factor in the economies of electrical engineering. But since a widespread interest in the use of accumulators has become a factor, it is necessary to regard the question of their economy from the cautioning standpoint. It is well to recognize that the American storage battery is at present insufficiently developed to meet the demand. This criticism is given only in the desire to present the subject truthfully. Just here we must learn

[Continued on page 124.]

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CIRCULATION, 16,630.

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THE Hawaiian cable project under government control was doomed when the administration announced its intention to veto the bill providing for an appropriation of $500,000 for the project unless this provision was stricken out. The measure was one of the last disposed of in the closing hours of the Senate. Without so much as the call of the yeas and nays, the Senate receded from its amendment to the diplomatic and consular bill. At 10.30 o'clock on Sunday night it became evident the House would not yield, but would allow the appropriation bill to fail and force an extra session rather than allow the cable to be built. Senator Hale made a last plea for the cable plan, of which he was the father in the Senate, but when White of California, representing the state chiefly interested, and who had worked for the cable in the most vigorous manner, announced in a short speech that it would be impossible to force the House over to the Senate's way of thinking, the bottom dropped out of the whole fight, and the Senate consented at 10:40 Sunday night, after nearly a week of futile conference. It had been hoped throughout the conference that the Senate would persist in its demand, and that the House would recede. The action of Congress is a great disappointment to all who were interested in the project.

The only chance for an American cable at the present time seems to be in the success of the International Pacific Cable company, which has been formed for the purpose of constructing a cable between this country and the Hawaiian Islands, thence to Japan, the mainlands of Asia and Australia. Inasmuch as this company will undoubtedly require a large appropriation in the form of a subsidy, it is not at all improbable that it, too, will fail. At any rate nothing important can be done before the next Congress meets and in the meantime the Canadian project may develop on other lines than those now contemplated, leaving this country entirely helpless. A golden opportunity has been thrown away and Congress by its action has made itself not only ridiculous but contemptible by its subserviency to the dictation of those opposed to the annexation of Hawaii.

ACCORDING to the tabulated statement included in the annual report of the commissioner of patents, there were 22,145 patents issued during 1894 that were classified by the department as electrical. This table is made up by classes, alphabetically arranged, and includes under the general heading of "Electricity," the following subdivisions: Conductors, railways, generation, medical and surgical, motive power, special applications. There are also these classes: Electric lighting, electric signaling, electro-chemistry, telegraphy and telephony. Metal welding, metal welding tools and measuring instruments form separate classes, and there is no means of knowing whether they include the electrical devices of these classes or whether the latter are grouped under "special applications." For many reasons it would be well to make a more detailed statement and a more accurate classification. The table shows that 393 medical and surgical devices have been classified as electrical, but it is safe to say that a vast majority of these belong to the electric belt and hair brush type and are not, strictly speaking, electrical inventions. No better evidence could be desired of the growing importance of the electrical industry than this excellent showing in the report of the patent commissioner. It is to be regretted, however, that the report also emphasizes the lack of facilities under which the department is laboring. It would be hard, indeed, to raise the efficiency of the Patent Office without complying with the recommendations of the commissioner, and Congress seems to look upon these suggestions with little favor, although they are generally acknowledged to provide for much needed improvements.

AMONG the numerous bills affecting electrical interests that are before the present Legislature at Albany is that recently introduced into the Assembly by Mr. Fitzgerald and referred to the ways and means committee for hearing. This bill provides for the inspection of electric meters, and there are many features that commend it to fair-minded men. At the present time central station managers generally favor the plan of supplying current on the meter system, and customers who do not wish to take unfair advantage of the companies, or, in other words, who are willing to pay for what they get, are satisfied with this arrangement. The day of flat rates is passed, at least in large cities, and the meter system is gaining in favor in the smaller communities as well. The object of the measure is commendable, and if wisely and carefully enacted the bill will work to the advantage of the central station managers, as it will place the business of supplying current upon a much firmer and far more substantial basis than it occupies at the present time. Every central station manager, it seems, would be only too glad to have the stamp of official approval upon the measuring apparatus upon whose report the bills of consumers are based. It would put an end to needless controversies over the accuracy of the meters, and while the proposed arrangement might for a time cause some embarrassment, as soon as the public was convinced of the reliability of the system there would be no further trouble. There is one provision of the bill which will doubtless provoke opposition to the measure. It is provided that "all such meters shall have exposed indexes, and so constructed that the public can read them." It is hardly the province of the Legislature to prescribe the type of meter to be employed, but rather adapt itself to prevailing conditions. The proposed bill invests the inspector of meters with powers somewhat similar to those of the sealer of weights and measures. Surely the state has not the right to insist upon the adoption of certain types of scales and measuring instruments for dealers in groceries, provisions and dry goods. Any instrument that is accepted by the trade as reliable and accurate must be recognized by the state, and while it is well for the public to have properly constituted authorities inspect these instruments to insure fair treatment at the hands of the companies, it would be a gross infringement of the rights of the people to dictate what style of apparatus should or should not be used. There are plenty of ways to guard the public interest without resorting to such arbitrary measures.

It seems that the principal point of interest to the electrical fraternity is to secure the appointment of a competent inspector and reliable assistants for this work. By the terms of the proposed law, the governor is authorized to make the appointment, and the salary provided by the act, $2,500 per year for the head of the department and $2 per day for the deputies should secure competent and reliable men.

AMONG the recommendations contained in the report of the State Board of Railroad Commissioners in the matter of the investigation of accidents on trolley roads in the city of Brooklyn, is one that the method of payment of the motormen and conductors shall be such as to tend in no event to cause employes to attempt to make up time by running at an excessive rate of speed. Ordinances, it says, should also be enacted by the Common Council and enforced by the police authorities regulating the speed of cars and the obstruction of tracks by vehicles. Further recommendations concerning the employment of fenders are made. The report says: "The question of fenders on electric and cable cars is one to which this board, for the past year, has given its careful consideration, by personal examination as to the practical working of the several forms in use in different cities in the state, and also by examination of types used in other states. The time has arrived, owing to the rapid increase in the number of electric and cable cars, when the adoption of the best obtainable form of fender is urgent. The companies should not wait until a perfect fender is obtained, but they should get the best forms at present in use and improve upon them." By far the most important recommendation, however, is that relating to the employment of motormen. The commissioners emphasize the responsibility of this position and the necessity of securing competent men. It recommends "that all applicants for positions as motormen shall be subjected to a thorough examination as to their habits, physical ability and intelligence. If this examination is satisfactory, the applicant shall be placed in a shop or power house where he can be taught and made familiar with the power and machinery he is about to control. When this is done he should be placed on a car with an instructor, and when the latter is satisfied as to the applicant's capability for the position of motorman he shall so certify to the manager, and, if appointed, the applicant should first serve on the lines of least travel. These requirements will necessitate the employment of first-class men, and they should be strictly held to the observance of all ordinances, rules and regulations." The board renews the suggestions made by it in December, 1893, which were published in its annual report for that year and again published in the report of 1894.

THERE was general rejoicing in electrical circles throughout the country last Monday when the announcement was made that the Supreme Court of the United States had handed down its decision in the case of the Bate Refrigerator company against Francis Sulzberger & Co., sustaining the opinion of the lower court and dismissing the appeal from its decision. The opinion, which was written by Justice Harlan and concurred in by all the other justices, determines the question of the life of American patents upon inventions previously patented abroad. The point involved is the construction of section 4887 of the revised statutes, which provides that "every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time as the foreign patent, or if there be more than one at the same time, with one having the shortest term, and in no case shall it be in force more than seventeen years." In this case the court held that the invention for which Bate received a patent was previously patented in a foreign country, and that the United States patent expired with the foreign patent. The case involves many important patents, including those held by the General Electric company on the incandescent lamp, the lamp socket and the multiple arc system, the American Bell Telephone company upon the battery telephone and other apparatus, the Western Union Telegraph company upon a quadruplex telegraph system, and many minor patents. The general public is principally interested in the telephone and incandescent lamp patents, and the greatest interest is displayed in these patents by the electrical fraternity as well. The lamp companies which been tied up by the General Electric company are naturally jubilant over the decision. Several lamp cases that have been pending in the lower courts will now be decided. Many of these have been delayed by the circuit court judges, pending the decision of the Supreme Court in the Bate case, and now that this decision has been handed down, they will undoubtedly be disposed of at once.

The lamp industry of the country will be greatly benefited by this decision and several factories that have been awaiting this favorable conclusion will be started up at once. This action will have a far-reaching influence upon the trade generally, and will do much to restore the electrical business in every department to its former prosperous condition.

# DECISION AT LAST.

## Supreme Court Justices Find Against the Bate Refrigerator Company, Establishing Principle That Terminates Fundamental Telephone and Incandescent Lamp Patents.

The long expected and vastly important decision in the Bate Refrigerating case was handed by the justices of the United States Supreme Court in Washington on March 4th. The justices were unanimous in deciding against the Bate company, the appellant, and promulgating the opinion that the invention for which the United States patent to John J. Bate was issued was, under the facts stated, "previously patented in a foreign country" within the meaning of those words in Sec. 4,887 of the Revised Statutes, and that the United States patent to him expired under the terms of that section before the expiration of seventeen years from its date. The opinion is written by Mr. Justice Harlan. Hardly anyone intelligently interested in electrical development in the United States need be told of the great importance of this decision to the industry, although the patent in suit is not of an electrical nature at all. The court has, however, definitely construed the language of the statute to mean that an American patent expires at the termination of the first foreign patent issued before the granting of the American patent for the same invention. This means, of course, that the fundamental Edison incandescent lamp patent and the Edison carbon transmitter patents, owned respectively by the General Electric company and the American Bell Telephone company, were cut off by the expiration of the respective foreign patents; and this implies, in turn, that the incandescent lamp and telephone fields are, in general terms, open to the world for competition, although the two great companies named still possess subsidiary patents on methods of manufacture and operation that are of considerable value. But, broadly speaking, the cloud of doubt in relation to infringement has been lifted from the manufacturer of incandescent lamps and the telephone business. It was realized that this would be the result of a decision against the Bate company, and the case was, by an agreement, fought out by some of the greatest lawyers in the country, representing the electrical interests involved. The General Electric and Bell companies took the ground that, in a question of this kind, in determining the time of issuing American and foreign patents for the same invention, the American patent should be reckoned from the date of making the application. In the case of the lamp patent the application at Washington antedated the issuing of the Canadian patent, and thus, if this argument prevailed, the expiration of the latter patent would not limit the life of the American patent. But the justices held that the language of the statute plainly contemplated the respective dates of the actual issue of the patents; and their decision thus throws open the telephone and incandescent lamp fields.

### Abstract of the Opinion.

The opinion begins with a review of the patent laws since the foundation of the government, tracing minutely the provisions as to foreign and domestic patents. It sums up the laws thus:

From this history of the several acts of Congress relating to patents for inventions it appears:

1. That in all the above acts Congress had in mind the date of an application for a patent, the date of the filing of specifications, and the date of the patent.

2. That under the act of 1836 a patent could not be granted if it appeared that the applicant was not the original and first inventor or discoverer, or that any part of that which was claimed as new had before been invented or discovered or patented or described in any foreign publication as in use in this or any foreign country; yet an original and true inventor was not to be deprived of a patent for his "invention by reason of his having previously taken out letters patent therefor in a foreign country, and the same having been published at any time within six months next preceding the filing of his specification and drawings."

3. That under the act of 1839 an inventor whose invention had not been introduced into public and common use in the United States prior to the application for a patent should not be debarred from receiving a patent by reason of his invention "having been patented in a foreign country more than six months prior to his application."

4. That under the act of 1870 an inventor whose invention had not been introduced into public use in the United States for more than two years prior to the application should not be debarred from receiving a patent by reason of its having been first patented or caused to be patented in a foreign country—these words not being qualified, as in the act of 1839, by any reference to the date of the application.

5. That when an American patent was granted in conformity with the sixth section of the act of 1839 for an invention "patented in a foreign country more than six months prior to his application" it expired in every case at the end of 14 years from the date or publication of such foreign letters patent, and when, in conformity with the twenty-fifth section of the act of 1870, a patent was granted for an invention, "first patented or caused to be patented in a foreign country," it expired "at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term."

6. That under the revised statutes, while a patent for an invention could not be withheld nor deemed invalid "by reason of its having been first patented or caused to be patented in a foreign country, unless the same has been introduced into public use in the United States more than two years prior to the application," yet "every patent granted for an invention previously patented in a foreign country shall be so limited as to expire at the same time" with the one having shortest term, "in no case to remain in force longer than seventeen years."

Justice Harlan then takes up the legal contention of the plaintiff that when the same invention is patented both in this country and abroad the American patent remains in force for seventeen years from its date if the foreign patent was issued after the application therefor, although prior to the date of the American patent. The interpretation placed upon the act of 1870 by the Patent Office and the courts is minutely considered and copious decisions cited, and the justice says that the Supreme Court may well adopt that construction which is in harmony with settled practice and under judicial decisions which may be disturbed or destroyed by the announcement of a new rule. The court then says:

Was the Bate invention patented abroad before it was patented in this country? If so the American patent expired with the foreign patent and thereby the American public became entitled to use the invention from the time the foreign public was permitted to use it. Congress, in effect, by the existing laws, says to an inventor seeking to enjoy the exclusive use in this country of his invention for the term prescribed by law: "If your invention has not been introduced into public use in the United States for more than two years you may, upon complying with the conditions prescribed, obtain an American patent, and you may, if you can, obtain a foreign patent. But the American patent will be granted on the condition that if you obtain the foreign patent first your invention shall be free to the American people whenever, by reason of the expiration of the foreign patent, it becomes free to people abroad; but in no case shall the term of the American patent exceed seventeen years." This we deem to be a sound interpretation of the statute, giving to the words used the meaning required by their ordinary signification. In our judgment the language used is so plain and unambiguous that a refusal to recognize its natural, obvious meaning would be justly regarded as indicating a purpose to change the law by judicial action, based upon some supposed policy of Congress.

It is also said the United States promised the inventor when making his application to give him a patent for the full term of seventeen years from the date of his patent if upon examination it was found that he was entitled to one at the time of such application, and, consequently, a curtailment of that term by reason of something occurring after the filing of the application and for which he may not be responsible is not consistent with good faith upon the part of the government. Of course this court would hesitate to accept any construction of an act of Congress that would imply bad faith upon the part of any branch of the government. But the contention just referred to assumes the very matter in dispute. It assumes that the promise to the inventor was not accompanied by any condition authorizing the government to limit the term of its patent to some period less than seventeen years from its date. If the promise to issue a patent is made with the reservation in the statute containing the promise that the patent, when issued, should be limited to expire with any foreign patent previously issued for the same invention, then there is no basis for the suggestion that the enforcement of that condition violates any promise made to the inventor.

Our answers, therefore, to the questions certified are that the invention for which a United States patent to Bate was issued was, under the facts stated, "previously patented in a foreign country," within the meaning of those words in Sec. 4,887 of the Revised Statutes, and that the United States patent to him expired under the terms of that section before the expiration of seventeen years from its date.

### History of the Case.

The Bate Refrigerating case involved directly but a small sum of money, and the complainant would probably have never thought it worth while to bring the case to a hearing had it not been that the lawyers of the General Electric company and the Bell Telephone company discovered that this case directly involved the point in which they were so vitally interested and would furnish the earliest opportunity of bringing it before the Supreme Court. The result was that the complainant soon found itself represented in court by such eminent and expensive counsel as James C. Carter, James J. Storrow of Boston, counsel for the Bell Telephone company, and ex-Commissioner of Patents Charles E. Mitchell and F. P. Fish of New York, counsel for the General Electric company. No sooner had these eminent counsel put in an appearance than the defendant, Sulzberger, found himself represented by the equally eminent counsel retained by the Westinghouse Electric & Manufacturing company and the anti-Bell telephone interests, including Wheeler H. Peckham, Edmund Wetmore, Benjamin H. Bristow and Leonard Curtis of New York and Charles H. Aldrich, ex-solicitor general, of Chicago.

The question was elaborately argued before the Circuit Court of Appeals for the Southern District of New York, Judges Wallace, Shipman and Lacombe sitting, but the court declined to take the responsibility of deciding the question and certified it up to the Supreme Court of the United States. This court treated the case as one of so great importance that it took the unusual course of assigning it for hearing some three years in advance of the regular order and also allowing double the usual time for argument. The oral arguments were by James C. Carter and ex-Commissioner of Patents Mitchell for the General Electric and Bell Telephone interests and by Edmund Wetmore and Wheeler H. Peckham for the Westinghouse and anti-Bell telephone interests, and a large number of briefs were filed on behalf of various other interests affected.

Probably there has been no case argued before the Supreme Court since the war in the outcome of which so many lawyers were interested.

A number of important electrical patents that have been overshadowed by the interest in the telephone and incandescent lamp litigation are also affected by this decision.

### General Effect.—Interviews.

The mere anticipation of the Bate Refrigerating decision had a marked effect upon the quotations of the stocks affected by it, General Electric having declined in a short time in New York from 37 to 29 on Saturday. American Bell Telephone stock also showed a marked decline. Upon the rumor of the decision on Monday morning General Electric experienced a sharp decline to 26⅛ and Bell Telephone to 139.

A dispatch from Boston states that the decision in the Bate case created no excitement in the local stock market. Bell Telephone and the other stocks affected closed strong. The only explanation is that the decision was anticipated and a slump was successfully guarded against.

In general the decision caused rejoicing in electrical circles throughout the whole country, except among the comparatively few interested in preserving the lamp and telephone monopolies. It was felt to be a good thing for the industry, removing doubt, stimulating business and exerting a wholesome influence throughout the length and breadth of the land. The lamp and telephone interests are such important branches of the industry that nearly everybody felt disposed to extend and receive congratulations. Seldom has a court decision had such a pronounced and cheering effect on a great industry as in this case.

Speaking of the effect of the Bate decision upon the interests of the electrical companies generally, George Westinghouse, Jr., said: "The control of one side of the Bate case was secured by the General Electric company, with the view of having the lower court's decision reversed as to the interpretation of the law determining the life of American patents. The Westinghouse Electric company in self-defense naturally took the opposite side, and it seems it has been successful. It would seem that the General Electric company, which has heretofore been the aggressor and plaintiff, will now have to bend its energies in the direction of protecting itself from the penalty of its own actual infringements."

A. S. Terry of the Sunbeam Lamp Manufacturing company of Chicago, with his brother, F. S. Terry, received many congratulations on the decision. Mr. Terry said that the great value of the decision to the outside lamp manufacturers lay in the effect it would have on the minds of consumers, particularly in the more conservative East, where it had been a difficult matter to sell any but Edison lamps for the last two years, owing to the aggressive attitude of the General Electric company. Customers often preferred other makes of lamps to the Edison, but had been deterred from purchasing by the reflection that it would be best to take no chances of an injunction. This fear was now swept away. Consumers could now exercise a wise discrimination in purchasing lamps, taking into consideration efficiency, life and price, without a haunting fear of legal entanglements, although, to be sure, the General Electric company did retain some important patents on methods of manufacture, such as the seal of the lamp. Speaking for his own company, Mr. Terry could say that great care had been taken not to infringe these minor patents and that the company was in position to take care of all business offered at a price that it could accept. The principal danger, of course, was that the business would now be injured by over-competition, but Mr. Terry felt that the consumer would make a more critical inquiry into the efficiency of his lamp than ever before, and in that case he had no fear.

Charles A. Brown of Barton & Brown, the patent at-

torneys, who pay particular attention to electrical patents, said:

The Supreme Court affirms all that was claimed by Sulzberger, and settles forever what constitutes the life of an American patent. As to its effects, it first of all removes completely all proprietary right to the patents covering the carbon or battery telephone transmitter. The Bell company claimed this invention under the Berliner patent, which was decided against the company by Judge Carpenter in the lower United States Court in Boston several months ago. The Supreme Court's decision and that of Judge Carpenter make it possible for anyone to use the carbon transmitter. The Bell company still holds numerous small devices, but its fundamental grip is gone and now the way is clear for rivals. The incandescent light patent controlled by the General Electric company had, under the most favorable decision of the courts, only three years to run. Its value may be estimated when it is stated that good judges believed it worth $1,500,000 for that brief period. A number of people have been preparing to start lamp works in this city and adjacent cities. They have been holding off for the Supreme Court's ruling in the Bate-Sulzberger case.

Another great electrical patent which is curtailed is that issued to Edison in 1887, known as No. 369,280, covering a dynamo with translating devices in multiple arc. Little has been said about it in the newspapers. It was a patent broad enough to cover every device for transforming electrical energy into mechanical energy. The General company, which holds it, began suits under it in the winter of 1893-94 to enforce payment of royalties. The institution of the Bate-Sulzberger case caused those suits to be discontinued. There are other minor patents involved. The capital which is interested runs possibly to more than $300,000,000. Certainly it is a staggering sum. I refer now to electrical industries alone, but throughout American mechanical industries the effects of the decision are felt. The rubber industry is heavily involved and a number of others.

## The Storage of Energy Essential to Economy of Working in Central Stations.

[*Continued from page* 121.]

an important lesson from the past. There is no longer a question but that the use of storage batteries will effect a considerable saving under proper conditions, provided the storage battery employed be reliable. At this stage, if the expectations based on the storage battery be too high, disappointment will result and a good thing again rejected with contempt. For this reason prospective purchasers of a battery should be put in possession of needed caution and should be well aware of their faults in order to properly estimate their virtues. Lack of proper knowledge of the subject can be assigned against many makers, inventors and supporters of this form of apparatus. Mere practical knowledge of storage batteries has always been bought at a high price. There is scarcely another class of electrical apparatus which involves so many intricacies and where the chances for success or failure are decided by such small margins. A storage battery plant, when it fails, fails so completely and involves such a relatively great expense, that it would seem only thoroughly competent men should be employed in their development and applications.

For the last few years the technical press of both Europe and America has given us a great deal of literature on the subject of accumulators. In most cases these articles have dealt with the economy resulting from the use of accumulators, based on their being a somewhat perfect piece of apparatus. Others have given results of investigations, pointing out their faults only. Articles relating to their care and installation have been too few and imperfect. Just at this juncture, when their use is shown to be so desirable, there is necessity for a good deal of plain, truthful statement. An accumulator plant must be intelligently and judiciously cared for. Its efficiency at best is low, and should the charge or discharge be continued too long the total efficiency is greatly lowered. The accumulator is not automatic in its action in the same sense that a transformer is, and requires constant inspection and testing, and supervision as well, when in action. The saving which it will effect at the coal pile is offset by the price paid for an attendant, and this factor must not be overlooked when estimating its economy. The cost of attendance is relatively high for small plants. Many people seem to think a battery can be left to take care of itself on discharge, but when the economy of the plant is more important than its convenience this is not possible.

It may be of interest to call attention to the nature and extent of attendanace. During charging the current must be regulated so as not to exceed a certain maximum, and since the tendency on charging is to decrease the current, it must be frequently regulated to hold it at the proper strength. The battery itself should be inspected at intervals during charging to detect excessive gassing and unequal action of the individual cells. Stress should be placed on looking after each cell rather than paying attention to the battery as a whole. A good practice is to wire each cell to a circular switch connected with a reliable voltmeter. In this way the voltage of each cell can be readily taken and a bad one located. It is not sufficient to take the volts at the ends of a series during charging as an indication of the extent of charge. A sulphated cell may cause a large drop owing to high internal resistance; the connections when badly corroded absorb a relatively great drop. These two causes may make the main voltmeter indicate the termination of the charging, when if the voltage of the cells was taken separately, the charge would be found to be far from complete. The separate voltage plan is then a check on such faults as bad connections and poor cells, and will call attention to their existence so they can be remedied. As the electrolyte evaporates or is lost through gassing, it must be frequently renewed and brought up to the standard density. The hydrometer is a piece of apparatus that must not be forgotten in the installation of a plant. There is always danger that the small pieces which become detached from the plates will cause a short-circuit. To prevent this a narrow strip of thin rubber should be run between each pair of plates. During the discharge the attendant should see that the discharge capacity of the battery is not exceeded, for if this occurs frequently the plates will be damaged. As the discharge proceeds, the voltage must be taken over each cell to prevent the weaker ones from over discharge. No matter how excellent the battery may be, it will need frequent repairs, and such repairs are not only tedious but take a great deal of time. This consideration must be allowed for in installing a plant or it will result in disappointment.

An accumulator differs from the the dynamo or engine in efficiency of working. A dynamo is most efficient when working near its rated capacity. The accumulator is not. The lower the rate of charge and discharge, within certain limits, the higher will be the efficiency.

Trade competition has led to a large overrating of cells. The ordinary 300 ampere hour cell will show the best results and most economical lifeif worked to only 75 per cent. of its rated capacity. In the main this is true for all sizes, unless the maker has rated his plates especially low. If work too high a too large proportion of the plate is converted into active material and in time much of this active material will scale off and fall to the bottom of the cell. The body of the plate, too,will become soft and spongy and completely fall apart. Experience has shown that this action is not confined to any particular form of plate, but seems inevitable at some period in the life of all plates. If a plate is abused it soon makes its appearance; if properly cared for, it comes only after a long and useful life. It is a matter that should be carefully looked after, for if detected before the softening has gone too far it may be partially remedied. The soft plate should be removed, washed thoroughly and dried, then worked as a negative and reduced to spongy lead, when it is in a condition for reforming. Built up in this manner, it can be restored to is place in the cell.

European experience has shown that it is possible to reach an efficiency in watts of 75 per cent. to 80 per cent. At present a good cell should show an ampere efficiency of at least 90 per cent. These are certainly good results but would seem capable of improvement. European investigators have given the development of the lead battery a vast amount of scientific and practical attention for years, and their results may be accepted as indicating very nearly high-water work. A good deal seems to be expected from the inventive ingenuity of the Americans, but much as we admire this we believe it has a rather hopeless task in the lead battery.

The most we can expect from invention is to make the product more uniform and reliable. The storage battery is such an intricate piece of apparatus that it is very difficult to secure uniformity in production. The least variation in the quality of the materials employed in making them often leads to disastrous failure.

At present it seems as if central station managers would not install a storage battery plant unless the life of the plate be guaranteed by the maker. This seems to be an unfair demand unless the manager in turn guarantees the quality and extent of the attention to be given to the plant. A good cell may be ruined by injudicious or careless treatment, and the margin between proper care and unfair treatment is so narrow that such questions would involve endless complexity and litigation. It is only fair to the manufacturer that he guarantees his cells to be fairly uniform as regards capacity and efficiency, and the question of life should be left with the purchaser, unless poor construction becomes evident in the life of the battery. In order to properly discuss the probable increase in efficiency it must be borne in mind that an accumulator is primarily a chemical device, storing chemical rather than electrical energy. A certain part of the energy is lost in local actions, which heat the accumulator on charging and cool it during discharge. A metal is deposited from solution in what chemists call a nascent or atomic condition. It cannot remain in the atomic state, but immediately unites with another atom to form the stable molecule. In doing this heat is evolved and represents utilizable energy lost. On discharge, when the load unites with the sulphuric acid, this molecular condition is broken up and heat is absorbed. When gases are evolved from the cell they pass off in the molecular condition, leaving their heat of combination to the cell. A number of other secondary reactions also occur on both charge and discharge, whose energy must be counted off from the efficiency of the cell. From the nature of the complex chemical reactions in the cell, these secondary energy-absorbing reactions cannot be well reduced in amount. If the chemical reactions were as simple as those usually stated by the books, we might hope for a higher efficiency. Again, there occurs during every charge and discharge a certain amount of chemical action which cannot be reversed, and the material clogs the plates and accumulates at the bottom of the cell. These will eventually consume the plates. Another local action in the cell is one which causes a waste of energy spent on charging.

If the different plates of a particular element be tested with a millivoltmeter, it is occasionally found that a difference of potential exists between them. This difference of potential tends to equalize, but in so doing sets up a local action which dissipates a portion of the charge. This loss is not an infrequent one. Still another class of local actions are bound to occur which lessen the life of the plates rather than lower their efficiency. Plates are as a rule complex in structure, that is they contain antimonial lead in metallic connection with spongy lead. On the negative plate there may be pure lead, antimonial lead and lead sulphate existing at the same time. On the positive there are the two forms of lead, the oxides of lead, and, at times, lead sulphate. Now in the presence of the acid electrolyte there will always exist an electromotive force between each two of these substances. This electromotive force may exceed one volt in some cases and must result in considerable local action which dissipates the charge and disintegrates the cell as well. On this account all forms of soldered joints are objectionable when they occur under the electrolyte. No matter how the positive plate may be built up the active matter will in time become loosened from the supporting material. Elements built up of the lead ribbon are especially liable to suffer from this cause, for the local action is greatest where the strips are fastened to the frame. The ribbon is so thinned at such points that it is common for the entire center of the plate to fall out bodily from the frame work, when as yet the body of the plate is sufficiently firm to last several years. Plates so constructed may not have a long life.

A serious trouble is apt to occur when the active material bridges two plates. Frequent attempts have been made to prevent this by placing a layer of felt or asbestos between the plates, but this method only introduces a new coil. The extent to which a cell may maintain a constant electromotive force on discharge is governed by the rapidity with which chemical action may occur on its plates. Their chemical action is conditioned by the amount of active material on the plates but equally to the supply of sulphuric acid to them. Any condition which interferes with the rapid diffusion of the acid will impede the chemical reactions in the cell. The slight increase of ohmic resistance due to the asbestos felt is of but little consequence in comparison with impeding the rapidity of diffusion. The larger the cell the more deleterious is its influence.

Experience in operation, as well as laboratory experiments, have clearly shown that the best practice is to leave ample space between the plates and that these should be elevated at least two inches from the bottom of the cell, and that all separating insulators should be vertical. A paddle run between the plates occasionally will prevent trouble from short-circuits, and render asbestos or other clogging material unnecessary. Any plate that will not operate satisfactorily without asbestos felt is inherently faulty and is to be avoided. A flat plate seems to yield better results than one perforated or built up of ribbon, for the reason that the action is more uniform, since all the active material has freer access to the acid. But such plates are often shorter lived, though they show a higher efficiency at first.

The active material is compressed on such plates and held in place by projecting points or studs. Owing to unequal expansion doubtless the active material separates a little in places from the support. Acid will pass in to fill the space and local action will be set up, and in time a separating layer forms over a portion of the plate, causing the active material to scale off and fall to the bottom.

The considerations in selecting a battery for central station or power may in part be summed up as follows:

First—Plenty of lead in the elements. One maker places the quantity at two ampere hours capacity per pound.

Second—Ample storage capacity for the work to be exacted from the battery. This should rather be over-estimated.

Third—The plates should be well separated and easy of access for cleaning.

Fourth—The mechanical strength of the plates should be able to withstand all charging strains.

Fifth—The plates should be free from all soldered joints and the metal should be homogenous.

Sixth—The plates should be free from points that may be especially weakened by local action.

Seventh—The active material should be so disposed that it may have the freest possible access to the acid.

Eighth—The active material should be so thoroughly attached to the plates that it will not readily fall off in use.

Ninth—The separate plates of an element should be so attached to the connecting bars that they may be readily removed for inspection or repair.

Having so fully discussed the plates, the electrolyte must not be passed over without some cautionary remarks. Good sulphuric acid should be used. It should preferably be free from all metallic impurities, such as iron or arsenic. Lead sulphate, a very common impurity, is not objectionable. If commercial acid be used, it should be purified by sulphuretted hydrogen or other means. The water used to dilute the acid must be equally free from metallic impurities, such as iron. It is well to bear in mind that excellent plates may be ruined by an impure electrolyte. In short no reasonable expense should be spared in the installation of a storage battery plant, for it is extremely dear economy. With proper measuring instruments and auxiliary devices, pure electrolyte, good plates, and intelligent care, a storage battery plant is undoubtedly a paying investment and a source of marked economy in operating a central station.

Herbert Lloyd, Philadelphia: Of the five methods of storage which Mr. Perry has considered, I would call your attention to the figures which are supposed to show the results obtained from electro-chemical storage. For the purpose of this discussion I will take it for granted that the figures given on the first cost of boilers, engines, dynamos and buildings are correct up to the subdivision, "Battery Storage;" also for the maintenance of the same, but I most decidedly take issue with the figures given on the first cost of a plant half storage and half direct, also on the cost of maintaining the storage battery and the amount of coal consumed in charging the same.

The author gives the total investment without storage battery as $306.80 per horse power. The first error is in assuming that all the energy generated is stored. He assumes a loss of 25 per cent. of all the energy generated, but as only half is stored, the loss should be but 12½ per cent. of the whole. Instead of dividing by .75 he should have divided by .875, which gives the total cost of the machinery as $155.42 instead of $181.80. Next, as to cost of buildings: Taking the buildings at $30 as in previous cases, buildings without battery would cost $53.04. Adding 25 per cent. to this, which is very liberal, for battery building, we get $68.30 or a total of $223.72 instead of $306.80. Next comes the cost of the electric storage battery, which is given at $35 to horse power erected, or $420 for twelve horse power hours, which would be necessary if the plant were half direct and half storage.

Where such figures could be obtained I am at a loss to understand. About 50 per cent. has been added to the real cost. A battery plant can be erected to-day for $24 a horse power hour, which would give a total investment for a plant half storage of $223.73 plus $288, or a total of $511.72 instead of $726.80, as given.

It would be readily seen how the decreased interest charge will effect the final result.

Next, as to maintenance of storage battery. Ten per cent. on the total investment of a central station battery plant is

unheard of; 10 per cent. on the price of the lead plates is the highest maintenance contract which has come to my attention, and this would about correspond to 6 per cent. on the first cost of installation. So, instead of 10 per cent. on $420 as a maintenance cost, we have but 6 per cent. on $288 as an actual fact.

Again, in estimating the amount of coal consumed for electrical horse horse power, Mr. Perry gives for steady work a coal consumption of 2.21 pounds. If charging batteries does not give regular load, I would like to know what does, and yet he gives the coal consumption for charging batteries at 4 pounds.

By substituting corrected battery figure for those quoted by Mr. Perry, we have the following results:

*Batteries at $24 per Electrical Horse Power Hour.*

| | | |
|---|---|---|
| Total investment plant | $223.72 | |
| Battery | 288.00 | |
| | $511.72 | |
| Interest at 4 per cent | | $20 47 |
| Maintenance and depreciation—buildings at $68.30 at 2 per cent | | 1 37 |
| Machinery at $155.42 at 7½ per cent | | 11.66 |
| Battery $288 at 6 per cent | | 17.28 |
| Total fixed annual cost | | $50.78 |
| Coal 2.21 pounds for 8,760 hours at $1.75 | | 16.93 |
| 12½ per cent. additional for loss in battery | | 2.11 |
| Petty stores and attendants | | 13.37 |
| Total annual cost per electric horse power | | $83.19 |

*Batteries at $28 per Electrical Horse Power Hour.*

Coal at $1.75 per ton—

| | |
|---|---|
| Steady load without electrical storage battery | $ 48.68 |
| Variable load made steady by battery | $3.19 |
| Variable load without battery | 117.76 |

Saving with electric storage battery, $34.59.

Coal at $3.50 per ton—

| | |
|---|---|
| Steady load without electric storage battery | $ 65.62 |
| Variable load made steady with battery | 100.12 |
| Variable load without battery | 148.41 |

Saving with electric storage battery, $48.29.

Mr. Perry's figures of $52.31 with steady load without storage battery is evidently an error in figuring, as it should be $65.62, as I have stated. To sum, comparing the results of the various systems, we have the following:

| | Coal at $1.75. | Coal at $3.50. |
|---|---|---|
| Storage battery | $34.59 | $48.29 |
| Gas engine | 29.50 | 44.79 |
| Feed and steam storage | 23.36 | 37.05 |
| Feed storage | 20.30 | 30.82 |
| Steam storage | 00.06 | 13.63 |

It will be seen that correcting the battery figures has changed the result from—$13.43 and—$13.34 to a saving of $34.59 and $48.29 respectively. I would state that the figures given on gas engine methods are in my opinion far too favorable to the gas engine for central station work when based upon results obtained in this country. The units are necessarily small and the speed comparatively high, making the cost of labor, maintenance and depreciation much higher than would be the case were large steam engines and generators used running at slow speed.

By correcting the figures on the first cost of battery—and the figures that I have given can not be disputed—the situation acquires a new aspect. Instead of the application of a storage battery resulting in the loss of over $13 per annum per horse power, we have a saving far above that shown by any other system, in fact, about 50 per cent. greater than the savings shown for combined feed and steam storage.

The Edison Illuminating company of New York is just installing a battery of nearly 2,000 horse power hours capacity and it is mainly upon this contract that the figures given above are based.

Mr. Perry touches very lightly on the great utility of the battery to be discharged in from one to three hours as applied to taking the peak of the evening load. I learned from many large station managers that a 1½ or a 2 hour battery is what they most need, and when it is borne in mind that a battery of this character costs to install about $50 per horse power, the situation acquires entirely new aspects. A direct plant, including boilers, engines and dynamos of the most improved and durable machinery, will certainly cost from $60 to $75 per horse power, and I think the fact that storage batteries can be installed and worked at 1½ to 2 hour rate for about $50 per horse power certainly brings the electric storage to the front. Mr. Perry is mistaken when he states that at a rapid discharge rate the battery is less efficient than 75 per cent. This can be readily proved and is being demonstrated every day. Not only is the first cost of storage battery brought within the reach of central station operators, but the depreciation can be kept down as low or lower than the depreciation of any other machinery which can be installed.

Those of you who were in Washington a year ago will probably remember a description read of the central station battery installed in Germantown, Philadelphia, the previous year. I am glad to be able to state that that battery has been in constant and successful operation ever since and up to date has not cost the station nor the battery manufacturing company $1 for repairs.

As the Germantown battery, the Merrill, Wis., battery and the one about to be installed for the New York Edison company cover all the central station batteries which have been as yet contracted for, with the exception of a foreign battery installation in Boston, the prices obtained for these different plants are the only ones on which estimates can be reliably based.

Anyone taking the trouble to have asked for information from the manufacturers would have been afforded every facility for obtaining the exact and reliable figures.

J. A. Seely, New York: Some years ago I was connected with a company which installed a storage battery plant of six hundred cells. I think at that time it was the largest plant in the United States. The cells cost $14 each, or $8,400 for the entire plant. When they came to erect the plant it cost probably $2,000 more to connect it up with various appliances. It required two men at $2.50 a day to pay particular attention to each cell, and the renewing of the plates was about $500 a year, which made the cost of maintenance about 28 per cent. on the investment. I regret to say that the battery was discontinued after giving it a two years' trial.

James I. Ayer, New York: How long ago was that?

Mr. Seely: 1885.

Mr. Lloyd: The fact that it required six hundred cells shows its character. We can now do the same service with sixty cells.

Mr. Seely: I would like to hear from some individual, a member of this association, operating storage batteries. I do not say there is not a good storage battery to-day, but I would like to see it demonstrated.

Mr. Wright, Philadelphia: The Germantown battery was installed during January, 1894, and was put into regular service on February 4, 1894. It supplies current to the 220 volt three-wire direct current mains furnishing electrical energy for incandescent light and power. It is in operation from dawn to dusk of every day. It has been in continuous use from the last mentioned date until the date of writing, with the exception of July 29th, when the entire battery was dismantled and a complete set of new wooden separators put in. The wooden separators originally installed were made of poplar, and it was found after nearly six months' trial that the acetic acid in this wood combined with the lead, forming acetate of lead, which tended to weaken the battery by discharging locally. The new separators are made of cherry, and after over two months' service it is found that they do not give the trouble experienced by the use of poplar ones.

The Germantown battery is put into charge during the evening after the load has dropped somewhat, and when fully charged, which is done in from five to seven hours, is allowed to stand until the engine is stopped in the morning. The battery is then put into circuit and feeds the line until dusk, when the engine is started again. It has been shown repeatedly when the battery has been allowed to stand over night without charging, as is occasionally done, that the quantity of fuel used is not appreciably decreased. It is necessary to say, however, that this is primarily due to the fact that the charge is usually a very small proportion of the total load of the engine. If the charge were a large fraction of the total load of the engine, there is no doubt whatever that it would take its proportionate share of fuel. In this Germantown case, however, the conditions were such that the day circuit when run by steam power was costly from the very fact that the output was so small. Now that the battery takes the day circuit, although the output has increased at least 25 per cent., it does not now average over 50 amperes, or the equivalent of 100 16 candle power incandescent lights burning.

Careful hourly readings of electromotive force, current and specific gravity have been taken on this battery from the time of starting up. Those figures show that up to the time of changing the separators February 2d, to July 28th, or nearly six months, the watt efficiency was 82.6 per cent. These figures include the first charge, for which some allowance ought of course to be made.

The figures from July 30th to October 7th inclusive, over two months, give the watt efficiency 74.2 per cent., ampere efficiency, 86.6 per cent.

These latter figures represent the true efficiency and are very much better than expected. Allowed 35 per cent. loss when estimating results prior to the installation of this battery.

I have again gone over the figures relative to the saving accomplished by the use of this battery. You will remember that before installing the first small battery at Germantown tests were made to find the actual cost of operating the day circuit by steam power. It was found that the operation of the day circuit cost $3,615.15 per annum. The saving by the use of the battery is made up as follows:

| | |
|---|---|
| One man at $10 per week | $ 520.00 |
| One-half man at $7.50 per week | 195.00 |
| (This man now spends half his time trimming arc lamps.) | |
| Fuel, 582 tons at $1.85 | 1,076.70 |
| Water, 300 M. at 60 cents | 180.00 |
| Oil, waste and sundries | 100.00 |
| Depreciation and repair on plant now idle, valued at $8,000, at 5 per cent | 400.00 |
| | $2,471.70 |
| Less depreciation, battery (esimatedt.) | 600.00 |
| Net saving | $1,871.70 |

Beside the above we hope to be able to put the battery to help out the dynamo during the night run. Tests have been made recently to ascertain to what extent this can be done.

Frederic Nicholls, Toronto: I would like to say that so far as the Germantown system is concerned, at that time it appeared to me that the day load, which is such an important feature in the use of the storage battery, was practically negligible. So far as I am aware, the only two practicable systems in central stations in this country are in New York and Boston, respectively. I believe Mr. Edgar of the Boston Edison company is present, and I am sure we would like to hear from him.

Mr. Perry: I was not able to catch specifically all of the criticisms that were made as to my figures. The statement is made that I have charged too much for the depreciation of storage batteries, which is put at ten per cent., and too much for the batteries. As to the cost, Unwin puts it at eight pounds per horse power hour storage capacity, or $40. Prof. Forbes puts the figures at about the same for English practice. I thought I was safe in putting it at thirty-five. In regard to my charges for energy lost, I have put it at twenty-five per cent. With twelve horse power hours stored, twenty-five per cent. of that would be lost if the efficiency of the battery were 75 per cent. That I have charged and nothing more. I have distinctly stated further along, where we apply it to a station, and change the character of our load line, that the amount lost is only that part of the energy stored in the battery at that time, and has no reference whatever to the other units working below it. The figures stated by me are less than those given by the Electric Storage Battery company.

Mr. Edgar: We have been operating for the past year one of the largest storage batteries in the world. I think that I can answer a number of the arguments made in the paper, but not having seen it until the reading cannot do it in detail. We pay for a four hundred horse power battery six per cent. on the cost of the cell, which is about four per cent. on the cost of the installation, and for a ten years' guarantee. As the result of putting in the first battery a year ago we are now putting in one double the size, so that we own to-day the largest in the world. The original battery was put in after a personal investigation abroad, and I do not see how anyone can go abroad and look at the batteries that are used there and have any hesitation whatever in putting in a battery, if you get a guarantee. It has never entered my head in the slightest degree as to whether a battery was economical. The only question which has come up has been, Can you get a battery which will not deteriorate. We are saving ten per cent. of our coal bill by a battery costing per horse power one-half as much as our steam plant. We have in one of our stations 600 horse power engines. We have four of them. Our maximum load, purely Edison three-wire system, lasts for an hour and a half. I asked for specifications for a battery which would run 600 horse power one hour and a half. Having nothing to go by for American practice, I asked for a battery to duplicate one of our steam engines. A first-class steam plant costs $100 a horse power, everything inside of the building. That is being done to-day. That battery cost us a little over $50 a horse power to do the maximum work. We did not want it to do it for twelve hours. That would be the point Mr. Perry speaks of. We did not need it. We bought it for service during one hour and a half. Looking at it on that basis, we can save 50 per cent., or half of the money, by putting it into batteries; so that our total investment in the station, with half batteries and half steam, is only three-quarters of what it would be all steam. We bought the battery to take care of the maximum load, and have never used it for anything but the maximum load, and still save 25 per cent. This is all assuming that the battery will be made to work and you can get a guarantee. We succeeded in getting a ten years' guarantee from a firm absolutely reliable, one of the old firms in Germany.

Mr. Perry: Your case would come under the supposition that I have referred to in the latter part of my paper, where you would take the peak of the load. You do not attempt complete storage. I have separated the two. If the batteries were stored for twelve hours and run for twelve hours, the cost would be doubled or trebled.

Mr. Edgar: Those conditions do not exist. I take the conditions as they exist in business. I do not know any condition such as you have shown in the electric lighting business.

Mr. Perry: The result would be as I have shown—too expensive.

Mr. Edgar: That would be running a battery with a steam annex, instead of vice versa. There are no stations running currents such as you have referred to. Your load curve is incorrect.

## Two Chicago Concerns Burned Out.

By the fire in the Kaestner building, 241 to 247 South Jefferson street, Chicago, on the morning of February 27th, two well-known electrical companies—the Cutler-Hammer Manufacturing company and the Pumpelly-Sorley Storage Battery company—were burned out. The fire was a peculiarly quick and destructive one, and both companies lost everything. The Cutler-Hammer company only saved its morning mail, and the employes were obliged to run for their lives, leaving hats and coats behind, and the legs of some were scorched at that. But it is a fine instance of western pluck and energy that by 4:30 P. M. of the day of the fire the Cutler-Hammer company had already rented a complete machine shop at 16 and 18 South Canal street and had resumed business. This company's loss was about $8,000, fairly covered by insurance. The Pumpelly-Sorley company sustained a loss estimated at $15,000, and, it is said, is without insurance. At one time it was feared that the fire would extend to the large adjacent factory of the Western Electric company, but this danger was averted.

## Dinner to F. W. Cushing.

On Tuesday evening, March 5th, a few of the electrical friends of F. W. Cushing tendered him a complimentary dinner at the Union League Club, Chicago, prior to his departure for Europe. Mr. Cushing returned to Chicago only a few weeks ago after a year's sojourn in Great Britain and the continent in the interest of Professor Gray's telautograph and is about to return on a similar errand. The following named gentlemen, in addition to the guest of the evening, were in attendance at the dinner: C. A. Brown, F. S. Terry, G. A. McKinlock, William H. McKinlock, Prof. Elisha Gray, C. E. Brown, W. A. Kreidler, William J. Lloyd, C. H. Wilmerding and B. E. Sunny.

The Central Union Telephone company is arranging to rebuild its system at Quincy, Jacksonville and Springfield, Ill., also to run a long-distance line down the Illinois and Michigan canal from Chicago to Ottawa, Decatur, Springfield and St. Louis, with a branch to Jacksonville and Quincy. All of this work will be pushed through the coming summer. The company claims not to fear competition, and believes that the Supreme Court will decide the Berliner case favorably to the company. The sum of $37,000 will be expended in rebuilding the Quincy system alone.

# COMMUNICATIONS.

## Machinery Litigation.

*To the Editor of the* WESTERN ELECTRICIAN:

In a recent issue of the *Iron Age*, under the head of "Machinery," there appeared an article concerning the settlement of suits between Fielding & Platt of England and the Morgan Engineering company, wherein they say that the Morgans agreed to forego a verdict of $10,600 and pay $4,500 besides.

It is true that we obtained such a verdict on the ground of defective machinery furnished by Fielding & Platt, but the $4,500, which was an undisputed balance of account due from us, was deducted therefrom, leaving a net verdict in our favor of $6,100. It is not true that after the argument in New York there was any prospect of the court disturbing our verdict. It was very evident that Judge Hammond, who tried the case, would support the verdict in our favor, and knowing this to be so, the representatives of Fielding & Platt proposed a settlement, which, with modifications, we accepted. In this suit, after a long trial, the jury had found as above stated.

At the same time another suit was pending by Fielding & Platt against us, wherein they claimed many thousands of dollars as royalties, on what was called "Tweddell's system." The settlement was this: First, Fielding & Platt had paid substantially all the costs (a large sum) in both suits to date of settlement, and this they released; second, Fielding & Platt released us from all alleged claims for royalties, and dismissed their suits; third, each party paid one-half the remaining costs, being a small sum; fourth, we paid the balance of account due from us.

We should not feel at liberty to state the terms of settlement, but for the evident fact that the article in question emanated from the other side. It will at once be seen that the terms of the settlement were entirely satisfactory to us.

MORGAN ENGINEERING COMPANY,
Per T. R. MORGAN, SR., President.

*Alliance, O.*, February 28, 1895.

## Stadt Theater Fire.

*To the Editor of the* WESTERN ELECTRICIAN:

An editorial appeared in a late edition of the WESTERN ELECTRICIAN which misrepresented the facts concerning the Stadt theater fire which recently occurred in Milwaukee. In justice to the Milwaukee Board of Fire Underwriters I would briefly state the following facts: The theater was being profusely decorated for a ball to be given on the evening of the day the fire occurred. A chandelier, used on the stage for parlor scenes, was temporarily hung from the proscenium arch and bunting was draped near it. In raising and lowering the chandelier the insulation of the wires became frayed where they entered the fixture stem, and when the current was temporarily turned on to please some members of the ball committee, a short-circuit was formed, setting fire to the bunting.

There was no cut-out on the fixture and in fact none on the stage, all fuses being located in an iron box in the basement. As the decorations and electrical fixtures were only partially completed when the fire occurred, no inspection had been made by the underwriters, although one was to have been made when the work was finished.

*Milwaukee*, March 1, 1895. ***

[We accepted the statement that the temporary wiring had been passed by the underwriters' electrical inspectors upon authority that has hitherto proved reliable and exact. We are entirely willing to give our correspondent the benefit of his positive assertion that no inspection had been made. The fact in this case, however, does not affect the weight of our argument that underwriters' inspectors should endeavor to prevent electrical fires rather than to make office lists of them after they occur.—ED.]

## Electricity from Typewriting Machines.

Static electricity and electro-magnetism have been reported recently from a new source—the typewriting machine. In manifolding, where four to eight carbon copies are made, on removing the carbons, they frequently stick together and to the hands, or if laid against the clothing or on a blotter will cling very closely; but if slowly drawn apart several times the magnetism gradually passes away. Some of the typewritten copies repel each other very strongly while others stick together. Miss Harriet Russell of Chicago, who reports this interesting fact, also complains that after a great deal of duplicating the machine becomes so charged as to yield a distinct and very annoying shock each time the gutta percha space bar is struck.

## American Institute of Electrical Engineers.

At the regular monthly meeting of the council held on February 27th it was voted that the general meeting of the Institute be held at Niagara Falls, beginning June 18th. It is proposed to devote this meeting principally to the question of power transmission.

The following named associate members were elected: Franklin Robert Anson, Salem, Ore.; Arthur B. Cumner, Boston, Mass.; Joseph Nisbet LeConte, Berkeley, Cal.; Hermann Loewenherz, New York city; Robert C. MacCulloch, New York city; Maxwell M. Mayer, New York city; J. T. Nyhan, Macon, Ga.; B. C. Paddock, Jr., Brookline, Mass.; J. Lloyd Prince, Brooklyn, N. Y.; Geo. A. Redman, Rochester, N. Y.; Bernard Victor Swenson, Champaign, Ill.

The following named associate members were transferred to full membership: James Wellington Crosby, New York city; E. Randolph Hix, New York city; C. O. C. Billberg, Philadelphia, Pa.; James Hally Craig, Boston, Mass.; Edwin C. Shaw, Akron, O.

At the meeting of the Institute held at 12 West Thirty-first street in the evening, H. Ward Leonard presented a paper entitled "Notes on Recent Electrical Engineering Developments in France and England." The paper was discussed by Townsend Wolcott, J. W. Lieb, Jr., C. E. Emery, Herbert Lloyd, A. E. Kennelly, Wm. Maver, Jr., M. W. Forney, Cary T. Hutchinson, Richard Fleming, Joseph Sachs, F. B. Crocker and E. J. Houston.

## Chicago & North Shore Company's Power House Burned.

Early on the morning of March 4th the power house of the Chicago & North Shore Electric Railway company at Edgewater was destroyed by fire. The generators and most of the motor cars were rendered useless. The offices of the company were also located in the building. The loss is estimated at $60,000. The plant was used to operate the Evanston avenue electric line from Graceland avenue to Evanston. It was a two-story brick structure, and was, in a sense, historic, from the fact that it stood on the site of the old electric light plant which figured in the Cronin mystery and trial as the place where the searchlight was flashed upon the wagon in which Dr. Cronin's body was driven to the sewer. The structure was built of the finest pressed brick; with elaborate and artistic trimmings, and handsome doors rolled over the four entrance ways for cars. The handsome appearance of the building was the result of intention to make the structure harmonize with the taste intended to be a feature of the aspect of the aristocratic town. A part of the building was fitted up handsomely for offices of the company.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, March 2.—There has been considerable uneasiness caused by the strike of the electrical workers last week. All members of the brotherhood are "out" and their action may precipitate a general strike of building organizations. It is evident that the men are well organized and that they are prepared for a long struggle, if necessary, as they have enlisted the support of other trade organizations. The Electrical Contractors' association is also prepared for trouble, and unless an amicable agreement is reached at an early day it is hardly probable that there will be much building on a large scale in New York this year. Out of sympathy with the striking electricians, the workmen employed on the palatial home in this city of Charles T. Yerkes, the Chicago millionaire, went out on a strike yesterday. They were joined by the men engaged on the Savoy hotel annex and the new Astor mansion. The strikers number 600 men. The men engaged on the New York clearing house have also struck.

The meeting of the Rapid Transit Commission was occupied largely in discussing suggestions for bills to amend the rapid transit statutes. Nothing was made public regarding the character of the proposed amendments beyond the fact that the commission wants the right to suspend indefinitely the building of any part of the lines it has adopted. It is supposed that one reason why this power is wanted is the uncertain character of the board's right to occupy the part of the East Side route laid out under, alongside and above the station and tracks of the Harlem railroad on Park avenue from Forty-second street to the Harlem river. In the discussion regarding general plans of construction, Mr. Orr said that while the board had estimates for construction upon the plans first suggested by the chief engineer, and approved by the board of experts, it was not informed definitely as to the cost of construction if the railroad should be built with four tracks on a level, and immediately under the surface of the street. He therefore requested the chief engineer to make a further estimate of the cost as based upon such plans. Taking up the matter suggested by Mr. Low at the last meeting, when he put forth the idea of taking in the whole of the streets from house line to house line and making tramway tunnels for package delivery purposes on each side of the main tunnels, Engineer Parsons said that some of the big buildings along Broadway had foundations which extended considerably beyond the house lines. He showed tracings of one which he said was a type of many such buildings.

Peter T. Austen, John Gibb, Ditmas Jewell, William H. Nichols and R. S. Walker, who were appointed recently by Mayor Schieren of Brooklyn as a special advisory commission to investigate the trolley system and devise some plan for operating the cars more safely, have submitted a report embodying the following recommendations:

1. The speed of trolley cars should not exceed ten miles an hour.

2. Every car should be provided with a device giving an audible signal when the speed of the car exceeds ten miles an hour.

3. Passengers should not be allowed to ride on the front platforms, and both gates of the front platforms should be kept closed when the cars are in motion.

4. The gates on the track side of the rear platforms should be kept closed.

5. Cars on all lines crossing main thoroughfares on which there are car tracks should come to a full stop before crossing. Cars on main thoroughfares must be kept under perfect control and run at a reduced speed at such crossings.

6. All cars should be provided with reliable fenders, which should be approved by a commission of experts.

7. In case of an accident occuring through the negligence of a motorman, the motorman should be held criminally responsible therefor.

8. It being the opinion of this committee that accidents have occurred which have been due to the use of intoxicants by employes, we earnestly recommend that the companies provided at their respective depots comfortable waiting rooms for the men, where tea and coffee may be obtained at reasonable cost.

9. The tracks shall be kept sufficiently sanded where needed.

10. As cars are often wilfully and unnecessarily obstructed by traffic wagons, we often advise that the law that makes it a misdemeanor wilfully to obstruct, hinder, or delay the passage of any car running on a street railway be rigidly enforced.

11. We consider that the present overcrowding of the cars is indecent and a frightful source of inconvenience, delay and danger, and we therefore strongly recommend that the number of passengers carried on any car should not exceed its seating capacity by more than 50 per cent. We are aware that the enforcement of this rule will necessitate an increase in the number of cars, but we consider that the public is entitled to proper and decent accommodation.

Much regret is felt at the assignment of Francis R. Upton, the well-known electrician of Orange. The papers were filed to-day. Mr. Upton's assets include promissory notes amounting to $20,000, real estate and stock in various concerns. The value of the whole is not stated. Among the creditors are: C. B. Farley, $5,000; Woodstock National Bank, $5,000; South National Bank, $5,250; Standard Thermometer company, $565; city of Orange, $1,000; German National Bank of Newark, $2,500. The contingent liabilities are: Tradesmen's National Bank, New York, $6,000; Chemical National Bank, New York, $6,000; Third National Bank, New York, $8,800; German National Bank, $13,250; New Britain Bank, $3,000; First National Bank, New York, $8,000; Newark National Banking company, $2,500; Market and Fulton Bank, New York, $6,000. The assignees are William J. Hammer of Elizabeth, N. J., and John F. Randolph of West Orange. Mr. Upton, according to the papers filed, is not now engaged in any business.

B. C. C.

# PERSONAL.

During the recent visit of Miss Frances E. Willard and Lady Henry Somerset at Orange, N. J., they were entertained at the home of Mr. and Mrs. Thomas A. Edison.

Frank S. De Ronde, New York, has been spending a day or two in Chicago in the interests of the Standard Paint company, of which he is general sales agent. Mr. De Ronde says P. & B. is still in the lead and he intends to keep it there.

F. W. Cushing spent several days in Chicago last week. Mr. Cushing has been abroad during the last year looking out for the interests of the telautograph in England and on the continent, and reports that it has been received with much favor.

Granville S. A. Gardiner, vice-president of the Graham Equipment company of Boston, has retired from his ticket business in Providence and will devote his entire attention to the sale of the Graham truck. Mr. Gardiner will spend his time, when not on the road, between the New York and Boston offices.

On February 28th, at the home of the bride's mother, 6404 Madison avenue, Chicago, Geo. W. Patterson and Miss Harriet O. Russell were united in marriage. The wedding was a quiet one, only a few intimate friends and relatives being present, but it was a most enjoyable affair. Among numerous presents was a check for $100 from Mrs. Elmer of Davenport and a handsome cabinet grand piano from the groom. Mr. Patterson is well known to the electrical fraternity through his connection with S. F. B. Morse & Co., who took this occasion to show their appreciation of his services by a substantial promotion. The young couple begin life under the most favorable circumstances, and certainly have the best wishes of all their many friends.

# TRADE NEWS.

The Imperial hot-blast blow-pipe, made by the White Manufacturing company, 40 and 42 State street, Chicago, which was illustrated and described in the last issue of the WESTERN ELECTRICIAN, is rapidly gaining in favor. This device is pronounced a most convenient, durable, reliable and safe tool and is adapted to a hundred purposes. Those who have had experience with it pronounce it a complete tool for soldering, brazing, burning paint, melting metals, heating soldering coppers, frozen pipes, heavy soldered

joints, etc. Electrical workers will find many uses to which to apply it. The company handles a large line of electric fixtures, and is prepared to furnish general supplies to lighting companies.

The Partrick & Carter company of Philadelphia has prepared a very handsome sample board of some of its house goods specialties, designed especially for small dealers and those who do not as yet carry a stock of such supplies. Everything is connected and in complete working order for practical exhibition. The board is made of hardwood with dealer's name and address in gilt letters.

The Fuel Economizer company of Matteawan, N. Y., secured the order for 1,000 horse power of Green economizers for the Detroit Railway company. Mr. Green has several orders "close to his net," he says, and he hopes to land them soon. The company also announces that at Hiram Walker's distillery, Walkerville, Ontario, a Green economizer bought in 1882 is still in successful daily operation, effecting a saving of 10 per cent. of fuel. Repairs on this economizer during this time have been made at an expense of less than $100.

The Wallace Electric company, 307 Dearborn street, Chicago, has just closed arrangements with the Electric Selector & Signal company of New York for representing it in the West. The system consists of a number of switches, selectors and one transmitter, with which the central station can control groups of incandescent or arc lights, transformers or motors direct from the station. The Wallace company has a complete system installed in their office in working order, and the arrangement is highly spoken of by central station men who have examined them.

The Newton Rubber Works of Newton Upper Falls, Mass., claims to have the only practical portable electric light and power battery made. After experimenting with various patented devices on primary batteries, the company has found nothing as practical as the one it has adopted. This battery was invented by Warren P. Freeman, who is well known in the electrical trade, having been in the business since 1870. He has had wide experience in all its branches, being a practical, as well as a theoretical, electrical and mechanical engineer of undoubted ability. The company also furnishes dynamos, motors and battery boxes.

The following is a copy of a letter received recently by the employes of the Electric Appliance company, signed by Thos. I. Stacey, secretary and treasurer of the company. No one connected with the establishment was omitted from the list, the errand boy and teamster being included, as well as the special traveling representatives: "We have decided to try on a small scale the experiment of profit sharing with our employes for the current year, commencing December 1, 1894, and at the end of the year will divide among those who have been with us for the entire year, in proportion to their salaries, one-tenth of the net profits of the business."

Metropolitan Electric company, Chicago, is sending out circulars advising the trade that it carries in stock the celebrated Hoffman rod polish. The company has found that the Knapp-Sellner adjustable desk lamp holder is attracting considerable attention. It is found to be just what is required for desk light. Business is brightening up and increasing considerably. The company is having a great many inquiries for its I. X. L. triple braided weatherproof line wire, and electric light, electric power and street railway, telephone, telegraph, police, messenger and fire alarm service companies interested in the use of insulated wires for overhead or aerial work, and desiring a superior article at a moderate cost will do well to confer with the Metropolitan company before purchasing elsewhere. The indications are that the spring and year of 1895 business of this concern will be very large.

The manufacture and introduction of alabaster glass marks the beginning of a new era in arc lighting. The E. P. Gleason Manufacturing company, 181 to 189 Mercer street, New York, claims the credit for its introduction. No glass works in the United States has expended the time freely given by this company to experimenting for the proper shapes, sizes and colors to produce the best results in both arc and incandescent lighting. Simple as the arc globes of to-day appear to be, many were the changes made before the present standards were adopted. Perhaps the most troublesome problem which engaged the attention of manufacturers of arc globes was to produce a material, or effect, which would soften and subdue the intense glare of the light, and yet not diminish the efficiency of the lamp too much. Opal glass which retards the passage of light 60 per cent. was first used where the glare of the clear lamps could not be tolerated. Ground glass was then used, but it diminished the light 40 per cent. A new material was clearly needed, and after a protracted series of experiments, alabaster glass was placed upon the market. The loss of light attending its use, it is said, is only 25 per cent., this too with a total absence of glare. The effect is similar to that of ground glass, but much softer, and the daylight appearance is that of a very thin sheet of alabaster. By making the arc lamp adaptable for inside and decorative lighting, alabaster glass has markedly increased its usefulness.

George S. Whyte, who has been connected with the Washburn & Moen Manufacturing company for the last eight years as salesman of wire rope and electrical wires, has severed his connection with the company. Mr. Whyte has temporary headquarters at rooms 1536 Monadnock building and has made arrangements to sell bare and insulated copper wire, iron and steel telegraph wire, wire rope and steel strand, wrought iron, steel and wood poles, cross-arms, brackets, insulators and other telephone material. Mr. Whyte has already secured an order for a carload of telegraph wire. With his long experience he will undoubtedly be able to secure his full share of the business. Mr. Whyte has the best wishes of the electrical fraternity for his success in the new undertaking, and will be glad to see his friends when in the neighborhood of the Monadnock building.

It is a pleasure to show appreciation of kind treatment, and the WESTERN ELECTRICIAN takes this opportunity in expressing its kindly feeling toward the very efficient Hollenden House staff which worked so hard and did so much toward the comfort of the numerous guests at that popular hotel during the trying convention time. John H. York, Frank Skelley, Howard H. Bundy, "Jim" Thompson and Chas. L. Adams were indefatigable in their efforts to make friends of the Hollenden visitors, and on this occasion these gentlemen surpassed themselves. The Hollenden is the headquarters for electrical men visiting Cleveland, and it may be said to the credit of the staff of clerks that there are few hostelries visited by men on the road that present so many comforts and are better places for a Sunday's rest, than the Hollenden. Manager Probst is to be congratulated on his successful handling of such a large gathering, and the efficiency of his management will be the better appreciated when it is remembered that in addition to the electrical convention there was also at the Hollenden at the same time a gathering of school teachers.

## BUSINESS.

The Westinghouse Machine company's steam engines find a market in the remotest corners of the earth. A 150 horse power compound of the latest type was recently shipped to Alaska. The trade of this company in foreign parts holds up well, orders having just been completed for three 150 horse power compounds to Mexico, 200 horse power compound to Spain; 300 horse power compound to France, 150 horse power compound to Buenos Ayres, 800 horse power compound to Havana, Cuba, beside a number of smaller engines to Russia and elsewhere.

Announcement is made by the Cutter Electrical & Manufacturing company of 1112 Sansom street, Philadelphia, that it is again forced by the demands of an increasing businesss to move into larger quarters. The company offers this explanation: Two causes have been contributory to this condition—a fixed determination followed by persistent effort to give to patrons the highest grade of electrical work possible, and the appreciation and liberal patronage with which the company's policy was received.

The Electric Appliance company, Chicago, has purchased of H. P. Lucas, receiver, the catalogue, good will and a large part of the stock of the Knapp Electrical Works (insolvent) and is prepared to fill orders for "Knapp" specialties promptly from Chicago stock. The Knapp Electrical Works catalogue is one of the largest, most complete and expensive electrical supply catalogues ever published. The Electric Appliance company is making some revisions and additions to the original volume, making it even more complete, and is now prepared to furnish them on application, together with a new special discount sheet, quoting exceptionally low prices. To those who are now in possession of a copy of the Knapp catalogue the company is prepared to send a new discount sheet applying to it.

Through the courtesy of Treasurer C. E. Newton of the Jewell Belting company of Hartford, Conn., a representative of the WESTERN ELECTRICIAN was able to become somewhat familiar with the manufacture of large belting by a tour of inspection through the company's large factory, at which time its big presses were at work, and although there was much to be seen, nothing was more impressed upon the observer than the manufacture of the 78 inch four ply belt, which is probably the largest that has ever been turned out by any belting company. The care and attention that were given to its manufacture were sufficient reasons for the success of this well known company. There has been a decided increase in the business of late, which promises that the coming year will be one of the most successful in the history of the Jewell Belting company. A few of the company's recent orders for wide belts are appended: 118 feet 78 inch four ply, 105 4-12 feet 62 inch three ply, 105 4-12 feet 62 inch three ply, 88 4-12 feet 62 inch three ply, 88 4-12 fee 62 inch three ply, 88 4-12 feet 62 inch three ply, 110 feet 34 inch three ply, 117 feet 42 inch double, 67 feet 30 inch double, 115 feet 24 inch double, 58 feet 24 inch double, 92 feet 40 inch double, 99 feet 26 inch double, 90 feet 36 inch double, 113 feet 40 inch double, 136 feet 36 inch double, 130 feet 24 inch double, 86 feet 26 inch double.

The Haschke Storage Battery company, 18–30 West Randolph street, Chicago, lays particular stress on the perfection of the insulation in its battery. The company says: "When we started on our course of seeking such an insulating medium we took as our ideal a substance which would withstand the aciduous solution of the battery, hold the active material firmly in place, allow the electrolyte to pass freely through it, retain its original qualifications indefinitely without becoming petrified, act as a neutral separator instead of a barrier to the passage of the electrolyte, withstand electric disintegration and still be tough enough to withstand rough usage. In our work we have been more than successful, and the result is an entirely new electro-chemically treated insulation." The company also claims unusual compactness for its cells.

The Mather Electric company of Manchester, Conn., reports a continuation of the unprecedented amount of new business secured. The following sales have recently been made through its isolated lighting department: Berlin Iron Bridge company, East Berlin, Conn., 250 light ring type dynamo, second order; Perkins Electric Switch Manufacturing company, Hartford, Conn., 350 light ring type dynamo; Haverhill Paper company, Bradford, Mass., 150 light ring type dynamo; Inter-Mountain Electric company, Pocatello, Idaho, 450 light ring type dynamo; Hub Gore Makers, Brockton, Mass., 450 light ring type dynamo; Coffee Exchange, New York city, 600 light ring type dynamo; Iroquois Furnace company, 150 light ring type dynamo; Cranston Worsted Mills, Bristol, R. I., 250 light ring type dynamo; Hub Gore Makers, Camden, N. J., 150 light ring type dynamo; New Opera House, Holyoke, Mass., 250 light ring type dynamo; Waverly Woolen company, Pittsfield, Maine, 350 light ring type dynamo, second order; Thacher Bros., New Bedford, Mass., 100 light ring type dynamo; James F. Grant, Youngstown, Ohio, 450 light ring type dynamo; Rockwell Manufacturing company, Milwaukee, Wis., 100 light ring type dynamo, second order; Burtis & Howard, Minneapolis, Minn., 100 light ring type dynamo, third order; S. N. Blake, Elmira, N. Y., two 250 light ring type dynamos; B. Lowenstein & Bros., Memphis, Tenn., 100 light ring type dynamo; Straight Line Engine company, Straight Line, N. Y., 20 kilowatt Manchester type generator; Cook Locomotive Works, Patterson, N. J., 45 kilowatt 220 volt multipolar generator; J. Holt Gates, Chicago, Ill., two 60 kilowatt multipolar generators, 500 volts; Denison Light & Power company, Denison, Tex., 45 kilowatt 220 volt multipolar generator.

Among some of the larger orders taken already this year by the Walker Manufacturing company, Cleveland, O., may be mentioned the following: Complete Electric Construction company, New York City, two 50 kilowatt belted lighting generators; Rahway Electric Railway company, Rahway, N. J., one 100 kilowatt belted multipolar generator, three double car equipments, 25 horse power spring mounted steel motors; Philadelphia Construction company, Philadelphia, Pa., for the Schuylkill Electric Railway company, Pottsville, Pa., three 400 kilowatt belted generators and switchboard apparatus, two double car equipments, 25 horse power motors; Michigan Electric company, Detroit, Mich., for Saginaw Consolidated Street Railway company, Saginaw, Mich., one 200 kilowatt belted generator, six complete car equipments, 25 horse power motors; Hartford & West Hartford Street Railroad company, Hartford, Conn., two double car equipments, 50 horse power steel motors; two double car equipments, 25 horse power steel motors; C. E. Loss & Co., Chicago, Ill., for Waukesha Street Railway company, Waukesha, Wis., one 150 kilowatt belted generator, three double car equipments, 50 horse power steel motors; Detroit Railway company, Detroit, Mich., two 400 kilowatt direct-coupled generators, one 750 kilowatt direct-coupled generator; Gloucester, Essex & Beverley Street Railway company, Gloucester, Mass., two 225 kilowatt direct-coupled generators; the Worcester Construction company, Worcester, Mass., forthe Gloucester, Essex & Beverly Street Railway company, 16 double car equipments, 25 horse power steel motors; Jasper County Electric Railroad company, Carthage, Mo., two 200 kilowatt belted generators, five double car equipments, 30 horse power steel motors. Beside the above the company has taken orders for its spring mounted steel motors for the Louisville Railway company, Louisville, Ky.; Atlantic Avenue Railway company, Brooklyn; Ottumwa Electric Railway company, Ottumwa, Ia.; Aurora Street Railway company, Aurora, Ill.; Bloomington City Railway company, Bloomington, Ill.; Steinway Railway company, Brooklyn; Kansas City Railway company, Kansas City; Atlanta Electric Railway company, Atlanta, and many others.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued February 26, 1895.*

534,639. Printing Telegraph. Samuel V. Essick, Brooklyn, N. Y. Application filed September 18, 1890.

In this arrangement there are a single main line battery at each end of the line, a two-point and single-point switch, with a pole changer and polar electro-magnet also located at each end of the line, and electrical connections whereby transmission is effected from either end of the line as desired.

534,640. Recording Wattmeter. Walter C. Fish, Lynn, Mass. Application filed December 22, 1894.

The device illustrated herewith includes the combination with an armature connected to a registering mechanism of a U-shaped conductor having a conductivity sufficient to convey the maximum current which will at any time flow through the main in which it is connected, the armature being located within the bend of the U-shaped conductor.

534,642. Railway Supply System. Harding F. Gray, Passaic, N. J. Application filed August 8, 1893.

The principal features of this arrangement are a set of supplemental conductors, studs or contacts upon the roadbed, a contact device carried by the vehicle in constant connection with one or more of them, a series of working contacts or conductors upon the roadbed, a current collecting device carried by the car and moving in constant connection with them, switch magnets, each energized by current taken from main line, and having its coil in a connection between a supplemental contact and a working contact, and a magnetically actuated switch in the connection between the main line conductor and the supplemental conductor or contact.

534,650. Electrically Actuated Combination Lock. Samuel L. G. Knox, Camden, N. J. Application filed April 13, 1894.

In this combination there are the following elements: A combination lock, a motor having a rotatable shaft provided with a scape wheel, gearing connecting the motor and the lock, and an electrically controlled escapement lever operating in conjunction with the scape wheel.

534,662. Electric Railway System. Herluf A. F. Petersen, Milwaukee, Wis. Application filed November 8, 1893.

The underground conduit for electric railway conductors, illustrated in the accompanying cut comprises a suitable casing divided into a plurality of longitudinal passages or compartments, one of which is arranged to communicate at intervals with a sewer, and provided in its upper walls with a longitudinal slot, and another passage being arranged to contain the conductors, and provided with a longitudinal opening, a suitable device movably engaged with the sides of the opening and adapted to normally close the same, blower mechanism arranged to discharge into the passage containing the conductors

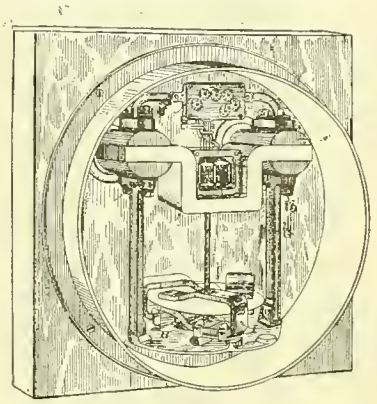
and adapted to produce a circulation of air therein, and suitable means for automatically controlling the operation of the blower mechanism.

534,663. Underground Conduit for Electric Railways. Herluf A. F. Petersen, Milwaukee, Wis. Application filed March 26, 1894.

The conduit is arranged to extend longitudinally adjacent to one of the track rails, and is located wholly beneath the surface of the ground and wholly outside of the line of the track, the conduit being divided into two longitudinal compartments, one of which is provided in its upper wall with a longitudinal slot for the admission of a contact carrier, and the other compartment being arranged to contain the electric conductors, and communicating with the first mentioned compartment by means of a longitudinal opening, a suitable closing device movably engaged with the walls of the apartment adjacent to the longitudinal opening and adapted to normally close the same, and a laterally and vertically adjustable contact carrier adapted to extend through the slot and the longitudinal opening into the compartment containing the conductors, and adapted for operative engagement with the closing device, and provided at its end with contact devices adapted for engagement with the conductors.

534,670. Telegraph and Telephone System. Charles A. Rolfe, Chicago, Ill. Application filed September 16, 1893.

The combination comprises a normally continuous metallic signaling circuit including signal transmitting instruments at substations and a signal receiving instrument at a central office, together with an auxiliary circuit or neutral line extending parallel with the signaling circuit and normally discontinuous



NO. 534,640.

at the central station, current transmitting instruments at the substations, each adapted to be connected in a branch extending from the metallic signaling circuit to a portion of the auxiliary circuit extending to the central station, and means at the central office for connecting a current receiving instrument adapted to respond to the transmitted current in a branch from the metallic signaling circuit to either terminal of the auxiliary circuit.

534,671. Fire Alarm Telegraph System. Charles A. Rolfe, Chicago, Ill. Application filed April 10, 1894.

In a signal transmitting system a suitable releasing device is employed, also a local battery and a normally closed auxiliary circuit including the battary and releasing device, and a local or house alarm and a magneto generator, both likewise included in the normally closed circuit, and a make-and-break device operated by the signal transmitting mechanism and arranged for making and breaking the auxiliary circuit when the signal transmitting mechanism is operated, the releasing device being operated to release the signal transmitting mechanism by an impulse from the magneto generator sent over the circuit and supplemental to the local battery current, and the local or house alarm being sounded by reason of the operation of the signal transmitting mechanism, and also by reason of a break in the local circuit from any other cause.

534,677. Electric Arc Lamp. Hans O. Swoboda, New York, N. Y. Application filed April 6, 1894.

A magnet for controlling the carbon support in an arc lamp, windings or coils surrounding the magnet, a movable piece consisting of a polarized armature independent from and actuated by the pole piece or pieces of the carbon support controlling magnet to make or break the circuit of one of the windings or coils, are the features of the device illustrated in the accompanying cut.

534,678. Electric Current Transformer. Joseph A. G. Trudeau, Ottawa, Can. Application filed April 6, 1894.

In a current transformer, the combination of a cylinder or drum provided with bars, having their ends extending past each other, two groups of contact brushes, and a conductor connecting the brushes.

534,699. Electric Resistance Cord. Alton J. Shaw, Muskegon, Mich. Application filed December 1, 1894.

A resistance cord or section consists of a frame having a channeled bar, a folded conductor having its folds insulated one from another and inserted within the frame, insulating strips inclosing the ends of the conductor folds, and a removable cap plate applied to the frame and serving to retain the conductor therein.

534,730. Means for Operating Drills. Elihu Thomson, Swampscott, Mass. Application filed March 17, 1892.

A system of power distribution, comprising a power station, electric conductors conveying energy from the station to an electric motor at a distant point, a fluid compressor driven by the motor, the compressor provided with auxiliary cylinders arranged to maintain a high pressure therein, and a reciprocating mining machine located near such compressor and adapted to be driven by the alternations of fluid pressure therein.

534,731. Method of and Means for Preventing Magnetic Leakage. Elihu Thomson, Swampscott, Mass. Application filed February 6, 1893.

The method of preventing magnetic leakage between adjacent magnetic poles consists in setting up an accessory field adapted to oppose such leakage.

534,732. Connector for Electric Conductors. Robert D. Titcomb, Schenectady, N. Y. Application filed December 21, 1894.

A connector or coupling for electric conductors is composed of two interchangeable parts, each having a tubular body, a knife blade contact registering with a recess upon the other part, a hole in each part, and a pin in the hole, a part of the pin upon one part being cut away to permit the insertion of the corresponding pin upon the other part.

534,779. Signaling System. Clarence H. Brace, Union City, Mich. Application filed November 27, 1894.

This signaling system has a series of movable signal characters for conveying intelligence, and a series of stops respectively registering with such characters, and a detent operated by an electro-magnet adapted to engage any one of the stops at the receiving station, means at the sending station in the circuit of the said detent electro-magnet adapted to continuously close the circuit and thereby disengage the detent, and then open the circuit and re-engage the detent, there being a length of time between the opening and closing of the circuit equal to that required for arresting the movement of the characters at some designated position.

534,785. Method of and Apparatus for Insulating Electrical Conductors. Louis W. Downes, Providence, R. I. Application filed August 22, 1894.

The improvement in the manufacture of insulated electrical conductors described consists in coating a wire with adhesive substance, wrapping it with fibrous asbestos, brushing out the nap in one direction, rolling the fibrous covering upon the wire, and then applying thereto a water-proofing substance.

534,786. Apparatus for Manufacture of Insulated Electrical Conductors. Louis W. Downes, Providence, R. I. Application filed December 11, 1894.

In apparatus of the kind described a rotating disk is mounted upon a hollow shaft through which the covered wire is fed, a carding wheel for operating upon the covered wire is mounted upon and rotating with the disk, a short shaft passing through the disk, carrying at one side of the latter a pinion meshing with stationary gear teeth, and at the other side a gear wheel engaging with a pinion on the carding wheel, whereby the latter is revolved as it is rotated about and in contact with the circumference of the covered wire.

534,802. Electric Metal Working Apparatus. Hermann Lemp, Lynn, Mass. Application filed December 3, 1892.

In an induction coil or cooverter, the combination with the primary of a tube enveloping the same and constituting the secondary, the tube having its ends united by an insulating liquid-tight joint to form a liquid receptacle, and containing oil.

534,826. Signal. Edward H. Goodman, Pittsburg, Pa. Application filed October 25, 1894.

The combination is claimed of a movable signal blade, two series of electric lamps mounted on the movable blade and having different colored globes, the series being arranged in independent circuits, and means operative on a change in position of the signal for closing one circuit and opening the other circuit.

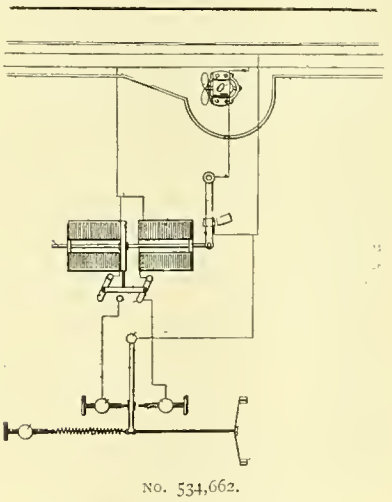
534,851. Driving Mechanism for Dynamos Located on Railway Cars. William L. Bliss, Brooklyn, N. Y. Application filed August 17, 1894.

In this arrangement the dynamo is supported on the car truck and a friction driving wheel on one of the axles thereof, a yoke is pivoted to the dynamo on pivots concentric to the shaft thereof, a countershaft carried by said yoke and geared with the dynamo shaft, a friction wheel on the countershaft running in contact with the friction wheel on the axle, a spring for applying pressure to the yoke and to the last mentioned friction wheel, and a connection between the spring and yoke permitting the yoke and countershaft to be disengaged and turned back from over the axle.

534,852. Electric Arc Lamp. James Brockie, Forest Hill, England. Application filed November 13, 1894.

A carbon rod provided with a rack, a feed wheel for actuating the same, the wheel being provided with a spiral periphery and operating to rotate a pinion gearing with the rack, a lever pivoted at one end to a fixed bearing and provided with a tooth adapted to engage the under side of the periphery of the wheel, a vertically movable frame in which the wheel is journaled, stops to limit the movement of the frame, and an armature connected to the lever and operating to engage and disengage the wheel, are the features of this invention.

534,834. Battery System for Electric Railways. Edmond Julien, Brussels, Belgium. Application filed December 9, 1886.



NO. 534,662.

The combination includes a car, an electric circuit, comprising a motor, and insulated spring contact plates or poles, a charging bench or pier having similar contact plates or poles, a drawer of accumulators having a pole or plate adapted to rest on and compress the spring of the poles on the car and bench, and an exterior charging circuit comprising a source of electricity, suitable switches, and the poles or contact plates on the bench or pier.

534,886. Electrical Lighting Device for Gas Engines. Calvin L. Ives, Grand Rapids, Mich. Application filed March 30, 1894.

In this combination there are an electric generator and a burner for gas, gasoline or hydrocarbon vapor, an insulated and longitudinally movable rod or needle adapted to be brought into electrical connection with the burner, a casing or shell supporting the needle and insulated therefrom, means for imparting a forward movement to the needle, and a retracting spring connected to the needle.

534,908. Electric Signaling Apparatus. Bernice J. Noyes, Boston, Mass. Application filed July 5, 1892.

Claim 1 is given: The combination with a message recording instrument located at a main station, one or more signal transmitters located at sub-stations adapted to transmit two different classes of messages, and an electric signaling circuit connecting the same, of a bell or other indicating device also located at said main station, having a movable or striking member, a toothed wheel to actuate said movable or striking member, a normally wound train to move said actuator, and an electro-magnet controlled by the circuit which controls the operative connection between the said toothed wheel and said movable or striking member of the bell or indicating device.

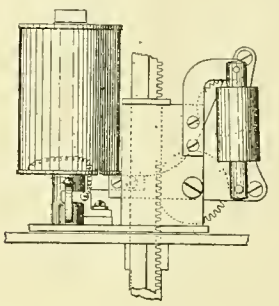
534,953. Dynamo-electric Machine. Rudolf Eickemeyer, Yonkers, N. Y. Application filed June 7, 1888.

The claim covers a disk armature for dynamo-electric machines, in which there is the combination of counterpart coils having radial sides annularly arranged in two sets placed back to back, with the radial portions of the coils of one set alternating with the radial portions of the coils of the other set, and also having said radial portions of both sets in a plane common to all of the coils near the periphery of the disk, but in two separate slightly inclined planes near the hub of the armature.

534,956. Electric Trolley Railway. Joshua M. Hammill, Aldan, Pa. Application filed January 23, 1894.

The claim is for the combination of the slotted conduit and the conductor located therein, the shield interposed between the slot and the conductor, the trolley wheel having insulating flanges, the trolley arm bent around the shield, and having throughout an external insulating coating or covering and an outer casing surrounding that portion of the insulated trolley arm which passes through the slot of the conduit.

534,961. Electrically Operated Keg Register. Josef Kuff, New York, N. Y. Application filed April 4, 1894.



NO. 534,677.

This arrangement includes a keg elevator having bucket arms, a rock shaft, arms located in the path of the bucket arms of the elevator and pivoted at their lower ends to the rock shaft, a slide rod connected with one end of the rock shaft, mechanism for guiding the slide rod, contact springs, mechanism in connection with the slide rod for operating the springs, and registers electrically connected with the contact springs.

534,970. Telegraph and Telephone System. Charles A. Rolfe, Chicago, Ill. Application filed February 15, 1893.

The device is described in the claim as the combination of the main signal line having branches, the neutral line, the main or central office telephone, and a switch comprising contact points, arranged in pairs and connected up with the telephone, a couple of contact points respectively connected with the right of the neutral line and one branch of the main line, a couple of contacts respectively connected with the left of the neutral line and the other branch of the main line, and levers having conducting sides insulated one from the other, one lever being arranged for establishing connection between certain contact points, and the other being arranged for establishing connection between other contact points.

534,971. Incandescent Light. Henry F. Rooney, Randolph, Mass. Application filed November 17, 1894.

The improvement consists of the combination of the central reflector, comprising the neck and the long substantially pear-shaped main portion, provided with the longitudinally parallel grooves made V-shaped in cross section and extending throughout the length of the main portion and the filament, each line of which is set opposite the center of a groove and follows it longitudinally for its entire length, the lines of filament being set at a suitable distance from the corner or center of the grooves to provide two reflecting surfaces for substantially its entire length.

534,974. Electric Brake. Elmer A. Sperry, Cleveland, O. Application filed January 30, 1894.

The last claim is as follows: In a brake for an electric car, a rotating axle, a portion upon such axle organized to be gripped, a gripping mechanism for such rotating portion, a stationary portion supported from the car axles, a projection provided on the gripping mechanism for arresting its movement, in combination with a cushion between the projection and the stationary portion.

534,975. Apparatus for Arresting Motion of Electrically Propelled Mechanism. Elmer A. Sperry, Cleveland, O. Application filed February 5, 1894.

One of the claims is for an electric motor, a circuit, and a brake magnet coil in the circuit of a switch, consisting of a single moving arm adapted when in one of its active positions to open the line circuit and close a local circuit through a rheostat, the magnet coil and the motor, and when in the other of its active positions to open the local circuit and close the line circuit through the rheostat and the motor, and means other than the motor or its parts for reversing the current direction through the coils of such motor.

534,977. Electric Brake. Elmer A. Sperry, Cleveland, O. Application filed June 8, 1894.

In a brake for revolving machinery, a revolving part, a brake magnet, independent means for the entire support of the brake magnet, and means mounted upon the revolving part co-operating with a face opposite the working face of the magnet for guiding the magnet in one plane, leaving the same free in another, are the features claimed.

534,986. Conduit Electric Railway. Michael F. Flynn, Stamford, Conn. Application filed May 24, 1894.

In an electric railway there is claimed the combination with the closed conduit and the line wire therein, of the trolley rail on the conduit, having contact surfaces above the line wire, tilting levers arranged below the line wire and adapted to carry the wire upward against the contact screws, and an operating mechanism extending from the levers up through the conduit in the path of the trolley for actuating the levers by the movement of a passing trolley.

Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, MARCH 16, 1895. No. 11

## Signaling Weather Predictions by Searchlight.

On the topmost level of the Auditorium tower in Chicago, 280 feet above the pavement of Congress street and 300 feet above the surface of Lake Michigan, is a large marine projector used for signaling weather predictions over the city of Chicago and the surrounding territory as well as the contiguous portion of the great lake. The use of a searchlight for this purpose is entirely new and is the result of the enlightened and progressive policy of the Hon. J. Sterling Morton, secretary of agriculture, who has brought the weather bureau to a state of efficiency never before attained and who is anxious to make the service of the greatest possible value to the public in the practical affairs of life. In this endeavor Secretary Morton is ably seconded in Chicago by Prof. W. L. Moore, who is in charge of the station in this city; and the accuracy and value of the predictions, no less than the scientific precision of the work undertaken, have received very general acknowledgment. The use of the electric searchlight to signal approaching changes of weather over wide areas in populous districts may fairly be said to mark the entrance upon a new era of development in weather forecasts, and as it seems likely to become a distinctive feature of the service the innovation bids fair to be remembered as one of the most important improvements introduced by the present administration of the agricultural department.

Secretary Morton's idea was first put in actual operation in Chicago, although experiments are also under way at the New York station. The lamp used here, at present, is a thirty-inch projector made by the General Electric company for the armored cruiser Maine, which has been building for several years at the Brooklyn Navy Yard and is now just about completed. This searchlight was loaned by the Navy Department for temporary use in Chicago and will be returned to the ship within two months. It is a projector of the regular marine type, and is shown in position for signaling by the two photographic views reproduced on this page—one giving a general view of the massive tower, surmounted by the searchlight, and the other showing the lamp in greater detail. Fig. 2 shows the tiny switchboard from which the arc is controlled. This is directly beneath the lamp platform, in a circular iron structure enclosing the spiral stairway leading to this level.

The lamp takes from 75 to 80 amperes of current at 47 volts. The arc is rated at 20,000 candle power, and the light sent forth is intensified by the reflector to about 100,000 candle power. The upper carbon is one inch in diameter and cored, while the lower is solid, with a diameter of ¾ inch. Current is taken from the house mains at a potential of 117 volts, and is reduced to 47 volts by rheostats. Considerable resistance is necessarily introduced in the circuit for this purpose, as may be judged from the glimpse shown in Fig. 2. The little switchboard is of marble and sustains the circuit terminals, switches and a voltmeter and ammeter. The movements of the projector are controlled by hand.

The tests already made indicate that the searchlight can be used with much success. Aside from the value of the signals to the general public, the plan of indicating changes of temperature or the approach of storms by this means will be of two-fold value—to the market gardeners and produce raisers in the vicinity of Chicago in foretelling frosts in the spring and fall and to lake mariners. As has been stated, the present projector is only for temporary use. It is intended to install a sixty-inch lamp, and with this it is believed that the beam can convey its signals over the area of a circle having a radius of 40 miles. Within this area resides a population of 3,000,000 souls which will have the benefit of prompt knowledge of the weather predictions made by the observer in the Auditorium tower. The gardener in the suburbs, for instance, may have foreknowledge of the approach of an early frost that will be of great value to him. Fog is the great enemy of the light, but it is believed that the larger projector will be powerful enough to pierce the mist at least far enough to apprise the marine interests on the lake and river fronts, in Chicago, of the approach of storms.

The signals proposed are very simple. A solid beam of white light means a cold wave, if shown in winter, and an approaching frost if displayed in the spring or fall. A solid red light will convey warning of a marine storm, with high easterly winds. A beam half white and half red (the line of demarkation being horizontal) means a marine storm with high westerly winds. In each case the beam travels slowly around the horizon, elevated at an angle of about 22½ degrees. Particular care must be taken to turn the light slowly else it passes over the head of the observer at the outer edge of the circle at the speed of an express train and thus defeats its purpose. These signals correspond with the red and white electric light signals for mariners which have been for some time displayed on the staff surmounting the Auditorium tower. This arrangement, partially shown in the left-hand picture in Fig. 1, comprises two hexagonal lanterns, one of clear glass and the other of red. The six faces of each lantern are strong lenses, and behind each is a 32 candle power incandescent lamp and a reflector, making 192 candle power for each lantern. The white lantern is above the red one, and the code is precisely the same as with the searchlight. These lanterns give a strong light and have proved themselves valuable, but compared with the searchlight their use is limited.

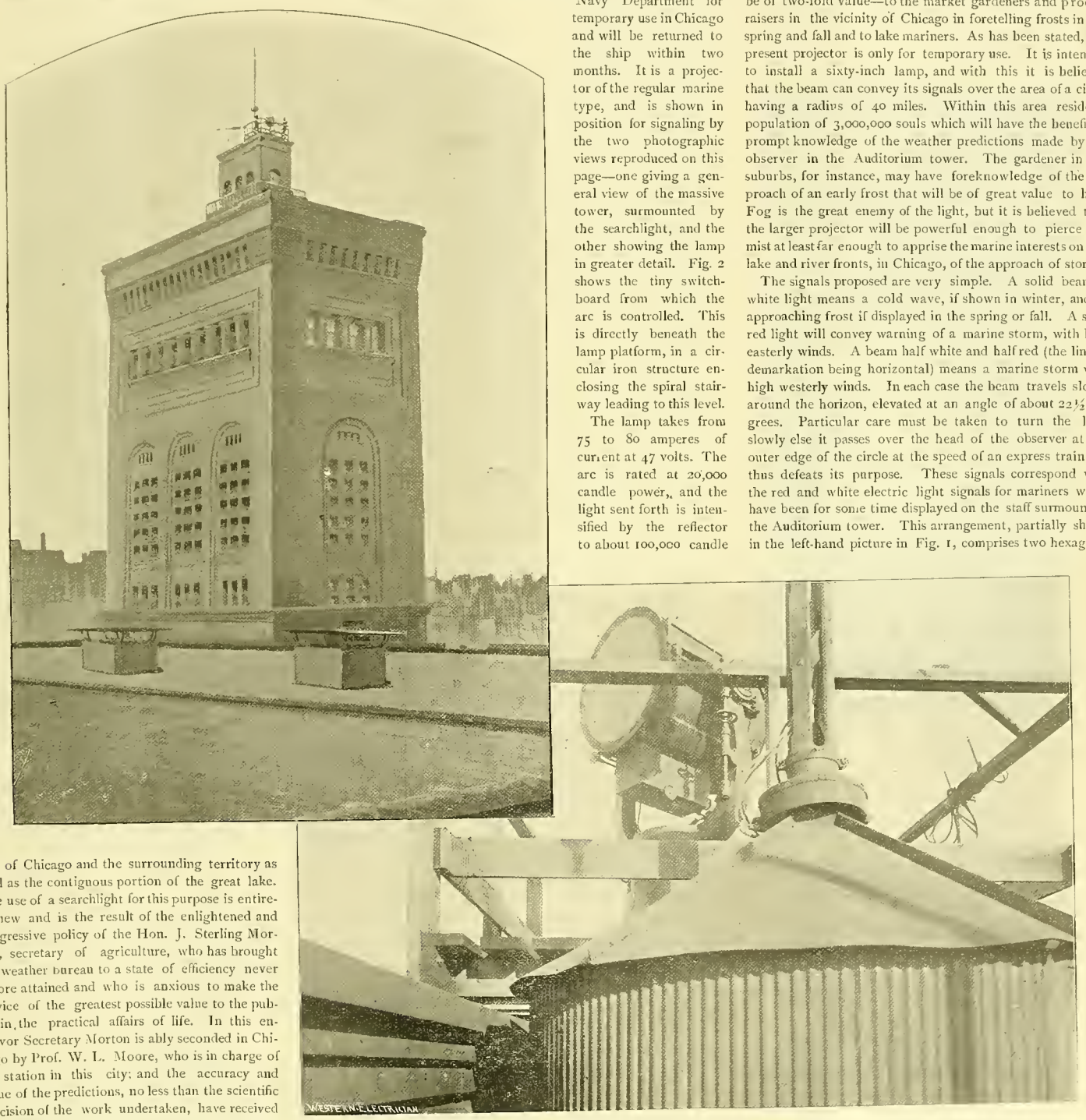



FIG. 1. SIGNALING WEATHER PREDICTIONS BY SEARCHLIGHT.—PROJECTOR ON THE AUDITORIUM TOWER, CHICAGO.

It is hoped that the sixty-inch lamp will replace the existing searchlight before the year is out. It is proposed to control its movements by an electric motor, and to arrange a room with a glass roof for the use of the attendant. The experiment is already considered successful, although the lamp has been in position but a few weeks, and thus the electric light is made useful in a new direction.

## An Unjust Patent Statute.

By Elihu Thomson.

Now that decided attention has been called, by the decision of the Supreme Court of the United States, interpreting Revised Statute No. 4,887, to the relations existing between patents taken out in the United States and abroad, it occurs to me that it would be interesting to note at this time some of the disadvantages under which the American inventor has labored in the past, and under which he still labors, not only in so far as concerns the taking out of patents, but also in relation to the publication of new matter or to the inventor's place in the history of an art.

While the decision of the Supreme Court makes it plain that the wording of the law in relation to the limitation of

FIG. 2. SIGNALING WEATHER PREDICTIONS BY SEARCHLIGHT.—PROJECTOR SWITCHBOARD IN THE AUDITORIUM TOWER, CHICAGO.

United States patents by foreign patents is to be taken instead of what would seem to me to have been the evident intent of the original enactment, I wish to point out some of the injustices under which the American inventor has suffered from this law, as it has been and is now interpreted, in comparison with inventors and workers abroad.

An American inventor making application for a patent has been and will still remain under the disadvantage of being required to perfect his United States patent before applying for patents abroad, and in order to secure valid patents abroad he must refrain from publication of any new matter which he may have discovered until such foreign patents have been obtained, as the mere publication nullifies the right to take a patent in most important foreign countries. But it is practically impossible, as is well known, under our system of patent examinations to control the time of issuance of a patent in the United States, and if the application should become involved in an interference, which is more than apt to occur with inventions of any considerable importance, the issuance of a patent may be tied up for an indefinite number of years. During this period there is every prospect of the same subject matter being worked upon abroad, or the matter becoming published, especially if the invention undergoes development in the United States. The inventor, therefore, if he desires foreign patent protection, must take his foreign patents and stand the shortening of the term of the United States patent; or, if the interference proceedings or other delays last during the life of the shortest foreign patent, he receives a patent which has already expired when it issues—a "still-born" patent, so to speak.

Again, in the race between two interfering inventions, the weaker party, finding that he will probably lose the interference in the United States, may easily transfer his scene of activity to foreign countries, while the stronger party, feeling that he does not wish to ruin his United States interest, at the same time refrains from patenting abroad. In this case the party who is likely to come out ahead here does come out at the last without any foreign patents, while the other party to the interference may come out with several valid foreign patents but no United States patent.

Now, I do not think it requires any argument to show that the evident intention of the United States law when it was first passed was not to bring about this state of things, and so handicap the honest American inventor. Nor is this all. The position of the foreign inventor, under the United States law, has been that he could make his applications in foreign countries whenever he felt like doing so and receive his patents, and, after an indefinite period thereafter, he was at liberty to apply for a United States patent and obtain a patent only limited by the shortest term foreign patent. Prior publication here would not affect his rights. Prior publication does affect the United States inventor's rights abroad. Does not this amount to a discrimination against the United States inventor? And would it not really tend, were there are not other favorable influences, to discourage invention here?

But there is still another point which I consider of the greatest importance. Owing to the conditions under the law as it exists, the United States inventor, no matter what the importance of his work may be, is debarred from publishing it until the issuance of his United States patent, which may take a year or two in the Patent Office, unless he is ready to forego some of the years of its life by taking out foreign patents at once after his United States application has been filed. He is, therefore, under restraint as to publication if he wishes to protect his foreign rights at all. And, let us ask, what has been the effect of this condition of affairs? Has it not been that an undue proportion of the history of many new advances, especially in the electric art, has been first published abroad? Has it not been that publications of new material have often been made abroad, when in fact the same subject matter had been worked out here, in some cases years before? Does it not result in the credit for new work or the making of history, as it were, in a new art, being accorded in larger measure to workers abroad than would otherwise be the case? Now, suppose that instead of this law having existed at all, inventors who had made valuable discoveries for inventions were at liberty to apply for their United States patents and were equally at liberty to apply for at once and obtain, without prejudice to their United States rights, foreign patents on the same inventions, then they might freely publish at once their work and obtain the credit for it to which they are entitled, and which, under the present condition of affairs, has often been taken from them on account of the enforced delay of waiting for the issuance of the United States patents before applying for foreign patents. I have known it to be the case, and I have not the slightest doubt that others actively at work in the electric field have had the same experience, that the first entrance into the electrical literature of some new and important advance has been through the foreign publications, when in fact the broad subject had been worked over and was known for a long time previously here, but was withheld on account of this unfortunate state of patent laws in this country.

The United States is entitled to take its proper place, not only in the actual work accomplished, but in the literature which naturally accompanies the work, and without such a restraint as now exists. The question arises, How long is the United States worker to be so handicapped, or practically put under a ban, by ill-considered laws? This is a question which I have often asked myself, and the answer to which, I have no doubt, has been sought by many who have experienced the same hardships.

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The use of the telephone is rapidly increasing in Mexico, and the telegraph service has been greatly improved since 1880 when the Mexican Central Railway company began to send messages for the public over its lines. This service is said to be superior to that of the government lines and is spread over much larger territory. The appreciation of the public of the efficiency of the railway lines is evinced by the report that 22,000 messages were sent in 1894, against 15,000 in 1884. The central office is in the City of Mexico. Connection is made at Torreon with the Mexican International Railway company and business is interchanged between the lines of the two railways at this point. The Mexican National system provides means of communication with points extending from Durango, which is within 200 miles of the Pacific coast, to Eagle Pass, Tex. H. R. Nickerson, general manager of the Mexican Central Railway company, has introduced many American ideas upon the road and these extend to the telegraph system, whereby it has been greatly improved to the satisfaction of the traveling public.

## Correct Method of Protecting Electric Circuits.[1]

By W. E. Harrington.

The use of fuses for the protection of electric circuits has proved unreliable and unsatisfactory. The adoption of magnetic circuit breakers being, as it is, a foregone conclusion, led the writer to make a study into the requirements entering into what would constitute a technically correct form of magnetic circuit breaker.

In a circuit entirely or partially inductive, a sudden increase of current is checked by the impedance of the inductive part of the circuit. The rise in current, with the time, is illustrated by the curve, Fig. 1, taken from Bedell and Crehore's work on alternating currents.

This curve gives the rise in current, with time, in a circuit whose resistance is .1 ohm and coefficient of self-induction is .01 henry.

The curve is based on Helmholtz's formula,

$$C = \frac{E}{R}\left(1 - e^{\frac{-Rt}{L}}\right) \text{ wherein}$$

C = Current in amperes.
E = Applied electromotive force.
R = Resistance in ohms.
$e$ = Naperian base of logarithms.
$t$ = Time in seconds.
L = Coefficient of self-induction in henrys.

This is a logarithmic curve and from the character of the formula, which is an exponential function, the practical interpretation has very seldom been appreciated by the practical operators of electrical apparatus. The utilization of the principle embodied in Helmholtz's formula gives the solution to the problem to determine the correct method of protecting electric circuits. The use of fuses for the protection of circuits has proved to be so antipodal to the fundamental principle contained in what is the severely technically correct method, that it is criminal, almost, in the light of present practice, for users to follow like sheep in the path of their predecessors in the use of fuses. The practical interpretation of the above formula indicates clearly that if a circuit be opened during the rise or first surge in current upon a tendency for abnormal flow, and further, if the time of opening be made as quickly as possible, the less the resulting flow of current will be.

To realize the importance of this time element in the

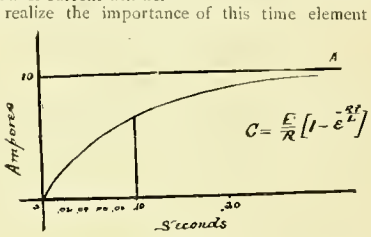



FIG. 1. CORRECT METHOD OF PROTECTING ELECTRIC CIRCUITS.

opening of a circuit, if we refer to Fig. 1, it is apparent that if the circuit were opened in .75 of a second, the current would be only one-half the strength it would be if allowed to flow until it had reached the volume due to ohmic resistance alone.

It will also be noticed that if the circuit were opened in .02 of a second, the current would be about one-sixth its final value.

To eliminate mathematics, and that most elusive of all electrical units to grasp, the henry, and to illustrate in everyday amperes the effect time has upon opening a circuit in a working power station, wherein exists the self-induction of the dynamos and station appliances and the small negligible self-induction of the measuring instruments used in testing, tests were made in the power station of the Camden Horse Railroad company as follows:

In order to vary the current for making the tests, a non-inductive resistance, to wit, a water rheostat, was employed. The use of non-inductive resistance for varying the current would not introduce factors to prevent the results from representing what would actually occur upon corresponding changes in condition of circuits with time such as would occur in practice. In fact, in the majority of instances, the results would be even more pronounced than those shown in tests, as there would usually be inductive resistances in circuits.

Fig. 7. A vertical iron rod having a sliding contact dropping from different heights, and making contact with a fixed wiping contact, completed a circuit for varying but predetermined periods of time, dependent upon position of sliding contact before dropping.

By carefully calibrating the device for the time of contact by the sliding contact, using the fundamental law of gravitation,

$$t = \sqrt{\frac{2h}{g}} \text{ whence}$$

$t$ = Time in seconds.
$h$ = Height of fall in feet.
$g$ = Acceleration due to gravity = 32.2 feet.

A means was thus at disposal for determination of time for making of circuit for $\frac{1}{50}$ of a second to $\frac{1}{280}$ of a second in steps as follows: $\frac{1}{50}$, $\frac{1}{60}$, $\frac{1}{70}$, $\frac{1}{80}$, $\frac{1}{90}$, $\frac{1}{280}$ of a second.

A Weston standardized ammeter was employed for adjustment. By placing the sliding contact to touch the fixed wiping contact, a circuit was completed through an adjustable water rheostat, permitting the flow of a predetermined current, after which circuit could be opened by an auxiliary switch. The sliding contact could then be set at a point, by dropping from which the time for completing circuit was as desired. In circuit was a carefully calibrated C-S magnetic circuit breaker, used as an ammeter and subject by adjusting

1. Read before the National Electric Light association, Cleveland, February 19-21, 1895.

screws to open on different currents. By letting sliding contact drop a sufficient number of times to find the adjustment of the C-S magnetic circuit breaker which the current flowing would not open, also the adjustment at which the current would open it, gave a means for knowing conclusively that the current actually flowing would be between the two indications of the circuit breaker. By continuing this operation for the same static current for the different periods of time within the limits of the testing device, the series of value thus obtained could be plotted out, showing graphically the differences between the current which would flow for continued periods of time, due to the applied electromotive force and the given ohmic resistance of the circuit, and the current which actually flows for the very short period of time established by the wiping contact. The effect of impedance is illustrated so excellently for a continuous circuit having an initial voltage of 500 volts, with currents ranging from 40 amperes to 70 amperes and in 10 ampere steps, that it will appeal at once to all as a striking object lesson. Figs. 2, 3, 4, 5, 6, show clearly the impedance effect.

Fig. 2 illustrates the values of current for the different periods of time current can flow, ranging from $\frac{1}{240}$ second to $\frac{1}{30}$ second, when the ohmic resistance of the circuit is 12.5 ohms.

This test was made without any effort to overcome the arcing attendant upon opening the circuit.

Fig. 3 illustrates the values of current under similar conditions, as illustrated by Fig. 2, except that an air blast was employed to blow out the arc following the opening of the circuit. The difference in eighteen results obtainable between tests 2 and 3 in the use of an air blast was so pronounced that it was employed in the remainder of the tests.

Figs. 4, 5 and 6 are curves illustrative of tests when the ohmic resistance of the circuit was respectively 10, 8.3, 7.1 ohms.

To appreciate the meaning of the curves, the full black line is the line showing the value of current if the circuit be closed for any extended period of time; the difference between the straight heavy line and the curved line shows clearly the effect the time of opening a circuit has upon a typical power plant.

The heretofore standard form of magnetic circuit breaker, and the type familiar to all, is immeasurably preferable to fuses, in so far as it opens the circuit much quicker on the score of time. Fuses open the circuit so late after the heavy, unusual condition of circuit is established, that the current reaches the high and parallel part of current curves. For illustration, referring to Fig. 8, in which we assume current has been flowing at, say, 100 amperes, with a 150 ampere fuse to protect the circuit, suppose a short-circuit occurs, making a condition wherein 1,000 amperes would flow owing to ohmic resistance, if not checked.

The fuse would not blow until the current had at least reached point *B* on curve, or some point beyond. The ideal point to open the circuit should be as near the point *A* as would be possible.

While the regular well-known types of magnetic circuit breakers open before fuses do, still they are not what they should be, when the heavier, more abnormal short circuits occur on circuits, for the reason that the magnetic circuit breakers as at present constructed have practically an unvarying fixed time element; that is, they open in the same time whether the condition of circuit be such as to just permit the passage of current required to open the circuit breaker, or the condition of circuit be such that the passage of current is due to a short-circuit.

The opening of the magnetic circuit breaker, as constructed, depends either on springs or gravity; the role the magnetic feature plays is simply to allow either the spring or gravity to act on the switch.

A magnetic circuit breaker should be constructed to open the circuit in less and less time as the conditions become more and more severe. This can be done by taking advantage of the flux of lines of force due to the passage of the current, since, fortunately, the two are simultaneous; and by designing the magnetic circuit breaker to open as regards time in an inverse ratio to the increase of the lines of force, tand not depending on the springs of gravity, except, possibly, as auxiliaries to act as potential energy to aid in overcoming the inertia of the switch jaws and arms. We have then the correct method of protecting electric circuits.

The destruction of electrical apparatus, the breaking

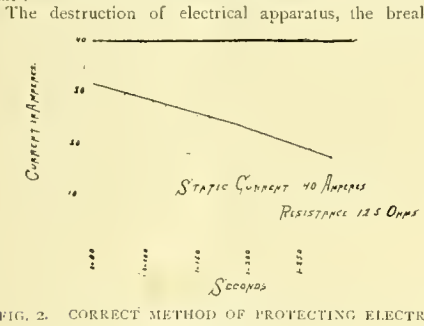



FIG. 2. CORRECT METHOD OF PROTECTING ELECTRIC CIRCUITS.

down of insulation, the burning out of circuits, is taken by the business managers of electrical stations with a meekness and a non-effort for relief which is astonishing. What business manager would permit his boilers to run with safety valves of such a type that an increase of 500 to 1,000 per cent. of pressure would be required to open them?

The writer has repeatedly made tests showing that a No. 21 B. and S. gauge copper wire would permit the passage of 450 amperes for $\frac{3}{100}$ of a second without burning out, without changing color. This is significant, as it shows that under conditions in practice the mechanical shock or torque tending to wrench or rupture insulation would be present in a marked degree, and further faults and flaws would develop which would by recurrence eventually cause the break-down in insulation. Owing to the sluggishness of fuses, permitting current to rise to the level point of current curve, wires under insulation in machines, as well as building wiring, unquestionably at times becomes red hot. I have seen wires become heated momentarily red hot, and cool off immediately after current was checked.

How many unknown, mysterious fires have started from this cause in electric wiring circuits?

All switchboards and minor lighting circuits should be protected by automatic (as regards time element) magnetic circuit breakers, and the urgency of this will appeal to the exchequer of the management of our many electric light and power stations when the full meaning and import of Helmholtz's law dawns upon them.

## The Monocyclic System.[1]

By Dr. Louis Bell.

To the central station man no recent change in engineering practice can have more interest than the renaissance of alternating current work which is now in progress. Truth to tell, until quite recently the alternating current was somewhat under a cloud in the estimation of both station managers and engineers. It had served an immensely useful purpose in the extension of electric lighting to places where it would have been utterly impracticable to install a direct current system of any sort, on account of the scattered nature of the work. A very large number of stations have been installed on the alternating system, and I am sorry to say that a large proportion of them have been somewhat unsatisfactory, not in their general operation, but in the character of their service and the commercial results. It is quite common to find alternating stations with a plant efficiency considerably below 50 per cent. and in which the regulation is maintained only within, perhaps, about ten per cent. Under these circumstance, it is small wonder that the advocates of the direct current, the uses of which as an engineering problem have been very completely worked out, have been often somewhat violent in their animadversions on alternating currents in general. Nevertheless, in the last two or three years there has been a vast change for the better in alternating practice—a change not yet rapid but bidding fair to be far-reaching. This change has taken up a threefold path toward progress.

First, the use of large transformers is becoming more frequent; next, these transformers are more and more used in con-

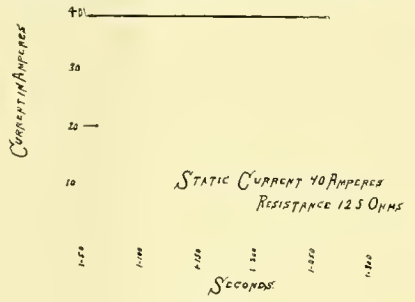



FIG. 3. CORRECT METHOD OF PROTECTING ELECTRIC CIRCUITS.

junction with systems of secondary mains; and, finally, it is now possible to install an alternating plant that shall be able to operate motors as successfully as can be done with direct current.

In ordinary central station practice the motor service does not usually play a very important part; nevertheless, the ability to run motors is most valuable. It is more profitable, speaking broadly, to sell current for light, for a better price per kilowatt hour can be obtained; at the same time, if motors can be readily furnished, a useful day load can be obtained when it is needed, and the plant becomes of the greater service to the community—a thing which, in these days of more or less friction with common councils, is of no small importance. Not only can motors now be successfully worked off alternating circuits, but off a wide variety of such circuits. As yet, however, there is no successful motor for use on the simple alternating system which has, for the most part, been installed in this country. While it is possible to construct a single-phase motor even for 120 to 130 cycles per second, the frequency most used in America, it is at present very doubtful whether such a motor can be made to start and run in a way which will be generally satisfactory. Abroad, where low periodicities are used, better results are obtained, hut, even there, there is a noticeable silence on several important points in describing alternating motor practice. Appearances indicate that even with the advantage of low frequency, motors for use on simple alternating circuits still start badly, and particularly require enormous currents at the moment of starting; hence the growth of various modified alternating systems, of which the polyphase are the best known, by the use of which it becomes possible to avoid this difficulty entirely and to work alternating current motors in every respect as satisfactory as those operated by direct current.

The polyphase motor has s lved the problem of securing good motor service with alte ating currents in a very complete manner, although at th cost of slight complications, which, while generally ove estimated, are nevertheless distasteful to central station men, especially where the use of such a system would involve an extensive and costly re-arrangement of the distribution service. It is the purpose of this paper to call your attention to the various methods of central station distribution, involving motor service on the alternating current system, and more especially to a modified single-phase alternating system which lends itself very readily to a very simple and straightforward distribution for lighting without sacrificing the excellent motor service which makes the true polyphase systems so desirable. For all-around central station work, the lightning service is of most fundamental importance and convenience, and economy in this particular must, in a vast majority of cases, be the first consideration. Let me invite your attention to the accompanying drawings (page 133), which show, in a diagrammatic manner, the general arrangement of various alternating circuits, including those already familiar and the polyphase and monocyclic systems.

First in order, both of time and extended use, comes the simple alternating system, single phase, with an ordinary two-wire distributing circuit. In operating the secondaries of such a system, we run immediately into limitations, imposed by the feasible voltage for lamps—limitations which have acted as a brake on alternating current work and which are responsible for a good many difficulties in the

FIG. 4. CORRECT METHOD OF PROTECTING ELECTRIC CIRCUITS.

operation of alternating plants. Opposite the diagram of this circuit I have placed the relative amount of copper required for lighting with such a distribution.

Next comes the alternating circuit modified for the Edison three-wire distribution, which is so familiar in its character that it needs no description here. The amount of copper needed, on the supposition that the neutral is half the size of either of the others, is, of course, enormously reduced, amounting, as you see, to less than one-third of that needed with the two-wire system; consequently the secondary main distribution, so important to economical operation, can be carried out with the greatest facility. We are justified, at present, in saying that neither of these systems lends itself to the ready operation of motors.

We may next consider the two-phase alternating system worked with four wires, giving, if desired, two separate circuits for each machine. The copper here required is the same as that used with the single phase, and so long as the four wires are kept together motors can be freely operated. Here is assuredly a step in advance. The operation of two separate circuits, however, from a single machine involves certain complications. In the first place, unless these circuits are balanced as to load, the operation of the system is somewhat difficult to make satisfactory in point of regulation. The circuits themselves have absolutely no influence on each other, but they are derived from the same machine, and with a given excitation of that machine, unless the loss in the two circuits is the same, the voltages must necessarily be different; consequently the generator cannot be compounded for both circuits unless the circuits are balanced. There are three ways out of this difficulty; none of them, unfortunately, is altogether unobjectionable.

In the first place, one can make the loss on the line so small that the difference in voltage, due to any reasonable difference in load, is of no moment. This can sometimes successfully be done, but more often it involves a very unnecessary cost for copper, and even at its best is likely to give regulation which, although better than that found on most simple alternating systems, is yet not good enough to suit the requirements of the best modern engineering. Secondly, the machine can be compounded for loss on one of the lines, a feeder regulator being used on the other. This practically means hand regulation of one circuit. Or, finally, both circuits can be operated by such regulators. In any case, if motors are to be operated, the two phases must be interlinked at least by one wire.

A somewhat simpler two-phase distribution is that shown in the next diagram, where the two phases unite into a common three-wire circuit. The amount of copper here required differs very materially according to the limitations of voltage that one chooses to fix. If the maximum voltage of the system is limited to the same maximum voltage used on the single-phase two-wire or two-phase four-wire system, the amount of copper required is very largely increased by the use of the third wire, owing to the fact that the two circuits combined are out of phase with each other by ninety degrees. The relative amount of copper required here is, as you see, 145.5. If, on the other hand, the question of maximum voltage between wires is neglected and the voltage is determined by the use of lamps of the same voltages as on the other systems, then the amount of copper is materially reduced, being a trifle less than three-fourths of that required on the systems before mentioned. In this case we neglect the fact of there being an excessive voltage between the outside wires, and connect lamps between the middle wire and the two outside ones, much in the manner of an Edison three-wire system, with the exception, of course, that the saving in copper is not anything like the same amount. Such a system allows the distribution of the whole load for lights and power in a single circuit containing only three wires. It therefore avoids the difficulty of regulating two separate circuits. On the other hand, it causes a new and very curious difficulty, owing to the fact that the two combined phases are unsymmetrical with regard to the inductance of the system. The voltages between the middle wire and the two outside wires are unequal, when the systems are equally loaded, by an amount depending on the inductive loss on the line. Consequently, when in balance for regulation, the system is unbalanced as regards the load on the two sides; a condition which, although it may not lead to trouble in some cases, is still a menace to the suc-

1. Read before the National Electric Light association, Cleveland, February 6, 1895.

cessful operation of the system, unless the distribution be skillfully engineered. There is, however, the possibility of a noticeable saving in copper.

We may next pass to the three-phase alternating system. The system which corresponds to the two-phase four-wire system I pass by, as the use of three separate circuits would be even more troublesome than that of two, and would have no compensating advantages. The ordinary three-phase circuit is that shown in the figure wherein the three phases are united into three wires and taken everywhere where the motors and lights are wanted. In this case, for the same voltage between wires, the amount of copper demanded is just three-fourths of that demanded for a single-phase two-wire or two-phase four-wire circuit. To compensate for this, there is the possibility of unequal voltages in case the three legs of the circuit are unequally loaded owing to interaction in transformers and in the generator. So far as inductance on the line is concerned, the system is symmetrical and balanced.

If the load on the three branches is very unequal, as, for example, if one branch is entirely unloaded or very lightly

FIG. 5. CORRECT METHOD OF PROTECTING ELECTRIC CIRCUITS.

loaded, while the other two are worked to their full capacity, there will be a perceptible unbalancing of the voltage. Experience, however, shows that with anything like the same care in balancing that would apply to an Edison three-wire system, this theoretical difficulty of balance is absolutely negligible. I say this advisedly, as the question has been so often raised that I have taken pains to investigate the conditions in three plants operating lights with reference to this particular thing, and the statement just made is the result of actual practice. It might be thought at first sight that good results could be obtained by combining with either a two-phase or three-phase system the Edison three-wire distribution. As a matter of fact, such a system would be unreasonably complicated with either two or three phases, as any central station man will readily appreciate, inasmuch as it would be necessary to have two or three three-wire systems, each balanced, and mutually balanced with respect to each other, covering the territory if motors are to be run, or at least interlinked in a somewhat complicated way.

There is, however, a three-phase system which does secure a very great advantage in copper. This is the three-phase four-wire system shown in the figure. It consists of the ordinary three wires employed on the three-phase system, with the addition of a balance wire proceeding from the common connection of the generator or the transformer and forming a part of the general distribution system. The lights are, as can be seen from the diagram, connected between either of the three-phase wires and the balance wire. Between each of the outside wires there are, therefore, what may be considered two lamps in series, having, however, a phase difference of 120 degrees. The voltage of transmission, then, between each of the three main wires is 1.73 times the voltage employed in the lamp connected, nearly 200 volts for 110-volt lamps. This necessarily means a large saving in copper, which is still further enhanced by the fact that the three-phase three-wire system requires intrinsically only 75 per cent. of the copper used on the single-phase or direct current system. The total result with this particular connection is but 29½ per cent. of the copper required on the single-phase system, supposing, as in the Edison three-wire distribution, the neutral wire to be half the size of either of the others. Such a system is in successful use at St. Hyacinthe, Canada, in connection with long secondary mains. The price paid for this saving in copper is the introduction of a fourth wire into the distributing system.

Comparing, then, the lighting distributions on the two and three-phase systems, we find that if three wires only are used both save very nearly the same amount of copper. The extreme voltage between wires on the two-phase circuit is, however, considerably greater, and both are liable, but not likely, to become unbalanced.

There is this difference, however: that if we are to balance a three-phase system in respect to voltage, we need only to see that the load is equally distributed between the three branches. If we are to balance a two-phase three-wire system, we must see that this load is unequally distributed between the three branches by an amount depending on the inductance of the line. We therefore see, comparing the polyphase with the single-phase system, that the price we have to pay for the privilege of successfully operating motors is a certain amount of complication in circuits, which, while not of great importance in new installations, hinders the ready adaptation of a polyphase system in a plant having already a large number of circuits installed. Attractive as the single-phase is in its beautiful simplicity of wiring, we cannot yet successfully run motors from it. It was for the purpose of preserving that simplicity of distribution which is peculiarly valuable in connection with large central stations, especially those already installed, and joining to this the same ability of running motors found on the polyphase system, that the monocyclic system, to which I am about to call your attention, has been perfected. You see it first in its two-wire form. Here, so far as the lighting distribution is concerned, it is absolutely identical with any of the alternating systems now installed in simplicity, convenience and in the amount of copper necessary. The main circuit of the monocyclic machine constitutes a simple single-phase alternator, and so far as the lighting on the system is concerned is identical with it, connected in precisely the same way, feeding, if desirable, into the same circuits without change. There is, however, on the armature of the monocyclic machine a supplemental coil, shown on the diagram as connected to the middle point of the main winding on the monocyclic machine, from which a power wire may be led. This need be of but small cross-section, and only has to be carried to those points in the system at which it is desired to operate motors, and, as I shall presently show, this power wire enables one to run motors possessing the same desirable characteristics as the polyphase motors, and, indeed, generally identical with them, without in any way disturbing the lighting distribution, except in so far as Ohm's law is a necessary limitation on all combined power and lighting circuits. In the last diagram here we see the same device applied to an Edison three-wire system for the distribution of lights, along with which is carried the same insignificant power wire which permits the successful operation of motors. The value of the three-wire feature in the distribution of lights is evident, the amount of copper being the same as in an Edison system of the same voltage. With this monocyclic system we can compound the generators for any reasonable loss in the line, and can arrange the lighting system, without incurring any troublesome questions of balance, so as to give as good regulation even as can be obtained on a direct current system. Beyond this, we have the power of running motors.

It is instructive to glance over this list of alternating lighting systems to see their relative complexity and advantages. It is especially noteworthy that any and every method of distribution that saves copper introduces in some form or other the question of balance. This is the price we pay for reduction in cost of conductors. It has not seriously interfered with the use of the Edison three-wire system; in fact, those most familiar with that system were the first to make light of the difficulty, nor do I think it stands as a valid objection to the use of the polyphase systems in cases where they are desirable, as none of them are more sensitive in the matter of balance than the Edison three-wire system, which is now in such extensive and uniformly successful use. We may further note that in each of the alternating systems where a very great saving of copper is accomplished, a fourth wire is necessary, at least if both lights and motors are to be operated; in each case, however, of trifling size.

Having now looked over the field in general, we may pass to the more minute consideration of the somewhat striking electrical peculiarities of the monocyclic system —peculiarities which, although they do not involve any particular complexity, are yet of decided interest.

The general principle of the system is well shown in the diagram. So far as the main work of the generator is concerned, its winding is closely similar to that of any well designed alternator. The armature is of the iron-clad type and the winding is made in machine-wound coils which are invariably insulated and can be very readily slipped into place. There is, however, upon the armature a second set of coils of cross-section equivalent to that of the main coil, but composed of comparatively few turns, so that the room taken up on the armature is very small, and owing to the shallowness of the slots necessary to accommodate this second or teaser coil, the output of the machine, considered as a single-phase generator, is not affected. This teaser coil is located with reference to the main coil, as shown in the diagram. Its place on the armature is midway between the other coils, and the electromotive force generated is in a direction at right angles to that of the principal coil. It is

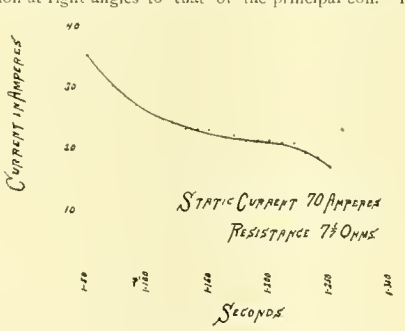



FIG. 6. CORRECT METHOD OF PROTECTING ELECTRIC CIRCUITS.

evident, now, that if we connect the terminal of this teaser coil with either of the terminals of the main coil, we shall get an electromotive force compounded of the two, and in some intermediate direction. In general, by varying the proportions of the two coils, and hence their electromotive forces, we could obtain a resultant electromotive force between their terminals, having any angle we pleased, with either the main or the teaser coil. If, then, wires are taken upon the line from the terminals of the main coil and also from the teaser coil, we can obtain from the main line three electromotive forces, two of which are symmetrically situated with reference to the electromotive force of the teaser coil, and bear to it any phase relation that we please. One of the most convenient arrangements, and that which is most generally adopted, involves such a relation of the electromotive force of the teaser coil to that of the main coils that we shall have on the line three electromotive forces approximately 60 degrees apart. In other words, the resultant electromotive forces between teasers and main coils are each 60 degrees from the electromotive force of the teaser coil. Such an arrangement is that shown in the diagram. Under these circumstances it is clear that if one of these electromotive forces were reversed, either in transformers or anywhere in the translating devices, the result would be three electromotive forces 120 degrees apart, one of them having been turned through an angle of 180 degrees. Meanwhile, the relation between the power wire, which is connected to the teaser coil, and the outside wire, has no effect upon the electromotive force between these outside wires, since the electromotive force of the main coil itself does not interact with the power wire, except in so far as a portion of it may act with the power wire to form a resultant phase and electromotive force for running motors. Consequently, so far as lights are concerned, the two outside wires behave precisely like the leads from any other alternating generator, while so far as motors are concerned, we have the power of getting our three electromotive forces 120 degrees apart, and hence have the same magnetic effect as with a three-phase system. The arrangement of lights and motors with this device is clearly shown in the diagram. It is evident that we can take from the outside wires of the monocyclic system either arc or incandescent lights anywhere and to any extent the capacity of the machine permits, working for

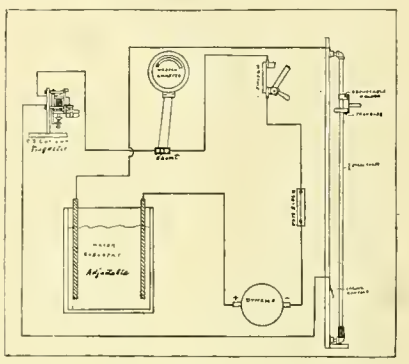


FIG. 7. CORRECT METHOD OF PROTECTING ELECTRIC CIRCUITS.

the incandescents either two or three-wire distribution at option. For a motor, two transformers are connected anywhere we please, one between the power wire and each of the outside wires. At this point the resultant phases come into play and the necessary reversal of one of the electromotive forces is accomplished by the very simple and obvious device of reversing one of the secondaries, as shown in the diagram. To the secondary circuit thus constituted we can connect a standard induction motor which will start and run as well as if connected to a regular three-phase system, or instead of reversing one of the transformer secondaries we may accomplish the same virtual reversal of the electromotive force by reversing one of the coils in the motor itself. We therefore have a system which, so far as lights are concerned, is a simple alternating system; so far as motors are concerned, the dynamical equivalent of a polyphase system. With a differently proportioned transformation we could place upon the secondaries two electromotive forces 90 degrees apart if necessary, and then run two-phase motors instead of three-phase motors if there were any object in so doing. Such an arrangement, however, would be less desirable than that of the quasi-three-phase system, for the reason that without gaining anything in the motors we should have to generate a larger electromotive force in the teaser coil, and hence take up more room on the armature with it; perhaps enough to have an effect upon the output of the machine considered as a single-phase generator. It is sufficiently evident that the method shown would not be the only way of getting the same result. For example, in this second diagram a somewhat different arrangement is shown, accomplishing precisely the same end. Here our object is to operate secondary mains on the Edison three-wire system, and in connection with them to run motors at any point we please. A large transformer to which the secondary is connected on the three-wire system is therefore installed, and the secondary mains distributed in any manner we please. A second and small transformer, proportioned to the total amount of motor service desired, is connected as shown in the diagram, and the power wire leading from it is taken through the whole or part of the three-wire system. The device is analogous to the arrangement of the generating coils themselves, and the result is the ability to operate a standard induction motor by connecting it anywhere on the three-wire system to the two inside wires and to the power wire. Such an arrangement as this is immensely convenient in distributing power and light in cities where, for example, it is desired to establish an extensive system of secondary mains through Edison tubes or other convenient underground distribution. It is, furthermore, interesting to know that one is not confined to the use of either two or three-phase induction motors, since a monocyclic generator connected to the primary circuit makes an excellent synchronous speed without the assistance of a starting motor; in this particular being vastly superior to the pure single-phase synchronous machine. But, it may be asked, how about this power wire? In case, for example, of a transmission over a considerable distance before the distributing point is reached, must the power wire be part of the transmission system? In answer, I need only call your attention to the fact that the essential point of the monocyclic system, so far as motors are concerned, is the establishing of an electromotive force bearing the same relation to the system as is borne by the teaser coil of the generator. Consequently, in case of a transmission plant, the main generators at the distant station may be simple single-phase machines, the subsidiary electromotive force being furnished by a synchronous motor or similar device at any point in the system. So we might readily have an extensive transmission with a monocyclic machine in the sub-station of such size as is necessary to furnish current for what motors may be upon the system. The power wire would then run only to the sub-station. Another interesting peculiarity of the mono-

cyclic system, and one which is not without importance in case of an extensive power distribution, is the following:

Under ordinary circumstances, induction and synchronous motors are wound so that the counter electromotive force affects the system in a perfectly symmetrical manner, and the current flows over all the wires with some degree of symmetry in response to the demands of the motors on the system. It is customary, however, in the monocyclic system to employ motors so wound as to throw a high counter electromotive force into the power wire when the motor is at speed and loaded, thereby reducing the normal current carried over the power wire to a purely nominal amount, and this can evidently be done without sacrificing much in the matter of starting, since at the start all the counter electromotive forces in the motors are zero. We have, then, a motor system of a type really peculiar to the monocyclic system in that each motor will start under the same conditions of impressed electromotive force as if it were a polyphase motor; while, when at speed and loaded, it would be operating virtually as a single-phase machine. If, however, it were overloaded so that it would tend to slow down or stop, sufficient energy would flow over the power wire to bring it back to speed just as if it were a polyphase machine. This is only one of various interesting ramifications in the system when developed to meet special conditions.

The connections shown in the diagrams, however, are those of the most direct applicability and probably which would be most extensively used for central station service. At this point it may be appropriate to ask what is the disadvantage of such a system? It evidently secures exceedingly marked advantages in the ability to operate the lights on existing circuits or with the simplest possible kind of distribution, and at the same time to run at any point in the system synchronous or induction motors of well tried and familiar types. The question can be readily answered; in fact, the answer is almost obvious. The price which we have to pay for this advantage is the installation of the power wire, which necessarily adds something to the weight of copper in the system and to the trouble of installation. Under all ordinary circumstances the power wire need be of trivial cross-section compared to that of the other wires, since, as a rule, the energy required for operating the motors from the given central station is small compared with the total capacity of the station; and further, it is worth remarking that the monocyclic motors, either synchronous or induction, will run perfectly well if the power wire is disconnected after the motor is at speed operating them as single-phase

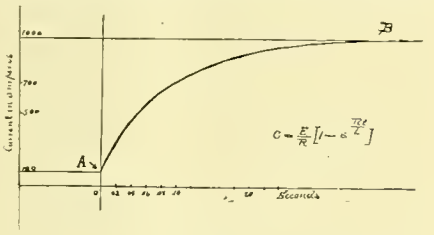



FIG. 8. CORRECT METHOD OF PROTECTING ELECTRIC CIRCUITS.

machines. It is, of course, well known that the single-phase synchronous motor gives admirable results, and it is also true that a single-phase induction motor can be constructed of excellent efficiency and other electrical properties. The only material difficulty in this case is to get the motor to start with a good torque. The monocyclic connection enables this to be accomplished. After the motor is at speed the power wire becomes no longer necessary to successful operation, so that in spite of the necessary existence of the power wire it is easy to see that the additional amount of copper is not likely to be burdensome in central station operation. It would hardly ever be necessary to install a power wire of more than one-fourth the joint cross-section of the others, as given in the diagram, and generally a much smaller wire will suffice.

I have thus endeavored in a brief space to give a good working idea of the monocyclic method of combined light and power distribution which has been devised and is urged upon the public as especially adapted to the work of central station distribution on account of its unique simplicity in practice. As to what has already been done in the installation of such apparatus, a considerable number of these monocyclic generators are in daily use in central stations, for the most part operating over circuits already established and displacing the higher frequency alternators which have been previously used. They are giving excellent results, and the operation of the motors, wherever employed, has been highly satisfactory. The system, therefore, needs no extensive exploitation on paper. After once pointing out here the principal and general advantages of the system, it is better to let the plants already running speak for themselves; and let their verdict be final.

### Discussion.

JOHN F. KELLY, Pittsfield, Mass.: I suppose I can honestly begin by paying a tribute to the ingenuity of the devisors of the system; but it is scarcely necessary, because we all know what they can do; they have already proved themselves. I cannot help feeling, however, that in this case their ingenuity has been somewhat misapplied. The most serious fault with the system is that it did not come soon enough. If it had come before the polyphase systems had been worked out, perhaps we would not have needed any polyphase system, but, coming when it does, it seems to me a step backward. In the first place, the generator, as Dr. Bell has explained, is substantially a single-phase generator. Now in any generator of given magnitude it is not possible to get the same output when worked single-phase as when worked two-phase. Dr. Bell seemed to think that the two-phase was in trouble, because of the difficulty of balancing the two circuits. I am more familiar with that system than any other, and my own reason for preferring it is because the regulation is better than if the work was thrown on one circuit. We have found that there is no more difficulty in balancing than in the common three-wire system. When it comes to the lines, I suppose it is in this point that the chief advantage of the monocyclic is supposed to be; but the system requires at least three wires and any polyphase system does not require more. Where lights only, and not power, are required, it only needs two; in practice that is all that any polyphase does, in any district where lights only are required. You need only run a pair of wires, so that in this respect there does not seem to be any gain in the monocyclic system. The cost for copper is, at the least, according to Dr. Bell's diagram, higher than it is with the plain single-phase, while the cost of copper in the two-phase three-wire system is very materially reduced. In the circular distributed I see it is stated that where power only is to be transmitted by means of the monocyclic system that the third wire is of the same section as the other two, making an addition of 50 per cent., but if the system is so working that this third wire is really a power wire, conveying energy, then there is not only this additional cost, but the percentage of drop in the circuits is increased beyond that in the single-phase system.

Dr. Bell has raised the question as to the periodicity at which motors can be worked. Now there are undoubtedly great advantages in low periodicity in cases of long-distance transmission, but one of them is not the possibility of operating motors. There is no difficulty in making polyphase motors of 16,000 alternations which will have high efficiency and start with large torque. As to the efficiency of the motor in the monocyclic system, there is nothing to be said against it, because the motor is substantially a polyphase motor, and whatever the polyphase motor will do of course the monocyclic will do.

CHAS. P. STEINMETZ, Schenectady, N. Y.: I am very much honored by being able able to speak before such an association as this, and may say that I have heard with very great interest Dr. Bell's interesting paper, and with much greater interest Mr. Kelly's remarks. However, I cannot quite agree with his statement that the single-phase alternating current system is antiquated and superseded by the polyphase system, and that therefore the monocyclic system is behind the times. The polyphase system has been before us now for nearly ten years. It made its appearance shortly after the single-phase system and at a certain time after the Frankfort exhibition, when our electricians came back from Europe and talked excitedly of what they had seen. Everybody seemed to think that the single-phase system would soon disappear altogether. Nevertheless, we have now thousands of single-phase stations running, while the polyphase system is only just beginning to be used in special cases. Therefore I feel confident that the polyphase system will never be able to supersede the well known single-phase system of old; but find that it possesses a limited application, although being very valuable in the proper place. The monocyclic system is entirely single-phase; that is to say, the total flow of energy issuing from the generator passes through zero and is fluctuating, while the polyphase systems share with the continuous system the common feature that the flow of energy is never zero, but more or less constant. Electromotive forces of different phase, or currents of different phase, do not constitute the polyphase system, for in the ordinary single-phase system if a induction coil is connected in series to incandescent lamps you get electromotive forces displaced from each other by 90 degrees. That is quarter-phase electromotive force, and in a loaded transformer, and in a transformer running light, the currents are displaced in phase. In neither case, however, do we speak of a polyphase system. The polyphase system is indicated when both electromotive forces as well as currents differ in phase from each other.

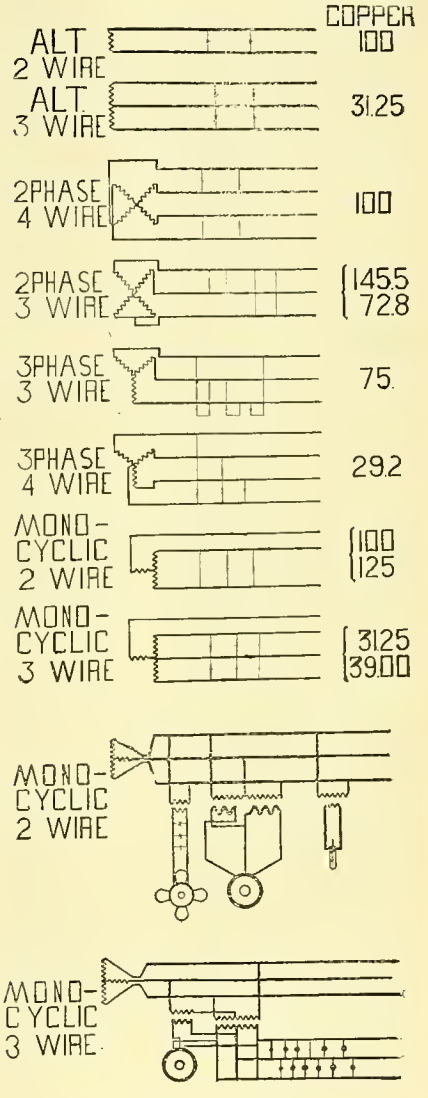
Now with regard to the statement of Mr. Kelly that the output of a polyphase machine is larger than that of a single-phase machine—that is a common mistake repeated now for years. It means that on the polyphase armature more wire can be put than on the single-phase armature. However, the output of an alternator is not limited by the amount of wire you can put on the armature, but by the armature reaction, or rather, by that amount of armature reaction which you can take care of by the field; and in a single-phase machine you can by compounding take care of a very great armature reaction which you cannot take care of in the polyphase machine, where small armature reaction causes unbalancing of the circuit. In consequence of which, the output of a polyphaser is less than that of a single-phaser of the same size and speed, or at least not greater.

PROF. ELIHU THOMSON, Lynn, Mass.: The paper of Dr. Bell has been so full and so clear that it leaves very little for me to say, except that I can express my agreement with the statements of the paper, and that furthermore, after due consideration, I think Mr. Steinmetz has the right of it. He has given an enormous amount of time and attention and close study to the question of polyphase, single-phase and other systems, and has originated a number of remarkable combinations, one of which is the monocyclic system. I think the system undoubtedly accomplishes all that has been stated by Dr. Bell to be its advantages.

CHAS. F. SCOTT, Pittsburg, Pa.: I have been, and I am sure all of you have been, very much interested in the presentation which has been made by Dr. Bell of the monocyclic system. We can take it, I think, as a carrying out of the remark that I made in an association a year and a half ago, that when we have an alternating polyphase system, we have something that we can do something with. It is flexible; we can twist it about; we can make it a two-phase and three-phase system—and now a monocyclic system—variations of the polyphase system, and go from one to another and get the different advantages which any one of these may present for different kinds of work.

We have had the characteristics and advantages and merits of this system pointed out. It may be well, it seems to me, to bring forward some of the questions which arise with respect to the points which have been brought out so that they may be answered now, and that we may determine the relation of this system to the other systems. To those who are not immediately and technically familiar with the subject there is apt to be a sort of haziness about it. We hear first about the two-phase and then about the three-phase systems, as if they were entirely new and different. As a matter of fact there is no fundamental difference between the two. Then we have a monocyclic system. What relation does it bear to the other systems? Is it radically and entirely new? Does this euphonious name mean something which is a departure from what has gone before, or is it a modification, and if so, of what is it a modification?

Starting with the source, the generator itself is just now somewhat in doubt. The single-phase generator is best, because it regulates better and has a better output. The polyphase generator, it is also stated, regulates well and has a good output, and without carrying that further we can all be satisfied by taking our choice. We will consider a few points made with respect to the transmission circuit. There are one or two statements of Dr. Bell which can either be called in question or certainly a little modification made to them. A two-phase four-wire system, which he has given as the third figure, he has considered as the correspondent of the alternating two-wire circuit only, and has not considered it applicable to use in a three-wire connection, in which the amount of coppper is so much less. The reason of this was the added complication of running two three-wire cir-




THE MONOCYCLIC SYSTEM.

cuits. That might be true if the area to be covered were quite small, but as central stations are usually run the lines are carried out in different directions. In alternating stations there are anywhere from three or four to a dozen or several dozen feeding circuits running in different directions and supplying different territories. It is just as easy to divide these up into three-wire circuits for lighting, as the different parts of the city to be supplied or the districts are separated, as it would be if all the circuits were of the same phase. If, therefore, this distribution can be carried on by the three-wire plan, the cost of copper here would be materially reduced and be made equal to that of the three-wire single-phase system. Considering the two-phase three-wire system, the figure 145.5 was stated as the relative amount of copper used, and that a possible reduction could be made to 72.8 if the extreme electromotive force can be increased above that for the first figure upon the diagram, which is for the two-wire single-phase system. The assumption upon which all these figures have evidently been made is that there has to be a definite electromotive force for the carrying of lamps. If that is to be carried through the various diagrams, then the 72.8 is a proper figure. If, on the other hand, a limited voltage is the consideration to be met, we have in the ordinary three-wire circuit twice the electromotive force of the single-phase circuit. If the same be applied to the two-phase three-wire circuits, then the amount of copper would not be 72.8, but one-half,

[*Continued on page 135.*]

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IN a dispatch from Ottawa, Ont., dated March 8th, it is announced that Comptroller of Customs Wallace has decided that electricity comes under the head of unenumerated articles, and consequently bears a duty of 20 per cent. This decision will be of interest in view of a proposition that was under consideration, it is said, to transmit power from the American side of Niagara Falls to surrounding Canadian cities.

THERE are many features of patent law and practice in this country which appear to work hardship to inventors and in a measure place this country at a disadvantage. Congress has been urged to revise the patent laws, and now the Bate refrigerator case has called attention to another feature which inventors and capitalists denounce. In another column Prof. Thomson discusses this question and urges those interested to make a thorough and systematic agitation with the view of securing a revision of the law. Aside from the injustice to the inventor that may result from this provision, it is shown that in many cases this country does not receive the credit that is due to it. As a patriotic plea alone the article is worthy of consideration.

IT is announced on what appears to be good authority that the International Pacific Cable company, which failed to get a national charter from Congress, will go ahead with its project of connecting San Francisco, Honolulu and Yokohama by cable, and will act under a state charter. It is now said that Russia, France, Japan and Hawaii will join in the enterprise, and that branch cables will be laid to the French islands and extensive naval stations in the Southern Pacific. Russia's interests in the project are regarded as even more important than those of Japan or France. Hawaii is also interested in the enterprise, as she regards it as a practical realization of her efforts to communicate with the outer world. The British project of a cable starting from Vancouver appears to be ended with the failure of the senate to so modify the treaty with Hawaii as to let the British cable land on Neckar Island. The only recourse for Great Britain would be to induce Hawaii to break this treaty obligation with the United States, but it is asserted that this will not be done. Instead, therefore, of a British cable across the Pacific, as has long seemed imminent, France, Russia, Japan and Hawaii are now uniting with American enterprise to execute this work of vast commercial and military importance.

AN interesting condition of affairs exists in Chicago, where a number of property owners have organized to fight the introduction of the trolley upon Indiana avenue and have become incorporated as an association in order that they may have a better legal standing. It appears that many of the property owners are clamoring for better transportation facilities, especially those living at some distance from the business center of the city, and the city council has granted the Chicago City Railway company a franchise to transform the present horse car line into an overhead trolley road. Of course there are property owners who object to the change. They want improved service, but do not favor the trolley or cable. Accordingly the company has decided to canvass the street and learn whether a majority of the property owners favor the trolley. The property owners hold a contract, entered into by C. B. Holmes, when he was president and superintendent of the company, agreeing that the horse car system would not be changed on the avenue until a request was made for such a change by a majority of the property owners. The fear entertained by some that the company would resort to trickery to secure a trolley line was dissipated at the mass meeting of the property owners recently when a letter was read from ex-Judge Julius S. Grinnell, general counsel of the company, reaffirming all the pledges made to the property owners last November. The company, Mr. Grinnell wrote, would not construct the trolley without the consent of a majority of the street frontage, divided into these three sections: From Eighteenth to Twenty-second, from Twenty-second to Thirty-ninth and from Thirty-ninth to Fifty-first. No surplus of frontage in any one of these divisions would be used to make up a deficiency in any other. Mr. Grinnell also wrote that the company was endeavoring to extend its line on Indiana from Eighteenth to Twelfth street, the cars to become trailers at that point instead of at Eighteenth street. He renewed every pledge he had made last November. If any canvassers of the company misrepresented property owners as signing the company's petition when they had not done so, they would be forced to make a public retraction.

THAT the telephone is entering upon a most important period of its existence and that the immediate future will witness most remarkable progress in the development, extension and wide application of telephony throughout the country, is evident to all who have watched the activity that has been displayed in this department during the last year. Much that has been done in that period, it is true, has been merely by way of preparation in anticipation of a favorable decision in the Bate refrigerator case, and now that the position of the lower court has been upheld by the Supreme Court of the United States, there is no reason why the execution of these plans should not be immediately undertaken. It is useless to deny or attempt to disguise the fact that there is much prejudice in the public mind against the Bell company, and it is needless to say that this opposition, which has resulted as a natural consequence from the policy of the old company while enjoying a monopoly, may be expected to seriously interfere with the further expansion of that corporation's business. It is apparent, too, that this opposition is developing and becoming more aggressive, now that the rights of rival concerns are established, and no better indication of the present state of the public mind could be found than that shown in the almost universal approval of every movement tending to restrict the old concern and prevent any attempt to further monopolize the telephone field. Legislation is pending in many states looking toward a reduction of the rates which existing companies are charging, and the enthusiastic advocacy of these measures by individual business men and organizations of business men shows clearly the deep interest that is felt in this matter. Heretofore it has been customary to classify many of these movements as "sand-bagging" schemes of politicians, but it must be admitted that earnest, thoughtful, intelligent and public spirited men are identified with the present agitation. This, however, is only one feature of the controversy, and while much is being done in this direction, it is not the only line of attack that is being followed. New companies have been formed and franchises granted for operating exchanges and employing apparatus other than that of the Bell company. It seems, too, that these newcomers are being quite generally favored, and this is particularly true in the West and Northwest. An idea of the magnitude of this movement throughout the Northwest may be gained by a perusal of the article presented elsewhere in this issue by a correspondent of the WESTERN ELECTRICIAN, who has gathered considerable data on this subject. It will be seen that extensive operations are contemplated, and it would be well to remember that this is only the beginning—an entering wedge as it were. With cheaper rates and improved service, which competition promises, the telephone will be placed within the reach of many who are now anxious to avail themselves or its benefits but who have heretofore found the charges prohibitory.

This prospect of general improvement will be welcomed by construction men and dealers in supplies, as well as by manufacturers of competing telephones, and it is not too much to expect a general improvement in all these lines. The effect will of course be far-reaching and will stimulate business in other branches. Manufacturers would do well to watch this territory closely, as unquestionably the development in the West will be the more rapid and extensive.

AN ordinance was passed by the Chicago city council recently granting unusual powers to the "Cosmopolitan Electric company," which, it was claimed, was formed for the purpose of supplying electric light, heat and power and telephone service in the city of Chicago. The identity of the projectors of the enterprise was not revealed and there was much opposition to the measure, but the ordinance was railroaded through the council together with a gas ordinance, and both have received the approval of the mayor. The ordinance of the Cosmopolitan company was modified somewhat at a later meeting, but the changes did not affect the character of the grant. Probably no action of the present city administration has been so severely criticized as the approval of these ordinances. After the first meeting of the council and before the franchises had been approved, an indignation meeting was held at which urgent protest was made against the signing of the ordinance. In the face of this opposition the mayor affixed his signature to the obnoxious measures. There is a good deal of speculation as to the identity of the men behind the ordinance, and it is believed that if this were known it might afford some explanation of the mayor's action. It is really a singular thing that upon the eve of his retirement from public office the mayor should have departed from the policy he has uniformly followed throughout his official career and that he should have taken this step in opposition to the advice of the corporation counsel and others whose opinions have heretofore had much weight with him. It is admitted that the corporation counsel had prepared a veto of the Cosmopolitan ordinance, in which numerous defects were pointed out. Chief among these was the fact that there was no responsible person known to be interested, and the project was therefore deemed unworthy of approval. Again, vast powers and valuable privileges were granted the company without sufficient recompense to the city and without any guarantee that these privileges would be used to the advantage of the community. In view of these facts the Civic Federation determined to investigate the matter fully and do everything possible to invalidate the action of the council and defeat the purpose of the men behind the measure if, as it was surmised, their object was to dispose of these valuable grants. Eminent legal authorities, who examined the ordinances, pointed out certain defects in the wording of the bill, which, it was claimed, would make it much less valuable. In section one of the ordinance permission is granted the company to maintain "electric conductors to be used for the production, transmission and distribution of electricity for the purpose of furnishing light, heat and power and the transmission of sound and signals or any or either of them." According to a ruling in a somewhat similar case in this state, the word "any," as thus used, limits rather than extends the ordinance. By this construction the company may do any one of the things specified, but it cannot do more than one of them under this franchise. This view of the situation is taken by attorneys not interested in the ordinance, and is admittedly correct according to counsel for one company that had hoped to take advantage of the ordinance for the purpose of establishing a telephone exchange business in Chicago in competition with the Bell interests. The aldermen may amend the ordinance in this particular, but immediate action is not anticipated, owing to the storm of indignation that their recent action has raised. It is to be regretted that such action should be taken at this time, in view of the tendency to impose burdens in the way of taxation and exacting conditions upon legimate enterprises.

## The Monocyclic System.

[*Continued from page 133.*]

or about 36, so that the figure 145.5 in connection with that diagram is not in accordance with the assumption of the electromotive force being controlled by the lamps in circuit, and if the highest electromotive force allowed is that of the three-wire circuit, then the additional figure for the weight of copper for the two-phase three-wire system should be 36 in comparison with the other figures.

Another point in connection with the lines is the unbalancing of circuits. It was stated that the two-phase three-wire circuit is one which is liable to unbalancing because of the reaction of one circuit upon another. While this is true in certain cases in ordinary working, it is one which would be met with but seldom. The next point in the system after going through our transmission circuits is the transformer. The transformers for transforming a given amount of energy for lighting or for power by the two-phase system, in which one transformer is placed on each of the two phases, is the same as that for the single-phase system. For the three-phase system, in which transformers are connected across each pair of mains, the converter capacity is the same; that is to say, if we have these transformers, we may connect them in parallel across the single-phase circuit, or we may connect them in two sets of three each on a two-phase system, or we may divide them into three groups of two each on the three-phase circuits, and each transformer will have the same individual capacity in each position. When, however, these transformers are connected as in the diagram illustrating the monocyclic two-wire system, then these transformers, as has already been pointed out, do not operate in their ordinary way, although the electromotive force upon them may be normal, the currents flowing through the transformers differing from those in ordinary cases. They are not in phase with the electromotive force upon the transformers, and the output of the transformers is reduced by a very appreciable amount—if I am correct in my present recollections, some 16 per cent. Thus transformers of about one-sixth greater capacity would be required for operating a motor under this system above that which would be required if the same motor were operated by two-phase or three-phase systems.

The transformers in the monocyclic three-wire system also seem to require an excess capacity. If the large transformer in that diagram is the one which supplies the lights and operates the motor when the motor is doing something, then the little auxiliary or teaser transformer is one which is useful only at the start and contributes nothing to the regular working of the motor, according to the assumptions which have been made. This transformer, therefore, is an additional piece of apparatus which must be provided in the system.

With regard to the motor itself, I observe that the motor in the monocyclic two-wire system is a three-phase motor and nothing else. I understand that the motors used are the standard three-wire motors, and the motor itself does not know where it is getting its supply; whether from a regular three-phase system or a two-wire monocyclic system. The transformers for this motor on the three-wire three-phase system would naturally be three. We seem here to have cut off a part of this system by cutting out one of the transformers. We are not keeping the symmetrical arrangement now, but are supplying the motor by but two transformers, tending to the result to which I have just called attention; that is, a larger transformer capacity. The reversing of the secondary coil of one of the transformers, if I understand the connections and arrangements, would be obviated and the transformer would be connected directly without this crossing if the primaries of these transformers were directly connected to three-phase mains. Suppose we have a system, then, with three-phase mains with three transformers connected, feeding respectively the three circuits of the motor. Now we cut out one of these transformers, but our motor will still run, but without the same efficient performance of the transformers. If we change the relation of the middle wire at the dynamo or change the voltage of this wire, we can do so in such a proportion that the phases of the two primary circuits will not have their former relation; will not be 120 degrees apart, but 60 degrees apart. In this case it becomes necessary to reverse one of the secondaries in order to obtain two currents 120 degrees apart for operating the motor. If, therefore, the teaser coil were wound with a different number of turns to give a higher electromotive force, we might have a three-phase generator supplying directly three-phase mains. What this seems to be, then, is really the elements of the three-phase system, distorted somewhat by changing the electromotive force on the middle or teaser wire and reversing the secondary of one of the transformers and leaving out the third transformer. So much for the motor which operates from the two-wire monocyclic system.

The motor on the three-wire system seems to have somewhat different relations. This is not a three-phase motor, but, I take it, is a two-phase motor, and it is rather interesting—

DR. BELL: It is a three-phase—the same motor as the other.

MR. SCOTT: Very good for the explanation; but on the diagrams I have seen of this monocyclic motor I have taken it as a two-phase motor, the two windings being given in the diagram as two coils placed at right angles to one another. The very reason for bringing up this discussion and making it so full at this time is to get a correct understanding of these motors. The understanding which I got from the diagrams and explanations which I have seen of the system seems to me to represent a two-phase motor, one of the circuits being wound through directly similar to the monocyclic generator. This motor has been pointed out—I do not remember whether in the paper Dr. Bell has just read or not—as similar to the monocyclic generator, which is stated to be a single-phase machine, wound with one winding straight through from one end to the other, with this little auxiliary or teaser coil connected between the middle of that coil and a third terminal. If this be the case, then it seems to me that this motor is either a single-phase motor or a two-phase motor. The explanation given of the operation of this motor has not been very complete to-day. If I make a mistake in drawing on other sources of information in regard to it, I hope I will be corrected.

This motor I have taken to be a single-phase motor when run at speed, but essentially a two-phase motor, which is supplied by the three wires which are operated by two transformers, which have electromotive forces at right angles, or the 90 degree relation of the two-phase motor. We are supplying, then, to this motor the output of two converters which are operated at a difference of 90 degrees. All the circuits of the motor are active while the motor is coming up to speed. One of the windings on the motor is somewhat different from that of the windings on the transformer; it is not exactly proportioned in both of its circuits to the electromotive force supplied, so that when run at speed one of the circuits does all the work. It is very much as if two transformers were connected in parallel, one giving 100 volts and the other 99 volts. If we put a load on the two transformers connected in multiple until the electromotive force drops to 99 volts, than one of the transformers would be carrying all the load and the other nothing. The motor described here is the same motor, if I understand it correctly, as is described in the patents granted to Mr. Steinmetz. Then in seems to me that this motor is very similar to a sort of lop-sided two phase motor, stronger on one side than the other. The two circuits operate with fair effect to bring the machine up to speed and then one of the circuits takes all the load and the other has but little to do. The motor in running at full speed and doing its regular work operates as a single-phase motor. A single-phase induction motor will not carry the same load that the two-phase induction motor will. Anyone who has operated two-phase induction motors knows that one circuit may be cut out and the machine will continue to run; but it will not carry the same load as before. If that be true, and the information upon which I understand the connection of this motor be true, then this monocyclic motor seems to be a rather decrepit two-phase motor.

There is one point to which attention was called by my able friend Mr. Steinmetz, to which I take exception. That is his definition of a polyphase system or a polyphase motor. He was pleased to say that difference of phase in electromotive force with no difference in current does not constitute a polyphase system, and he pointed out that if a coil and a lamp be placed in series—the electromotive force measured directly across the lamp and the electromotive force measured directly across the coil—they would not be in phase with one another, but would occur at different times. So also if a coil and a lamp be placed in multiple so that the same electromotive force is on the terminals of both, then the currents are not of the same phase. But he held that neither of these would constitute a polyphase system because the flow of energy was not constant. A constant flow of energy may be taken as a definition of a polyphase system, so might difference of electromotive force or difference of currents. As I understand a polyphase system, I do not mean that the electromotive force at one part of the circuit may be one thing, and at another part, somewhere else, another thing, either at a great distance or connected with a different piece of apparatus; that would not necessarily constitute a multiphase system; but if the two different elements with difference of phase cause the operation of that apparatus, then we have the essence of a polyphase system. If we have a motor and wind its circuits in such a way that the circuits shall differ in capacity or self-induction; if the currents in the different circuits differ in phase, and owing to this the apparatus operates and the motor runs; then we have something which should be legitimately considered as polyphase apparatus. We have an apparatus which operates due to the difference of phases, or to too many phases, and in the polyphase motors that is the characteristic element. The element which causes rotation, the fundamental element, seems to be the shifting of the magnetic field in the apparatus. It is not fundamentally essential to the operation of such an apparatus that the currents give equal energy to the apparatus at all times, but that they be supplied in such a way as to give the shifting field, which will cause the rotation and running of the apparatus. I would therefore call a multiphase machine one which has in it a shifting magnetic field of many phases or currents producing these magnetic fields, rather than one having constant flow of energy to the apparatus.

The power wire operating in the monocyclic three-wire system is said to be a powerless wire. This wire is for the purpose of operating the motor while it is coming up to speed. The two great problems in an alternating current motor are: First, the bringing of the motor up to speed, and secondly, keeping it there. These are two different problems, and different methods are devised for effecting the two different results; and very often the elements which contribute to one detract from the effectiveness of the other. The power wire, if I am right in understanding this motor, does not necessarily supply power to the motor at the time when the motor is running at full speed, but it contributes to the power which is required for bringing the motor up to speed, and would continue to deliver power to the motor instead of lying idle and resulting in so much idle copper in our system, if the motor were a complete and symmetrical motor instead of one which has possibly been made defective to meet the requirements of this system.

DR. BELL: The first question raised may be granted, that the monocyclic system is a modification of something. Is it now to be considered as a single-phase or two-phase system or polyphase system of some sort? I think that question was clearly answered by Mr. Steinmetz when he pointed out that you must consider as polyphase a system in which the energy remains constant—the common characteristic of all polyphase systems whether evenly balanced or unbalanced. In the monocyclic system we have three currents substantially in phase with each other, and the total energy passes through zero. I fail to see how the widest possible extension of the definition of a polyphase machine could be made fairly to include it. The most that could be said would be that there might be a limiting case in which the unbalancing of a polyphase system might go on until the total energy would actually pass through zero. If that is so, it might serve equally well as a limiting case for either the single-phase or the polyphase system. It is certain that the monocyclic in its operation suggests a polyphase system. In the character of the currents which flow through it, and in the distribution of the energy it is peculiarly single-phase in its character. I was interested in Mr. Scott's remarks on the subject of the four-wire connection of the two-phase, and in the second place the three-wire connection of two-phase system. Now, with a four-wire connection it is of course possible to use the Edison three-wire system on each branch if one so desires, but in order to do so and to run motors at the same time, one must interlink the two three-wire systems; in other words, you must have two three-wire systems, each system being approximately balanced as to itself, and each three-wire system balanced as respects the other three-wire system occupying the same territory. They must be interlinked for motor service, and that is the reason which, I maintain, bars out the two-phase four-wire system from employing the Edison three-wire connection, just as it must bar out in the same way and even more effectively the three phase system from operating on each of its three phases an Edison three-wire system. It makes a complication of circuits for general distribution which would be perfectly intolerable—two three-wire circuits in the same territory and each balanced with respect to the other; it would be something better imagined than described. In certain cases for lights only it may be applied, because you are at liberty to scatter your circuits, but even then it would require more or less balancing of the two systems, else you get into trouble with one side of the machine having a greater load than the other, which causes a difference in drop which cannot be compensated by compounding. With the two-phase three-wire system Mr. Scott's point was well taken on the question of maximum voltage. However, if you are dealing with the maximum permissible on the transmission line, where the thing to be considered is not the maximum on the distributing system to translating devices, but the maximum permissible on the whole system, and if you confine yourself to that, you will find that combining the two-phase into three wires requires excessive copper. If you confine yourself to the secondary system alone, it will be possible to permit the same maximum voltage as on the straight Edison three-wire, and I should say that the same rule would apply to the reduction of copper in the three-phase three-wire system or any other system in varying degree according to their character.

As regards the question of unbalancing, I think I stated with a fair degree of distinctness that with any polyphase system, though unbalancing may occur, and occur in a serious degree, I do not believe it would be a common occurrence. I think I specifically included the polyphase systems in general.

With regard to the question of the reduced capacity of transformers operating on three-phase or monocyclic systems, as a matter of fact there are three plans of working, we will say, with a three-phase system as regards its transformers. In the first place we may have a composite transformer including all three legs of the circuits, which has been used with very fair results. Next, we may use three transformers, or finally only two transformers. Sometimes it is more convenient to use three, and sometimes two. We must remember that there are not to be had an infinite number of sizes of transformers, nor an infinite number of sizes of motors. The consequence is it is sometimes a difficult matter to find transformers which will exactly fit a given horse power of motor, and the loss of capacity which is thus met in furnishing transformers too large for the motors (because we must be sure to have them large enough) may easily amount to 10 or 15 per cent. either with two or three phases, and unless special transformers are made to fit the motors, we are liable thus to require an increased total capacity of transformers as well on two-phase as on three-phase systems. With the three-transformer connection for the three-phase circuit we have one very material advantage, which perhaps makes it worth while to employ it in many cases, and that is if one of the transformers for any reason is crippled we can operate at least two-thirds of the output with the remaining two, whereas on the two-phase system, if one transformer gives out the motor is crippled, either by overloading and stopping absolutely, or able to run only at half output as a single-phase motor, but in no case starting until the transformer is fixed. If two transformers are used, the statement has been made that the loss in output in connecting three-phase transformers is about 16 per cent. I would like to see experimental evidence brought up in this case. We have been informed in many well written technical articles that the output of the polyphase machine was thus and so in connection with the single-phase machine, and we know that the facts do not fully bear out the theory. We are now given similar information in regard to the transformers. While I am not prepared to dispute the fact without having experimented on it, I would like to see some evidence that the difference in output rises to any practical magnitude.

As regards the teaser transformer, I think we may consider the secondary transformer on the monocyclic three-wire system as practically part of the power wire. It needs to be of small size and furnishes only a small amount of energy. With that connection the one transformer furnishes the power wire for the whole three-wire system. It is not a part of each motor, simply a part of the power wire, and as such it may be taken as a part of the installation belonging to the three-wire system. The single small transformer in the system furnishes the entire power wire for the whole system.

As regards the motor on the monocyclic two-wire system, it is correct in a sense to say that the motor does not know whether it is on a three-phase circuit or a monocyclic. As regards its operation, it does not know; that is, as regards the directions of the electromotive forces in it. It is a matter of perfect indifference which system it is on; but as regards the character of the currents and their direction, if the motor possessed an ammeter to put in its own coils, it would find there was a very large difference in the distribution of currents. As regards its magnetic qualities it would not matter, although the actual distribution of the current is widely changed. We have in the monocyclic induction

motor a motor which in its operative qualities is like a polyphase motor. Nevertheless the distribution of currents in it, although resulting in a perfectly symmetrical production of motive power, is something that you cannot find in any polyphase motor. It depends on the particular action used in the monocyclic system. It has essentially a single phase current, although its effect as regards magnetism is closely similar to that of the true polyphase motor.

As regards the motor on the monocyclic three-wire system, I was much pleased with the ingenuity with which Mr. Scott constructed a large, able-bodied and well-dressed man of straw for the purpose of knocking the gentleman down and jumping on him with both feet. The motor is not a two-phase motor of any kind. It is an ordinary induction motor, such as is used indifferently on three-phase or monocyclic systems. Doubtless from the experience of the speaker, he deeply realized how bad a bad two-phase motor could be. The winding of the monocyclic motor is in every respect similar to that of the three-phase motor. There is a possibility and sometimes a great convenience in being able to work a monocyclic generator as a synchronous motor. Used in such a way, it works during its operation like any other synchronous motor. It is a possibility which is sometimes very convenient; the motor starts itself, and the teaser coil when the motor is up to speed produces no effect on the rest of the system of the motor is properly designed with reference to suppressing the electromotive force of the teaser circuit. In the monocyclic three-wire system we have in the first place a three-phase motor structure, but operating on a monocyclic three-wire and teaser circuit, with the properties and distribution of currents—or electrical character—of the single-phase system. The actual details of operation in a monocyclic motor are somewhat complicated. Substantially we have a structure which in all its characteristics is only proper to be operated on the monocyclic or three-phase circuits. The currents which flow through it however, are not three-phase currents, the electromotive forces being, however, 120 degrees apart. The currents are substantially in phase, but the magnetism produced is so distributed as to give a perfectly symmetrical torque on the motor just as though it were run from a polyphase circuit—a point which I think justifies me in the remark I made at the beginning, that the monocyclic system is to be regarded not altogether as a modified and glorified single-phase, nor again as a decrepit and disreputable polyphase system, but rather as in a class by itself.

W. R. GARDENER, Pittsfield, Mass.: I am very much interested in this question of multiphase apparatus, and after hearing the paper read and the arguments which followed it, I am not quite certain about it. I do not pretend to know anything about polyphase or multiphase systems, or teasers or anything of that kind; but I do know when I have something in my station that gives me perfect satisfaction. I know that I have got something in my station that satisfies my requirements as a central station man. We are operating a two-phase machine, and have been for over a year and a half. The first work required of the two-phase machine was to furnish fifteen horse power a mile and a half from our station over an existing circuit. We ran an extra wire, and from that circuit are furnishing incandescent lights to stores and dwellings, and also this fifteen horse power. Later on a fire occurred in a mill and the engine was destroyed. We put in two motors of twenty horse power each, and furnish power on this circuit, giving perfect satisfaction. Our business increased and we were obliged to put in larger machines, and to-day we are furnishing power, incandescent and arc lights from this one machine. We are at the present time going to change our station. We have got five alternating current machines, from 750 to 1,500 lights capacity—machines as good to day as when they were bought—but we cannot afford to run them as long as there is something better. But the item of repairs on ordinary apparatus is enormous, as you know. With these two-phase machines, including the transformers and motors, we have not spent one cent. We are going to take out the five machines referred to and put in one two-phase machine, and instead of our dynamo attendants bobbing from one end of the switchboard to the other and reading five ammeters and voltmeters, they will read one. We have not experienced any difficulty on these lines.

## Telephone Inventors Not Infringers of Their Own Patents.

In the suit of the Western Telephone Construction company against Alfred Stromberg and Androu Carlson, Judge Seaman handed down a decision recently denying the motion of the complainant for a preliminary injunction. Owing to the contract relations between the parties to this suit the defendants were estopped from denying the validity of the two patents upon which this suit was brought, so that the entire controversy was upon the question of infringment, and the defendants succeeded in demonstrating to the court that infringement was not shown to the extent required for a preliminary injunction. Stromberg and Carlson were formerly employes of the Western Telephone Construction company and had assigned to the Western Telephone Construction company the patents upon which the suit was brought. One of these patents, No. 504,636, was for the combination of a magneto telephone with a magneto generator in such form that the magnets of the magneto generator were used for the telephone, and *vice versa*; the other patent, No. 516,777, was upon an automatic telephone switch. The counsel for the complainant were Stanley S Stout and James H. Raymond; for the defendants, Barton & Brown.

The contract for lighting the streets of the city of Cordele, Ga., has been awarded to the Industrial Fertilizer company of that place.

## Columbia Incandescent Lamp Company.

A representative of the WESTERN ELECTRICIAN recently visited St. Louis and was shown through the extensive works of the Columbia Incandescent Lamp company by President J. H. Rhotehamel. The Columbia company certainly possesses every facility for the production of high class lamps in large quantities, and the appearance of every department of the works is indicative not only of scientific management of detail, but of that discipline and care that are so necessary to insure a product uniformly excellent. There has been recently made a three-story addition to the factory of 40 by 42 feet, and another additional story. Thoroughly enterprising and energetic, Mr. Rhotehamel is continually engaged in improvement, with the determination to

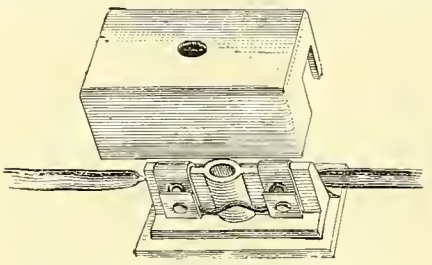


FIG. 1. NEW GLEASON SPECIALTIES.

keep the Columbia lamp always to the front and at its present very high standard of excellence. The company has recently purchased and is now installing a new outfit of pumps, boilers, engines and dynamos, and with this new machinery the capacity of the Columbia works will be from 10,000 to 12,000 lamps per day. The factory is now running on the regular "Columbia," but the company's new "coiled filament" lamp, made in types for both high and low efficiency, is also being manufactured and is meeting with marked success. It is claimed for these lamps of high economy a maintenance of candle power superior to anything yet placed on the market. Special candelabra lamps and a "round bulb" lamp admirably adapted for ceiling and window decoration are also being made.

Mr. Rhotehamel was asked for his opinion as to the effect

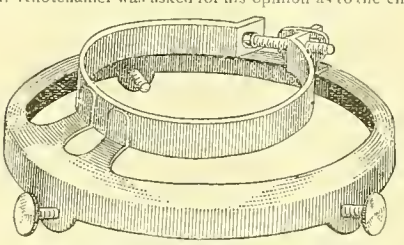


FIG. 2. NEW GLEASON SPECIALTIES.

on the lamp market of the recent decision in the Bate case. He said:

"The recent decision of the Supreme Court in the Bate refrigerator case finally terminates the life of the Edison lamp patent. This will no doubt have the effect of placing on the market a number of incandescent lamps which have been held in stock by those manufacturers who were forced to close their works some two years by injunction, and they will no doubt be offered at exceedingly low prices. It is a well-known fact that lamps when carried in stock for a long time will deteriorate somewhat, owing to the loss of vacuum. This may have the temporary effect of reducing the price of incandescent lamps, but I believe it will be found, after a trial of such lamps, that the users will be satisfied to return to and buy the standard makes at fair prices, and that the company manufacturing the best and most economical lamp will find a ready sale for its product.

"At the present prices quoted there is but a small manufacturer's profit, and there is so much depending on the quality of the goods that I am satisfied that the users who take pains and test their lamps for economy, life and maintenance of candle power, will come to the conclusion that it is better to pay a fair price than to buy a cheaper article and obtain unsatisfactory results therefrom.

"There has been in the past considerable objection to lamps of high economy, owing to the fact that they depreciated so rapidly in candle power, but by new processes employed in the manufacture of lamps during the last year, all these objectionable features have been overcome, and lamps of high economy can now be furnished which will show in six hundred hours a loss of less than 10 per cent. in candle power. We believe that what is known as the structural filament lamps, owing to their high economy, will prove very beneficial to the large central stations, where they have to meet the competition of the Welsbach burner and where their stations are overloaded. On the whole, the outlook for the future seems bright."

## New Gleason Specialties.

The illustrations presented herewith represent three new specialties just put on the market by the E. P. Gleason Manufacturing company of 181 to 189 Mercer street, New York. Fig. 1 shows an armored insulating joint made of composition brass, andinsulated with sheet mica. It is approved by the National Board of Fire Underwriters. Fig. 2 is a covered porcelain bug cut-out, for use in the canopies of electroliers and brackets. It is made of two pieces, is readily fused without disturbing the leading-in wires, and because of its smallness can be used in smaller canopies than can any of the covered cut-outs now on the market. The cut shows its actual size. Fig. 3 shows a shade holder and needs scarcely any comment. It fits any standard socket, is unusually deep in the rim, thereby accommodating shades with very thick lips, and centers the lamp perfectly in the shade.

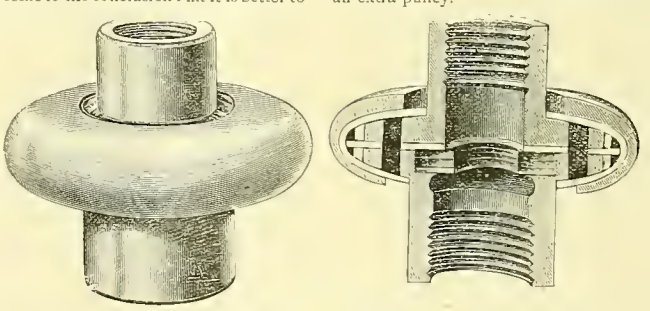
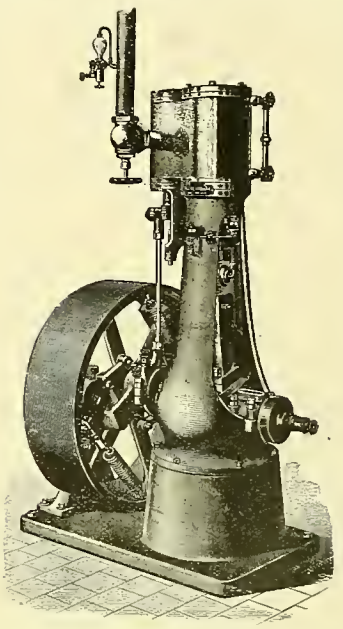


FIG. 3. NEW GLEASON SPECIALTIES.

## Racine Automatic Engine.

The accompanying cut illustrates an improved automatic engine made by the Racine Hardware company. These engines are of the "self-contained" type, and are especially adapted for electric light stations and where high speed in connection with economy and close regulation is desired. The frame is rigid and of tasteful design. The slides for the cross-head are cast solid to the frame, as are also the broad boxes for the shaft. The connecting rod is from a steel forging and is provided with ample means for taking up wear at both ends. The shaft, crank and crank-pin are made from one steel forging. The crank-pin is lubricated by an improved method, using a compression grease cup, and forcing grease through the short end of the shaft. The cup can be detached, filled and replaced while the engine is running at full speed. The shaft is supported by three bearings, two in the frame and one outside of the governor pulley, beyond which the shaft extends far enough to attach an extra pulley.



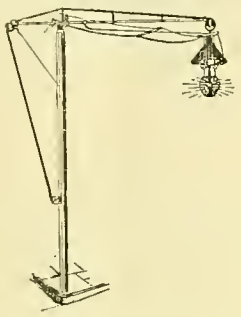
RACINE AUTOMATIC ENGINE.

The valve is perfectly balanced and fitted with rings. Cross-head shoes are made with large bearing surfaces. The governor is of an improved type. All castings are made of the best charcoal iron, and the best of fittings are furnished with each engine. Beside the vertical and horizontal engines the Racine company makes an automatic outfit, stationary and marine, from one to six horse power, which has a vertical automatic engine and porcupine boiler on one base, and feed water heater, pump, oil burner, feed water regulator, air pump and all piping to make the outfit complete, beside all fittings for the engine and boiler. The boiler is fitted with a combination grate, whereby coal, wood

and oil can be burned. With oil 150 pounds of steam can be raised from cold water in 10 minutes.

## "Reliable" High Speed Engine.

A very handsome high speed automatic cut-off engine manufactured by J. F. Chuse & Co. of Mattoon, Ill., and especially adapted to electric light and power stations, is presented in the accompanying cut. This machine is built in eight sizes, ranging from 20 to 150 horse power, and is an improved self-contained automatic cut-off engine, combining strength, durability and economy. The frame is the latest improved pattern, oil-tight and dust-proof. It has three hand plates, by which the inner parts are made easily accessible. The frame is designed for compactness, and the metal distributed so as to give great strength. The bear-

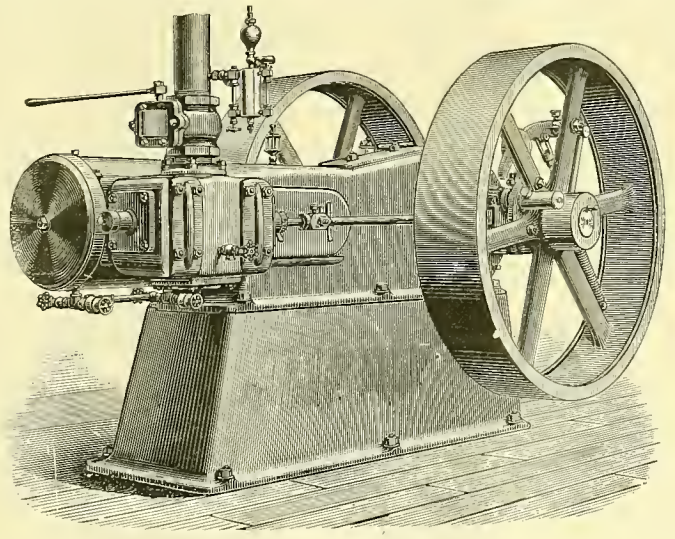


BRADY IMPROVED MAST ARM.

ings are unusually large, thereby insuring the least possible wear. The main bearings are detachable and are fastened on the side of frame like a cylinder head. By this arrangement when a box has worn out it is only necessary to re-babbitt the box, put it in a lathe and bore it out. When returned to the place it is in perfect alignment. The cross-head guides, wrist-pin and main bearings are automatically oiled. Oil is carried in the bottom of the frame and dashed up by the crank disks. As this oil is used over and over, very little, if any, is lost. The oil retains its amber hue after long usage, proving that it remains clean and fit for lubrication as long as it lasts. The valve is of the piston type and perfectly balanced. All parts of the engine are adjusted at the works until a perfectly running balance is obtained. The steam chest is large and the ports near the end so that full pressure is realized on the piston. The piston is a hollow casting of great strength and fitted with self-adjusting steam packing rings The crank shaft is a solid forging, balanced with cast disks. The connecting rod is steel and fitted with brasses that are adjustable with key and gib. The governor is of the centrifugal, inertia type, contained in the fly-wheel. It is connected to a swinging eccentric and to the valve directly with a ball joint. It has two balls, one of which operates by centrifugal force, the other, balancing this, operates by inertia. It has few parts, and the bearings are fitted with renewable brass bushes and are oiled with grease cups. Any engineer can adjust it to the right speed.

## Ammeters and Voltmeters.

The accompanying cut illustrates a type of ammeters turned out by Charles E. Norton of Manchester, Conn.



RELIABLE HIGH SPEED ENGINE.

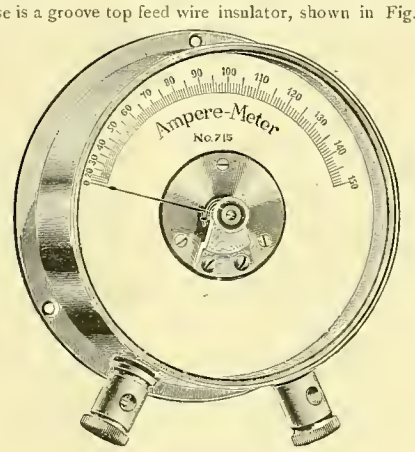
Instruments of this class have been extensively used for five years in direct current work. They are accurate, durable, neat in appearance, finished in handsomely lacquered brass and can remain in circuit twenty-four hours a day without injury. The mechanical parts are strong and well put together. Each instrument is carefully compared with a known standard, and the scale made by hand. The voltmeters as well as ammeters made by Mr. Norton should remain in circuit constantly, and because the former are calibrated after being thoroughly heated, the indications are accurate only when so used.

## New Machine of the Onondaga Company.

The accompanying cut represents one of the many excellent machines now being turned out by the Onondaga Dynamo company of Syracuse, N. Y. This prosperous concern, being located in the center of New York state, has excellent facilities for prompt service. The business of the company has necessitated the doubling of its capacity during the last year, which goes to show that careful attention to the building of machines, with improvements adopted, and courteous attention to the wants of its patrons are placing this company to the front. Many testimonials are received by the company during the year and the machine speaks for itself.

## Medbery Specialties.

The Fiberite company of Mechanicsville, N. Y., has recently placed on the market a number of new designs for overhead trolley equipment for electric railways and lighting purposes, which have attracted no little attention. One of these is a groove top feed wire insulator, shown in Fig. 1,




AMMETERS AND VOLTMETERS.

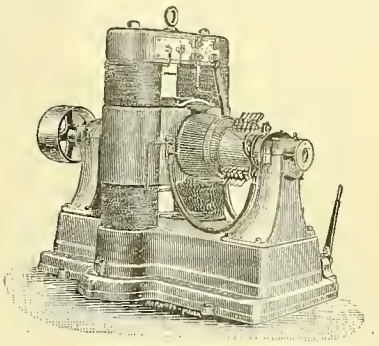
to carry an inch and a half cable on the top and two sides. The Medbery insulation is a composition invented by H. J. Medbery, after a long series of experiments, and is a chemical mixture, moulded while in a plastic state, under enormous hydraulic pressure, into various shapes, for electric insulating purposes. It is a very hard, strong, tough, acid and water proof material, and impervious to the weather. Possessed of high insulating qualities, it resists high temperatures, and is in every way a model insulation for those who construct their lines with a view to permanency.

The Fiberite company has had such a large demand for this material in foreign countries that it is about to appoint several agencies in England and Germany.

The Fiberite company, through its agent, the Mason Electric company, Chicago, is sending out a new catalogue of its material. The two devices illustrated in Figs. 2 and 3 are being used very largely on the different Chicago roads. Fig. 2 shows a car house insulator. All of the barns of the North and West Chicago systems have been fitted with this device, which is made strong and rigid for such very trying work. The Medbery bolt gives absolute insulation. Fig. 3 represents a strain insulator and turnbuckle combined and is used by both the roads mentioned wherever unusual strength is necessary. The Mason Electric company will send catalogues on application.

## Brady Improved Mast-arm.

The necessity of extending arc lamps beyond the overhanging foliage of trees, thus diffusing the light over a large area, is recognized by all interested in electric lighting.



NEW MACHINE OF THE ONONDAGA COMPANY.

This want is fully met by the Brady improved mast-arm, shown in the cut. The arm is made to extend from ten to twenty-two feet from pole to lamp. Experience has shown the twenty-two feet mast-arm to be of sufficient length to light the widest avenues. These mast-arms are manufactured by T. H. Brady, New Britain, Conn.

## Lectures on Electro-chemistry at Johns Hopkins

There has been started at the Johns Hopkins University an addition to the present electrical course, consisting of lectures and laboratory work on electro-chemistry. The work is being done by H. C. Jones, Ph. D., who has had a thorough training in this country and abroad under Ostwald The course consists briefly of: First, a historical sketch of electro-chemistry, including theories on electrolysis; second, electrical energy; third, discussion of the laws of Faraday; fourth, the wandering of ions; fifth, conductivity methods and results; sixth, properties of ions; seventh, electromotive force; eighth, polarization; ninth, electrolysis; tenth, electro-chemical analysis; eleventh, electro-metallurgy. There will be laboratory work in electrolysis and electro-metallurgy, and in such experiments as conductivity methods, etc. This course will be be elective this year. It is attended by fifty students, of whom twenty-seven are electrical engineers, nine physicists and fourteen chemists.

## Presentation to E. L. Powers.

On Saturday, March 9th, at the office of E. H. Fox, 107 Madison street, the members of the Chicago delegation to the Cleveland convention presented Mr. Powers a gold watch-charm as a slight token of appreciation of his wholesouled devotion and untiring attention to their comfort on the Chicago special train, which was under his charge. The charm was suitably engraved, on one side being a fac-simile of the button of the National Electric Light association, and on the other the legend, "Presented to E. L. Power

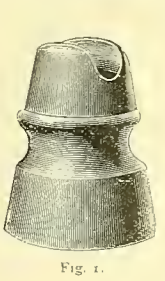


Fig. 1.

Fig. 2.

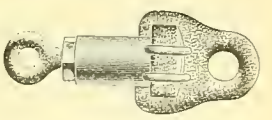


Fig. 3.

MEDBERY SPECIALTIES.

by the Chicago Delegation to the Cleveland Convention, 1895." William S. Hine, with a few fitting words of thanks to Mr. Powers for his labors while in charge of the western transportation to the meeting, presented the charm. In response Mr. Powers thanked the members of the delegation for so unlooked-for a recognition and one that he should always remember with much appreciation. Among those present were Edward H. Fox, William S. Hine, E. L. Powers, George Cutter, George S. Searing, Edward Lasell, E. Nashold and W. F. Collins.

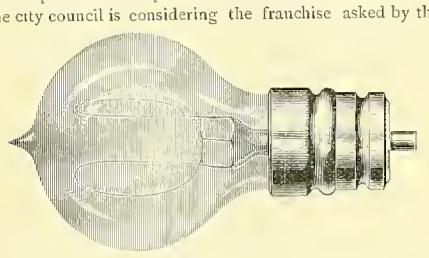
## New Ætna Lamp.

The Ætna Electric Works of Hartford, Conn., are manufacturing a new lamp, shown in the cut, which is specially adapted to railway and steamship service. By a peculiar method of anchoring the filament, the life of the lamp is increased. The manufacturers claim they can guarantee 50 per cent. longer life for their lamp than any other lamp made. The filament, being bent upon itself, presents all the radiating surface possible in condensed form and makes a very pretty and taking effect. It is claimed that there is no drooping or warping of filaments when the lamp is placed at an angle or in factories when used near large belts; in fact, that there is absolutely no vibration, jarring or shaking that can affect them to any extent. This is a feature which should be appreciated by all dealers and users of incandescent lamps. The firm also manufactures ordinary incandescent lamps of every description and is prepared to supply them in any quantity promptly and at lowest possible prices.

## The Telephone in the Northwest.

MINNEAPOLIS, March 9.—Considerable activity has been displayed by rivals of the American Bell Telephone company throughout the Northwest, and the competition is seriously affecting the old company's business. As will be seen from the subjoined announcements, the new companies are receiving much encouragement from the people of this section.

The Columbia Telephone company of New York is the latest aspirant for telephone franchise honors in St. Paul. The city council is considering the franchise asked by the



NEW AETNA LAMP.

United Electric corporation, clause by clause, and representatives of the Northwestern Telephone company and the Columbia are present at the meetings, the manager of the Northwestern personally catechising the attorney for the United as to what the new company proposes to do.

John D. McLeod, secretary of the Wisconsin Telephone company (Bell), announced in Oshkosh, Wis., recently that marked improvements would be made in the system and a reduction in rates of 20 to 25 per cent. would probably be made. He also said that the company had no idea of being forced out of the field at Appleton or abandoning it to the new company. It seems that the protests which have been filed with the company and the granting of new franchises at various points have stirred them up, and there is reason to believe the changes will be made.

Centralia, Grand Rapids, Merrill, Wausau and Stevens Point., Wis., have joined in a letter to the Wisconsin Telephone company to ask a reduction of rates to $2 per month for business houses and $1 for residences. If favorable action is not taken by the company, they will proceed to put in a new system.

The Bell Telephone company's manager came to Dubuque, Ia., recently to head off any move of the Harrison company, and promised to meet and reduce any rate that might be made. The Harrison company, through the local company which it proposes to form, will get subscribers for a term of years under a contract before putting in an exchange, so the Bell company could cut rates without disturbing them.

The switchboard of the Dubuque telephone exchange will be entirely rebuilt and arrangements for a metallic circuit made. In another year long-distance communication with Chicago will be made, says the manager of the exchange.

The Mutual Telephone company of Fort Scott, Kas., lately organized to compete with the Bell company, went into actual operation on February 19th. The new company is using the Reynolds transmitter and subscribers are only charged $1 a month, while the Bell company collects $4 a month. The new company claims to have already secured more than twice as many customers as the old company, whose patrons, it is said, are all putting in the cheaper phones.

A committee has been appointed in Davenport, Ia., to take steps to organize a local telephone company, and treat with the Harrison Telephone company as to the cost of the plant, after which rates will be announced and subscribers solicited.

Three men, named Crawford, Bond and Smith, representing the Harrison Telephone company, secured a franchise from Davenport, Ia. The Harrison Telephone company now claims that the franchise was intended for them, and as these men are no longer in their employ they cannot carry out its provisions unless it is changed to the company named. The council is considering the request.

The Rocky Mountain Bell Telephone company will build a line from Bozeman, Mont., to Great Falls in the spring and also extend the line from Helena to Butte. The longest distance covered by this company in Montana is 325 miles.

The Northwestern Telephone Exchange has announced that the long-distance line between Fargo, Hillsboro and Grand Forks, N. D., will positively be built in the spring, and representatives are now securing a right of way. The line will also be built to Cummings, Grandin, Mapleton, Casselton, Gardner and Argusville, N. D., and a line is proposed to Fargo from Minneapolis and St. Paul early in the spring.

The Northwestern Telephone & Construction company of Osage, Ia., has been incorporated with $50,000 capital stock to construct and operate telephone lines at Osage, Charles City, Mason City and New Hampton and to connect these places.

The bill of Representative Feig of Kandiyohi county, Minn., regulating telephone tolls, will not be pushed, as its career thus far shows that it is doomed.

The Board of Trade of Madison Lake, Minn., has been considering establishing a telephone line from Madison Lake to Waterville and Mankato. An estimate of constructing the line was placed at $1,800.

The Rawlins Electric Light company of Rawlins, Wyo., and the Dillon coal mines have consolidated, with M. W. Dillon as manager. A telephone system is contemplated by the combination.

The Tacoma Telephone company of Tacoma, Wash., will equip its line with the McDonald phones and use the Strowger switch.

Charles Huber and others are incorporating a new telephone company in Oskaloosa, Ia., and have been successfully soliciting subscribers.

The Winona Telephone company expects to have its poles set by April 15th.

There is considerable talk of building a telephone line from Waumandee, Wis., to Fountain City, Minn.

N. Magnuson & Co. of Rock Dell, Minn., are moving to secure telephone connection with Rochester, Minn., a distance of 15 miles.

The Harrison Telephone company is trying to get a franchise in Cedar Falls, Ia.

Dr. W. W. Bradley of Forman, N. D., will extend his telephone line to Oakes and Ellendale, N. D. He already has 50 miles of line in the county.

Great Falls, Mont., people talk of building a telephone line to Lewistown.

The Menomonie telephone company has petitioned the Menomonie, Wis., council for a franchise.

The new telephone company at Oshkosh, Wis., has secured 130 subscribers, and expects to get about 300. When 225 have been secured, work will be begun on the plant.

A new telephone company is trying to get in at Great Falls, Mont., offering service at not more than $7.50 per quarter. Connections will be made with Lewistown, Neihart, Belt and other towns. The present rate is $60 per annum.

A company has been organized in Glencoe, Minn., with $400 capital to build a telephone line to New Auburn, Minn. The cost of the line is estimated at $300. Work will begin as soon as frost is out of the ground. The company proposes to extend the line to Chaska, Minn., and there connect with Minneapolis and St. Paul. Arlington, Minn., may extend its line to New Auburn and thus connect over the proposed line to the Twin Cities. Jacob Koons is secretary of the company.

It is thought that in another year long-distance telephones will connect New York and the Twin Cities. The western end of the eastern line now is Madison, Wis., while the eastern end of the Minnesota line is Winona, Minn. It is reported that the Wisconsin company will build the line on to La Crosse, in which case the Minnesota line will be extended to connect with it there.

There is a grand carnival of franchise seekers at Ishpeming, Mich., three different companies being after the chance to locate there. W. L. Porter of Ontonagon, Mich, was the first. A number of local capitalists decided to form a company and have applied for a franchise, and a Marquette company wants to come in. The Marquette company proposes to cover the cities of Marquette, Ishpeming and Negaunee, and in the event of failing to secure a franchise at Ishpeming or Negaunee and the success of the Ishpeming company they will consolidate. Their success seems to be reasonably assured, as there is considerable feeling against the Bell company on the peninsula. The latter company does not make any difference in tolls for a residence or a business firm, asking $60 per annum for all classes. Representative John Jones of Ishpeming has introduced a bill in the Legislature regulating tolls on the peninsula.

Telephone lines will be built from Marshfield, Wis., to the lumber camps at Staat and Stratford, and the Rousch Bros. mill in the early spring.

C. K. Mead is making arrangements for establishing an independent telephone exchange in Des Moines. Mr. Mead proposes to have the exchange equipped with the best and most modern improvements, and to furnish satisfactory service at a considerably reduced monthly charge as compared with the rentals exacted from patrons at present. The projector of the new company says: "The service to be given by the new company will certainly be better than that furnished by the present company. We shall build toll lines to all neighboring cities at once, using metallic circuits, same as are now being used by long distance companies." Mr. Mead is a veteran in the telephone business, and for eight years was manager of the Des Moines exchange. He built the exchanges at Dubuque, Iowa, Rockford and Galena, Ill., and rebuilt those at Sandusky, Fremont and Defiance, O. M. S. P.

## PERSONAL.

As the WESTERN ELECTRICIAN goes to press, the sad intelligence is received that H. C. Thom, president of the Northwestern Electrical association, is lying at the point of death at his home in Madison, Wis.

## ELECTRIC LIGHTING.

Owen Ford, St. Louis, has prepared plans and specifications for an electric lighting plant for Webb City, Mo., to cost $16,000.

The Consolidated Lighting company of Montpelier, Vt., the company which absorbed the Standard Light & Power Manufacturing company and the Montpelier Gas Light company, will build a new power plant this season. Its equipment will be enlarged by the addition of 600 horse power in water wheels, shafting, clutches and pulleys, and 900 feet of 10-foot steel penstock.

According to the New York *Sun* it costs about $10,000,000 a year to supply gas and electricity for illuminating purposes in the cities of the United States. This total is exclusive, of course, of the amount paid by individuals, corporations, hotels, theaters, and railroad and steamship companies. It covers only the item of gas and electricity furnished under official authority and at the public expense. The city of New York appropriates for gas and electric lighting $250,000 a year. Of this sum $105,000 is divided among four gas companies. The sum of $98,000 goes to the electric light companies, with seven of which the city has contracts. The gas supplied to public departments costs $10,000 additional, and about $1,000 is expended for naphtha lamps. In Chicago the cost of gas is $140,000 a year, Chicago owning its own electric light plant. Philadelphia owns its own lighting plant and spends $300,000 a year for lighting. San Francisco spends $200,000, and Boston about the same. St. Louis spends more in a year for electric light purposes than for gas illumination, and is the only large city of the United States of which this is true. New York city's gas will soon be increased by the East River gas tunnel from Ravenswood, and before very long a considerable amount of gas burned in New York will be, as it were, the imported article. It costs the city $7 a year to furnish gas for the dog pound.

## ELECTRIC RAILWAYS.

The city council of Chicago has passed an ordinance permitting the South Chicago City Railway company to construct a new electric line. This proposed line is to connect the Cottage Grove avenue cable directly with Manhattan Beach. From its starting point--Seventy-first street and Cottage Grove avenue—it will pass through the suburbs of Grand Crossing, Brookdale, Parkside and Windsor Park. This will afford these suburbs great improvement in transportation.

A movement is on foot to build an electric railway connecting Valparaiso, Ind. with Chicago. Several Chicago capitalists have signified their willingness to furnish a large proportion of the capital if the territory through which the line passes will furnish and guarantee reasonable support. It is proposed to carry passengers to Chicago for 30 cents, and 40 cents for the round trip. Cars will also be arranged for carrying light freight at a nominal price. A company will be incorporated in the early spring. The proposed line passes through Hobart and Whiting.

A recent Washington letter to the New York *Sun* contains the following interesting gossip concerning the affairs of street railway companies of the District of Columbia: Senator Hill has hung up all the street railway bills before the Senate, and means to let them remain suspended until some sort of action is had on the particular one in which he is interested. It is a bill providing for the construction of a street railway in the suburbs of the District, and one of the capitalists interested in the new road is an old Albany friend of the senator. The House passed the bill some time ago, but Senator Hill has since been unable to get any action upon it. The District of Columbia committee, to which it was referred, does not seem inclined to report it either favorably or adversely. Senator Hill says that he has written or spoken to everybody who has any responsibility in the matter, and has been promised more than a dozen times that action would be had. He does not seem to understand the ways that are dark and the tricks that are vain of senatorial procedure, otherwise he would not have made his speech in the Senate the other day attacking the District of Columbia committee for not reporting his bill. When he did that he

aroused the wrath of every member of the committee. They feel that they have been insulted by the action of the New York senator, and they have, therefore, determined not to report the bill in which he and his Albany friend are interested under any consideration, and Senator Hill has in turn determined to block the passage of all the various bills authorizing the construction of railroads and amending the charters of those already in existence until favorable action is taken on his bill. He may or may not win by this method of warfare. The District of Columbia committee has informally agreed to let all the bills die rather than yield to Senator Hill, but the pressure from the friends of the corporations interested is so great that the committee may be compelled to let Senator Hill have his way.

## MISCELLANEOUS.

According to the *Chicago Tribune* twelve West Side physicians who have been making a study of electricity and its use in the practice of medicine made a visit last week to the new plant of the Chicago Edison company at Harrison street and the river, and later to the city electric light plant on Throop street. The party was under the direction of Electrician Brownell, who has been acting as demonstrator and instructor for the class. The object of the visit was to give the doctors a more comprehensive idea of the modern uses of electricity.

Charles H. Stone has been sued in the Superior Court, Chicago, for $10,000 damages for breach of promise of marriage by Daisy M. Gardner, a telegraph operator for the Postal company. According to the statement made by Miss Gardner, the wedding was set for January 16th, and when the day appointed arrived the bride and a number of invited guests were in waiting, but the bridegroom did not appear. Stone explained his absence by the statement that his father was opposed to the match, and had locked him in the office vault. The story was retracted, but the wedding was never celebrated.

## TRADE NEWS.

The Bryant Electric company has placed a new double-pole flush switch of ten amperes capacity on the market.

M. A. Knapp, late of the Knapp Electrical Works, has opened an office at 1164 Monadnock block, Chicago, for the sale of incandescent wires and cables.

The Interior Conduit & Insulation company of New York announces that its general offices will be at the company's works, 527-531 West Thirty-fourth street, New York city.

The city of Knoxville, Tenn, is in the market for a complete equipment of an electric light plant consisting of about 250 arc lamps. Bidders should address J. R. Wade, chairman light committee.

L. B. Allen, the inventor and sole manufacturer of "the Allen soldering stick," is to be congratulated upon the success of his device. It has proved itself to be convenient, clean and effective. All the principal supply houses of the country now carry a full stock of these soldering sticks.

The Medart Patent Pulley company, 1119 Monadnock building, Chicago, has sent out a new discount sheet to the trade, together with a circular in which it calls attention to improvements in its shafting. By an entirely new process the company is enabled to furnish a grade of turned steel or iron shafting that for quality, trueness of gauge and finish, it says, cannot be excelled.

Revised estimates place the loss of the Pumpelly-Sorley Storage Battery company in the recent fire in the Kaestner building, Chicago, at less than $3,000, instead of $15,000, as reported. Within three hours from the time the fire was discovered the company had rented new quarters at 128 and 130 South Clinton street, and was making preparations to fill orders. It is equipping its new factory as rapidly as possible.

M. B. Austin, western selling agent for the Safety Insulated Wire & Cable company of New York and Holmes, Booth & Haydens of Waterbury, Conn., reports business as very good so far this year. The Safety company secured the contract for the feeder cables for the North and West Side electric railway systems of Chicago—one of the largest wire contracts closed in Chicago since the World's Fair. Mr. Austin's office is at 1533 Monadnock block, Chicago.

The practical exhibition at the Cleveland convention of the Jewell pulley covering, manufactured by the Jewell Belting company of Hartford, Conn., has resulted in a flood of orders, this concern reports, beyond what was anticipated. The company has been pushed to keep pace with the increase in business. The statement made by the Jewell Belting company that this material will save a large per cent. in coal bills, prevent slipping of belts, and can be applied to any pulley of a manufacturing or central station plant, recommends it at once to the attention of the electrical trade.

The Electric Appliance company, Chicago, is rejoicing over the decision in the Bates refrigerator case. It is of particular value to it, as it enables it to be in the market again with the old reliable Packard lamp with platinum leading-in wires, for which the trade has been clamoring for the last two years, but which the company has been unable to supply owing to patent litigation. Where the merits of the old lamp are known, the Electric Appliance company says that the simple mention of the fact brings in the business, which is already coming in a way that is making the company decidedly happy.

An excellent little device in the shape of a "date label" is being used by the New York & Ohio company, maker of Packard lamps. This is a small label pasted on each lamp, on which is printed beside, the candle power and voltage in the usual manner, three spaces headed respectively; Fin., ——; Up, ——; B. O., ——. In the first is marked at the factory the date on which the lamp is finished. The other two spaces are for the use of the consumer to mark the date the lamp is put up and the date burned out. By this means users can be assured of getting "fresh" lamps and can readily keep a record of their life. The device is certainly an evidence of good faith on the part of the maker and is a great convenience to the user.

The Indianapolis Electric company of 124 West Ohio street, Indianapolis, is introducing a telephone outfit for which it claims special features of considerable value. The company claims that two of these instruments have been in practical operation two years and have been constantly used and in that time no repairs were necessary. The company makes the following claims for the several parts of the outfit: "The transmitter is absolutely self-adjusting; no delicate springs to fool with; no tension regulators to worry over; no burning of contact points, and no unnecessary heating of parts. Can be regulated to any height of person, and is so arranged that it can be placed in a noisy, jarring place. By placing the hand over the transmitter case, all external jolting and jarring cease. The bells are of the most powerful kind, and at the same time simple. The case is neat and convenient and takes up less room than any wall instrument yet made."

There is to be started in Chicago a council of the order of the United Commercial Travelers of America, to be called the Electric council, and be composed of managers or salesmen who sell at wholesale either as jobbers or manufacturers in electric appliances. There are councils all over the United States, and the Electric council will be No. 79. It is an accident association, paying $6,300 in case of death by accident, or $25 for 52 weeks in case of injury by accident. They meet twice a month in room 210 Masonic Temple and have some small initiatory ceremonies, but the benefit from the social part more than pays for the cost of the insurance which will be $12 per year. The charter members of the new council, by dispensation, will take about a dozen from the companion council, Chicago, No. 30, including Edward H. Fox, A. R. Hildreth, Albert E. Snow, Frank F. Kinney, L. E. Frorup, Franklin Overbagh, C. H. Blumenauer, Henry D. Hatch and H. B. Whitney. The new charter members will be W. W. Low, J. H. McGill, R. C. Holmes, Geo. M. Baggot, R. J. White, D. O. Whelty, C. J. Willis, Zag O. Benedix, F. S. Terry, John F. Fiegel and Andrew J. Shillinglaw, new names being added every day. Those anxious to join or to obtain information may address E. H. Fox of the Phoenix Glass company, 107 Madison street, Chicago. The initiation is $5 on signing the charter and $5 more when initiated. This includes an advance assessmeot of $1, a quarter's dues of $1, and the widow and orphans' fund, $2, which has so far required no extra assessment. This is used when any member of the order dies and leaves a widow or children in needy circumstances, and the member is not killed by accident. There are other good features of the order, and the uniform is a very neat cap, with the crescent and bag worked in silver or gold in front. The badge adopted by the order is a crescent on a blue ground with the name of the subordinate council, and underneath, suspended a traveler's grip, with the letters U. C. T. The headquarters of the order are in Columbus, O., where the supreme council is located. Several of the states, by having three or more councils or lodges, have a grand council. Ohio, Missouri, Texas, Kansas, Michigan, Minnesota, Dakota and New England are among the number. There is about to be formed another council in Quincy, this state, which will give Illinois a grand council. New councils are formed every month, and some subordinate councils have over 200 members.

## BUSINESS.

Friends of the Chicago Cross-arm company will be interested to know that this concern has changed its suite of offices in the Monadnock building to another floor of the same building. The old offices of the company were on the ninth floor, but those just secured are on the fourteenth floor, Nos. 1440-1441. Vice-president Chas. L. Marshall is on the lookout for several good electrical specialties, which he proposes to exploit in addition to his cross-arm business.

The Metropolitan Electric company of Chicago is introducing to the trade a new carbon battery of high efficiency test for open circuit work. The battery is guaranteed and is offered to those seeking a high-class article of this description.

The Bryant Electric company of Bridgeport exhibited a large variety of specialties at the recent convention, but not all of its most recent articles were ready. It will soon place upon the market a novelty in the socket line and also a combination cleat and rosette. A new catalogue is now being compiled.

The W. J. Davis Electric company of Pittsfield, Mass., has issued a circular describing its alternating fan motor, wound for 50 or 100 volts, and running at 900 revolutions. This fan motor was recently described and illustrated in the WESTERN ELECTRICIAN, and its special features are well known to the trade.

The Mather Electric company of Manchester, Conn., reports the sale through its western contractor, J. Holt Gates of Chicago, of two 65 kilowatt new type directly connected generators for the Fort Dearborn building, Chicago. These generators are to be used in connection with Ball & Wood engines. Another sale reported is that of two 50 kilowatt directly connected generators to be used with McIntosh & Seymour engines for the Lauderdale building, Providence, R. I.; one 85 kilowatt 220 volt generator to the Walter Ferris Coal company, Salem, Ohio; and two, 30 kilowatt new type multipolar generators in the station of the Catasauqua Electric Light & Power company, Catasauqua, Penn. These two generators are of the Mather company's latest type, their speed not exceeding 300 revolutions per minute.

A very complete catalogue of Smith-Vaile pumping machinery has been published by the Stilwell-Bierce & Smith-Vaile company of Dayton, Ohio. In this connection there is also published a circular in which the company makes the announcement that it has withdrawn all exclusive agencies heretofore existing with general jobbing houses, feeling that the interest of patrons can be best served by direct dealing with the manufacturer. In addition to existing warehouses, the company has opened a large sales department and warehouse in Chicago, where a complete line of goods will be carried, so that any order for regular stock goods can be filled without delay. The catalogue describes the company's triplex electric power pumps, directly connected and belt driven, and furnishes much valuable information and many suggestions for those in charge of this class of apparatus.

Among the specialties in lighting fixtures that are attracting the attention of supply men now, none has been received with greater favor than the parabola aluminum reflector shade made by the Interior Wiring & Fixture company of New York. This shade requires no holder, as it may be firmly secured between the neck and tip of any incandescent lamp. It is self adjusting, and is made of pure aluminum, highly polished inside and enameled outside. In shape it is a perfect parabola and like a locomotive headlight reflects the greatest amount of light possible from an incandescent lamp. It is applicable to cluster lamps in use with porcelain shades, or over lamps used with other reflectors for picture galleries, footlights, etc., and wherever applied is bound to increase the light. As it is applied to the lamp it is not necessary to throw away or differently arrange present fixtures. It is pronounced just the thing for desk lights and show windows. Another device which this company is exploiting with marked success is the Klein shadowless aluminum reflector which is placed over the neck of any incandescent lamp.

James Brown & Son of Pittsburg have just completed a nine-story structure in that city, known as the Smith building. This building is fireproof throughout, having steel girders and cement floors and is equipped with weatherproof wire and brass covered conduit furnished by the Interior Conduit & Insulation company. When the building was ready for occupation, a thorough test was made by the fire marshal's inspector. It was very satisfactory. This firm has been awarded the contract for whole of the electrical work of the Casino building, Pittsburg. This will include two 45 kilowatt multipolar dynamos of the General Electric type, one 20 horse power motor, 44 arc lamps, two 67 horse power Russell engines, and a large number of incandescent lights, together with all the necessary construction work. The senior member of this firm has had many years' practical experience in this business. The firm carries in stock a full line of electrical supplies of every description. They are also makers and dealers in gas, electric and combination chandeliers, and are in a position to fill all orders promptly, and it may be to the interest of intending purchasers to consult them before placing their orders.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued March 5, 1895.*

535,010. Transformer. Fred S. Hunting, Fort Wayne, Ind. Application filed February 25, 1892.

A polyphase transformer is described, comprising two or more cores differing in the number of magnetic lines threading them respectively and in the phase of the magnetic flux of those lines, with one or more secondary circuits, comprising in each a coil wound upon two or more of the cores in multiple.

535,027. Rheostat. Alton J. Shaw, Muskegon, Mich. Application filed December 1, 1894.

In combination with shell or casing, provided with an opening, a plate or cover of non-conducting material is secured to the shell or casing by external fastenings, a series of resistance blocks or sections is carried by the plate and extend into the interior of the shell or casing, and fastening screws pass through the plate and into the frames of the respective resistance blocks or sections, whereby the plates are adapted to be detached from the shell or casing and the resistance blocks are adapted to be detached from the plates.

535,042. Telephone Apparatus. Otto L. Wullweber, Chicago, Ill. Application filed January 7, 1893.

The combination is claimed with a slotted arm, plate or brace of a clamping device, comprising a binding screw, a pair of clamping washers mounted upon the stem of the screw and having adjacent faces V-shaped, one of the washers having legs adapted to project through the plate slot and fit within grooves in the other washer, whereby the angular position of the plate may be varied with reference to the stem of the clamping screw, and the rotation of the clamping washers be prevented.

535,051. Electric Arc Lamp. Harry P. Davis, Pittsburg, Pa. Application filed October 23, 1893.

The features of this lamp, as illustrated in the accompanying cut, include a movable carbon, a chain for supporting the same, and a feed gear comprising a wheel for receiving the chain at one end and a brake wheel at the other, in combination with a clutch lever pivoted between its ends, a clutch attached to the lever and adapted to engage with the opposite surfaces of the wheel, a series coil and core therefor co-operating to draw down one end of the lever, and a shunt coil and core therefor co-operating to draw down the opposite end of the lever.

535,052. Electric Arc Lamp. Harry P. Davis, Pittsburg, Pa. Application filed May 3, 1894.

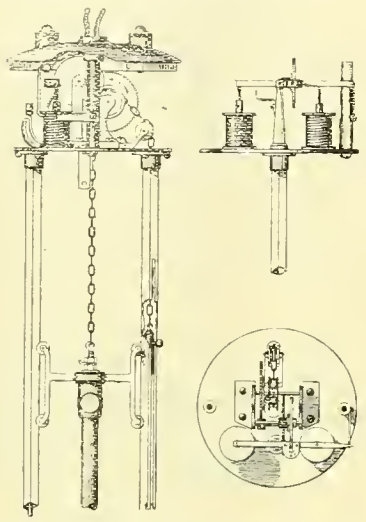
In a feed mechanism for arc lamps the following arrangement is utilized: A movable gear train for tripping the arc, an escapement for controlling the action thereof, a pivoted weighted stop located in the path of movement of the escapement and adapted to yield whenever the escapement is moved into engagement therewith and operating directly and solely by its weight to lock the escapement against movement.

535,060. Demagnetizing Apparatus. Charles Houlgrave, Buffalo, N. Y. Application filed January 22, 1894.

A device of the class described comprises a solenoid whose inclosure is free from all paramagnetic substance, pole pieces arranged entirely without the solenoid, means for reversing the polarities of the pole pieces, means normally disengaged from the reversing means for operating it, and a switch operated by the engagement of the reversing means with its operating means to cut the reversing means into circuit during its operation.

535,069. Light Fixture or Analogous Article. William McElroy and George W. Bayley, Brooklyn, N. Y. Application filed May 9, 1891.

This combination includes in an electric light fixture, the lamp carrier, a support therefor insulated therefrom, and the electric circuit for feeding the lamp, in combination with a cut-out, and a conductor communicating between the carrier and earth, the conductor adapted when traversed by an electric current to cause the cut-out to operate to break the circuit to the carrier, whereby in case of leakage to the carrier it will be automatically cut out from the electric circuit.



NO. 535,051.

535,077. Circuit Interrupter for Alternating Electric Currents. Henry N. Potter, Allegheny, Pa. Application filed February 28, 1894.

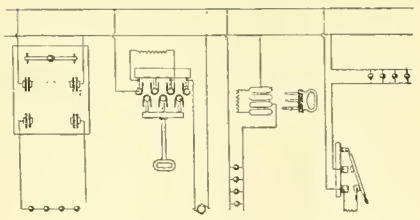
The illustration herewith presented shows a circuit-interrupting device, including a number of stationary contacts and a number of movable contacts, some or all of which are made of non-arcing metal, in combination with a shunt around one or more of the contacts, and a resistance in the shunt so proportioned as to counteract the effect of current lag in producing an arc.

535,084. Insulating Conduit for Electric Conductors. Lewis B. Stillwell and Charles F. Scott, Pittsburg, Pa. Application filed October 25, 1894.

This conduit comprises a plurality of tubes of insulating material, each consisting of telescoping, joint-breaking sections, and all inclosed in a pipe or tube, the entire space in and around the insulating tubes, except that occupied by the conductors, being filled with non-conducting liquid.

535,086. Lightning Arrester. Alexander Wurts, Pittsburg, Pa. Application filed February 28, 1894.

A combination is claimed consisting of a plurality of non-arcing metal parts, a two-part insulating holder therefor having oppositely arranged aligned sockets, in which non-arcing metal parts are seated, and passages leading outward from between the sockets



NO. 535,077.

535,090. Electric Battery. Horatio J. Brewer, New York, N. Y. Application filed May 2, 1892.

As shown in the illustration there is in a battery the combination of a cell, a cover for the cell, a positive element connected with a binding screw or connection extending through the cover, a block or part of insulating material extending upwardly from the cover, a negative element having a shank extending into the block or part of insulating material, and a conductor fitting between the block or part of insulating material and shank.

535,104. Armature Winding Machine. Harry E. Heath, Windsor, Conn. Application filed May 15, 1894.

The machine consists of a revolubly supported annular spool carrier, comprising two non-contiguous but connected concentric rings, peripherally disposed supporting wheels for the carrier, one or more circumferentially disposed tape or strand-carrying spools revolubly supported between the two rings, comprising the spool carrier, tension devices in connection with the spools, and means in connection with one of the peripherally disposed wheels for rotating the carrier.

535,105. Apparatus for Winding Armature Coils. Harry E. Heath, Windsor, Conn. Application filed May 15, 1894.

The apparatus illustrated is intended for winding coils, and consists of a revoluble carrier having a retaining flange at one end, a series of duplicate interchangeable former sections, each comprising an annularly recessed hub with a transversely grooved peripheral flange at one end thereof, a combined guiding and locking device connected with the carrier and adapted for facilitating the positioning of the several sections relatively to each other, and for locking them against rotation with relation to the carrier, and a binding nut screwed upon the unflanged end of the carrier, and clamping the several sections between the nut and the carrier flange.

535,106. Method of Forming Armature Coils. Harry E. Heath, Windsor, Conn. Application filed May 15, 1894.

The method of forming armature coils for dynamo-electric machines described consists in first winding upon a former an elongated hexagonal coil, having its opposite sides parallel with each other; and, second, bending all of the short sides of the hexagon inwardly without increasing the number of salient angles therein, and, while maintaining the long sides in parallelism, to form two similar but oppositely disposed end portions, each of which has two parallel members perpendicular to the aforesaid long sides, and to form also a third short member, connecting and perpendicular to each pair of the parallel members and in alignment with the opposite short member.

535,107. Winding or Taping Machine. Harry E. Heath, Windsor, Conn. Application filed May 17, 1894.

The machine comprises an annular revoluble spool carrier, peripherally disposed supporting wheels, one or more tape or strand carrying spools rotatively mounted upon corresponding studs, means for pivotally securing the studs to the side of the spool carrier, and for locking the studs upon the carrier in their adjusted positions, spool retaining tension devices carried by the spool carrying studs and bearing against the spools, the tension devices being loosely mounted upon the studs and adapted to be maintained in position by the rotation of the spools, and means for rotating the carrier.

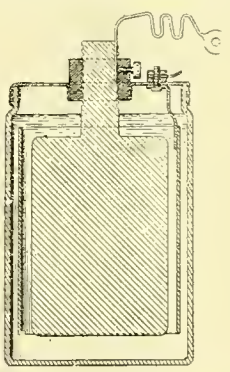
535,158. Method of and Apparatus for Regulating Electric Circuits. Julien M. Bradford, Portland, Me. Application filed January 9, 1894.

This is a method of governing the action of a current varying apparatus, and consists in simultaneously releasing and actuating the current varying apparatus by differential power the instant the force of current controlled by the apparatus varies from the required degree.

535,173. Drying Electric Cables. Charles H. Rudd, Chicago, Ill. Application filed April 18, 1892.

The method of removing moisture from the cores of cables provided with a protecting sheath, as shown in the accompanying cut, consists in heating the completed cable in an oven from which the air is not exhausted, and simultaneously maintaining a vacuum within the sheath surrounding the core of the cable.

535,199. Incandescent Electric Lamp. Frank L. Fowler, Philadelphia, Pa. Application filed July 30, 1894.



NO. 535,090.

The last claim follows: The combination of the lamp, having a bulb with projecting flange, a collar with seat for said flange, and a filament-carrying plug inserted into said collar, with a vacuum pipe, having a socket for receiving the collar, and a packed rod provided with means for engaging the plug in order to turn the same.

535,214. Contact Device for Conduit Electric Railways. Frank E. Lodetti, Rondout, N. Y. Application filed May 4, 1894.

This device comprises an elastic guide, a contact device formed of ribbons of conductive material connected to it at intervals through insulating media, and a conductor carried by the guide and insulated from it, and having connections with the contact device and a translating device on the vehicle.

535,247. Battery Telephone Transmitter. William W. Jacques, Newton, Mass. Application filed June 22, 1894.

The method of increasing the microphonic distance of metal electrodes or variable resistance mediums for telephone transmitters, and thereby increasing their microphonic power described consists in converting the surface of buttons or granules of metal into a salt composed of the metal itself, and a non-metallic element or radical.

535,267. Electrolytic Conduit for Beer or Other Liquids. Louis Wagner and John Marr, Baltimore, Md. Application filed November 12, 1894.

In an apparatus for the electrical treatment of beer or other liquids there are a conduit section composed of glass, serving as a sight tube, and adapted to be interposed in a conduit, and opposing electrodes supported within and substantially midway the length of the conduit section, leaving a central narrow space between them for the passage of the liquid.

535,284. Telephone Transmitter. John Goodman and Henry M. Goodman, Louisville, Ky. Application filed September 19, 1894.

The principal features of this instrument are a diaphragm, a pair of magnets having their opposite poles approximated, and a mass of magnetic material interposed between the magnets, a spring or flexible arm forming a support for one of the magnets and maintaining it in light contact with the diaphragm a bar carrying the other magnet, a movable piece or spring connecting one end of the bar to the case, and an adjusting screw in contact with the opposite end of the bar.

535,289. Telephony. William W. Jacques, Newton, Mass. Application filed May 26, 1892.

The last claim reads: The combination with a local circuit containing a powerful battery or similar source of electrical energy, a telephone indestructible by the heat resulting from said source of electrical energy and the primary of an induction coil, of a main line containing the secondary of said induction coil, and a receiving telephone differentially wound.

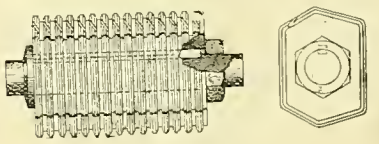
535,294. Closed Conduit for Electric Railways. Patrick Murphy, Chicago, Ill. Application filed January 9, 1894.

The combination is claimed of the conduit inclosing the trolley wire, and comprising the hinged members made in sections, the trolley wheel adapted to engage the trolley wire, and conduit opening wheels carried by the car and located, one pair in advance of and another to the rear of the trolley wheel.

535,297. Sectional Conductor System for Electric Railways. Alfred Rosenholz, San Francisco, Cal. Application filed October 11, 1894.

In a conduit electric railway a main conducting wire and a supplemental trolley wire parallel therewith, a casing arranged at right angles to the main conductor, and adapted to swivel about the same, and within which the main wire is embedded and insulated, switches at intervals connecting with the main conducting wire, carrying upon their inner ends the supplemental trolley wires, trolleys carried by yokes or frames depending from the car into the tube or tunnel, and adapted to form contact with the trolley wires to depress the switch and make connection between the trolley wires and the main conducting wire.

535,299. Combined Telegraph and Telephone System. Christopher A. Shea, Boston, Mass. Application filed January 3, 1893.



NO. 535,105.

In a combined telegraph and telephone system there are a main line and a telegraph instrument in combination with a loop between the telegraph instrument and the main line, a telephone oppositely vibrated by concurrent impulses along the two branches of the loop, a barrier in one of the branches for incoming telephonic impulses, and a return circuit for such impulses arriving along the other branch.

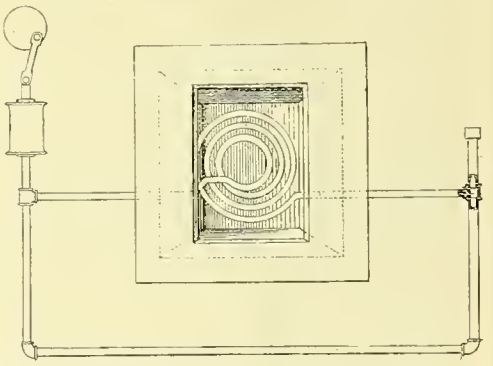
535,303. Motor Truck. Elmer A. Sperry, Cleveland, O. Application filed June 5, 1893

A truck frame, a power transmitting gearing mounted upon an axle of the truck, a cross-bar to which such power transmitting gearing is attached at a suitable point with reference to the horizontal center of the truck, in combination with seats for the end of the cross-bar attached to the truck frame, whereby the bar may pass approximately straight from one seat to the other without upward or downward flexure.

535,304. Mounting for Electric Motors. Elmer A. Sperry, Cleveland, O. Application filed April 13, 1894.

This claim was allowed: In a power transmission for vehicles, a bi-axled running gear, a motor connected with each axle and extending therefrom in such a manner that its center of gravity shall pass through a line at one side of the axle, an arm extending from one motor to the other, pivotally attached thereto at a point in substantially a vertical line above the said center of gravity upon one motor, and below such center of gravity upon the other motor.

535,321. Electric Heater or Rheostat. James H. Delaney, New York, N. Y. Application filed November 23, 1894.



NO. 535,173.

A non-conducting base or support of tiling porcelain or such like material, a heating or resistance conductor arranged thereon, and a layer or coating of vitreous enamel intimately united with the base or support and attaching the conductor thereto.

535,324. Electric Railway Conduit. William T. Dulany, Jr., New York, N. Y. Application filed December 14, 1894.

In an electric railway conduit there is the combination of yoke plates having a flat bottom, and a top integral therewith, consisting of a central inverted arch and two lateral inverted arches with horizontal surfaces between them, angle plates bolted to the yoke plates upon the surfaces, flat surfaces at the ends of the yoke plates, I-beams secured upon the surfaces, and rails secured on top of the beams, the lateral inverted arches constituting supports for the feeder cable conductors of the conduit.

535,336. Electric Lamp Support and Cut-out. Lafayette Johnson, New Albany, Ind. Application filed April 5, 1894.

As an improvement in supports for electric lamps, the combination is claimed of hooks that form part of the light circuit, a switch to electrically connect the hooks, comprising a fixed and a movable contact, loops carried by the lamp, that are electrically connected with the translating means thereof, and are adapted to be moved into and out of engagement with the hooks, and an arm extending from the movable contact in the path of one of the loops as it is moved to place it in engagement with a hook.

Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, MARCH 23, 1895. No. 12

## Buffalo Street Railway Power Plant.

By Frank C. Perkins.

The Buffalo Street Railway company now operates all of the street cars in the city of Buffalo by electric motors, the last horse car having been taken off from the Jefferson street line during the last year. The power plant, which is considered a model installation, has a capacity of over 6,000 horse power, but it has never been called upon for that amount of power. During the last two months the greatest demands were made upon the station, and during that time the company experienced great difficulty in keeping the cars in operation, the plows, sweepers and several hundred extra men being employed continuously on some of the outlying lines. The last snowstorm with a total fall of 10 inches was drifted in places ten or twelve feet, and the power house was taxed to its utmost capacity, the heaviest load being recorded at that time since the introduction of electric power. The maximum was 5,011 horse power, the minimum load 884 electrical horse power, the mean load being 3,142 horse power. The next highest record shows a maximum of 6,400 amperes, minimum 600 amperes, average 3,115 amperes. The maximum voltage was 550 volts, minimum 545, average 549. These excessively heavy loads are very unusual, the average load for 24 hours being about 2,800 horse power. The maximum loads are about 5,000 horse power, and usually occur between 5 and 7 P. M., while the lightest loads even reach as low as 250 horse power, and usually occur from 1 to 4 A. M. This great variation is a serious matter for consideration in the economy of operation.

Two views of the engine and dynamo room in the power house are herewith presented. This room is 124 feet long and 87 feet wide, and is entirely occupied by dynamos and engines. An electric crane, shown in Fig. 2, is used for handling the heavy parts of the engines and generators. The work of installing this plant has been in progress for a long time. The first installation (illustrated in the Western Electrician, August 22, 1891) consisted of three Ball engines and generators. These engines are cross-compound and each has a capacity of 250 horse power. They operate three Edison '85 type vertical magnet bipolar generators, each of 200 kilowatts capacity and belt driven. The boiler room has recently been enlarged, and now contains 16 pairs of Babcock & Wilcox boilers and four cylinder boilers. In this room there are also two large settling tanks six feet in diameter and 16 feet high, three duplex compound boiler feed pumps and two large feedwater heaters. The boilers are all fitted with automatic stokers, built by Westinghouse, Church, Kerr & Co. Under the ash pits of the boilers there is a long tunnel large enough to run a sheet-iron coal car, and the traps in the ash pits under the furnaces open into this tunnel and allow the ashes to drop into the car, which is emptied outside the building. A screw conveyer is used to carry the coal from the coal house to the boiler room. The conveyor does away with the need of always having a great pile of coal in front of the boilers, and the room is thus kept neat and clean.

The second installation consisted of six 500 horse power compound vertical engines of the type shown in Fig. 2. In the background of this illustration may be seen one of the first Ball engines installed. These vertical engines were built by the Lake Erie Engineering Works, and the size of each is 17 by 33½ by 28, and they can develop 550 horse power each with the steam pressure at 130 pounds and the speed at 138 revolutions per minute. Each of these engines is belted to two 200 kilowatt generators. In this installation there are nine Edison 200 kilowatt generators and six Thomson-Houston four-pole generators, each of a capacity of 200 kilowatts. Each of these generators is belted direct to the engine fly wheel, the speed of the engine normally being 138 revolutions per minute.

The illustration, Fig. 1, gives a good view of one of the two large engines and generators recently installed in the power house. The size of each engine is 22 by 44 by 36, and with steam at 130 pounds pressure will develop 1,250 horse power at a speed of 100 revolutions per minute. These

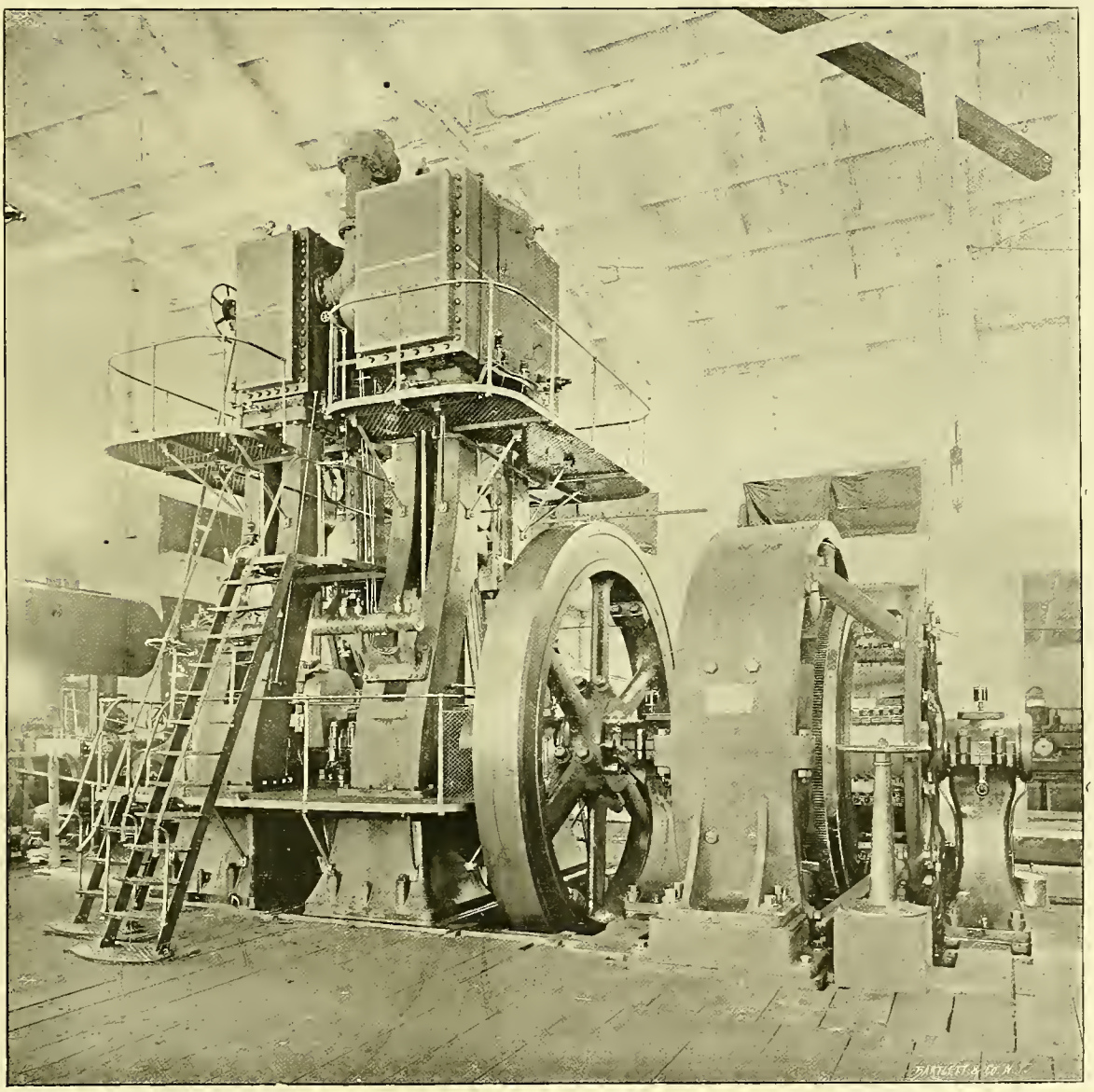


FIG. 1. BUFFALO STREET RAILWAY POWER PLANT.—INTERIOR OF POWER HOUSE, SHOWING 1,250 HORSE POWER COMPOUND ENGINE DIRECTLY CONNECTED TO 800 KILOWATT GENERATOR.

engines are compound condensing engines and were built by the Lake Erie Engineering Works. They are of the same type as the vertical engine used at the power house of the Intramural railway at the World's Fair. Each of these engines furnishes power to operate an 800 kilowatt generator, which is directly connected to it. These directly connected engines and dynamos are located at the farther end of the power house, one on each side of the center aisle. The total capacity of the plant is 6,250 horse power with all of the engines in operation, and the total capacity of the generators is 4,600 kilowatts, although these figures, it is said, could be exceeded with the present equipment if at any time it was found necessary.

Pennsylvania screen coal is used in this station, and the cost is $1.80 per ton. With the present equipment the company is generating its power by steam engines about as economically as it is possible under the most favorable conditions, except as to variable load. It is said that the company will without doubt operate the cars of this city by power from the Niagara Falls plant, if satisfactory terms can be made. The method suggested by Prof. Forbes, consulting electrical engineer for the Cataract Construction company, for utilizing Niagara current at the street railway power station, in order to use the present generators, was to install in the station alternate current motors belted to the dynamos now furnishing a direct current at 500 volts, the present steam plant being held in reserve for an emergency. The switchboard consists of a long inclined table, constructed of slate, upon which are mounted all of the switches controlling the current on the various lines. This arrangement was also very clearly shown in the WESTERN ELECTRICIAN of August 22, 1891. The bus-bars and connections from the different generators are found beneath this slate table and are connected to the various switches upon the board. The upright switchboard back of the inclined slate table has mounted upon it the ammeters which indicate the current flowing in the feeder circuits. Fusible cut-outs are used to a large extent in protecting the circuits and dynamos. The two largest directly connected generators are protected by Thomson magnetic blowout circuit breakers or automatic switches. The various feeders will be fitted with automatic circuit breakers within a short time, as they are much more reliable than the fuse cut-outs now in use. The voltmeter slide is so arranged that by moving the slide on which the voltmeter is mounted into various positions, the potential of the different generators is indicated on the dial.

Great care was exercised in line and roadbed construction. The Niagara street line has center iron poles with cross-arms, which carry both feeder and trolley wires. The lines from Cold Spring to the city limits on Main street also have center poles, while the remaining lines nearly all have iron poles at the sides of the streets, with the trolleys suspended in the center. The rails are not used alone for the return circuit, but besides having the rails double bonded and copper wires buried in the ground parallel with the rails, there are also a number of cables drawn into conduits, and to which the rails are connected by heavy copper conductors every 400 feet. The cables are from ¾ inch to 1⅛ inches in diameter, and are made from stranded copper wires. The current is thus returned to the generators without seriously affecting the gas and water mains. The feeders are also in many parts of the city laid in underground conduits. Iron pipes, with an insulated lining, are laid in cement, and cables manufactured by the Standard Underground Cable company are drawn in. These cables, besides being lead covered, have another outer covering, and they have given good satisfaction. The most of the cars are heated by stoves, but 43 cars have been equipped with electric heaters, which are giving satisfaction, although costing somewhat more to operate than coal stoves. There are nearly 370 cars in operation, over 30 of which are extra long, having double trucks.

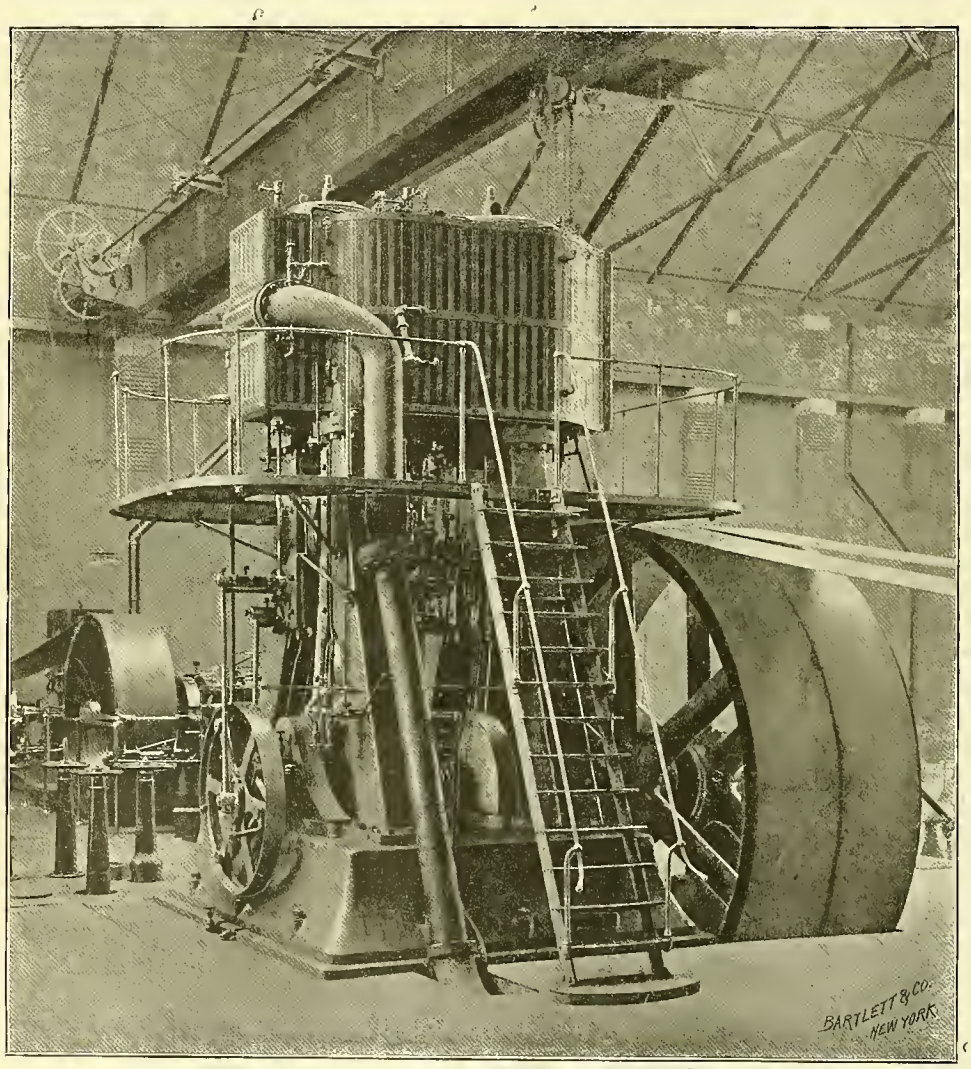



FIG. 2. BUFFALO STREET RAILWAY POWER PLANT.—INTERIOR OF POWER HOUSE, SHOWING 500 HORSE POWER COMPOUND ENGINE AND HIGH-SPEED BALL ENGINES IN BACKGROUND.

## New Transformer Company in Chicago.

It is reported on excellent authority that a new company is being organized in Chicago to engage in the manufacture of transformers. Among those interested in the project are prominent men who have been identified in transformer work. The new company is now completing its preliminary arrangements, and it is hoped that it will be ready for business within a very short time. The company will have ample capital and will engage in the manufacture of transformers on a large scale

## Large Arc Dynamos.[1]

BY C. N. BLACK.

Glancing back over the last fifteen years and noting the rapid progress made in all branches of electrical engineering, it appears strange that arc dynamos have met with so few changes, more especially so when we remember that arc lighting was one of the first branches of the science reduced to practical use on a large scale. It is impossible to ascribe this to the fact that there was nothing left to be desired in the design or the efficiency of this type of machine, since it has always been notoriously weak in respect to efficiency, and has by no means kept pace with the incandescent dynamo. Within the last eighteen months, however, various manufacturers have awakened to this fact, and we have seen the results in numerous descriptions of arc dynamos appearing from time to time in the technical journals. The general tendency seems to be toward larger units and lower speeds; but, although the increase in size has, of course, increased the efficiency to some extent, we still notice the massive field magnets with their enormous amount of copper and the small armature, which alone is enough to account for the inefficiency of these dynamos. Another noteworthy fact is that, with one exception, which, perhaps, I need not mention, all the new machines thus far described are of what is known as the closed-coil type. This is the more remarkable when we consider that fully 75 per cent. of the arc lights in this country are run from open-coil dynamos. The open-coil dynamo at the very earliest date appealed to such men as Charles F. Brush and Elihu Thomson as being especially suited for this constant current work, and, by the remarkable genius of these pioneers, was so perfected that to day machines with scarcely a single alteration from the design of fifteen years ago are being sold in competition with the latest closed-coil dynamos.

The question as to the reasons for this preference naturally suggests itself, but, before answering it, I will briefly describe some of the most marked points of difference between the two classes of machines. As the name implies, the open-coil machine has the separate coils or sections of the windings of the armature entirely distinct one from another. In other words, they do not form a closed circuit. In the open-coil armature each coil or bobbin, as it is generally called, has a large number of turns, and there are but few commutator segments, while in the closed-coil armatures we have exactly the reverse, namely, few turns per coil, and a large number of commutator segments. This is due to the different manner in which they commutate. In the open-coil machine a large amount of self-induction in each bobbin is by no means objectionable; in fact, one might almost say that it is essential in order to obtain the best results, while in the closed-coil machine the less self-induction there is in each bobbin the better the action at the commutator. The latter is true of all closed-coil machines, whether for arc or incandescent lighting, as all engineers well know who have had any experience in the designing of dynamo-electrical machinery.

The first statement, however, is not nearly as well understood even among those who have had considerable experience with the open-coil machine. The fact that a large amount of self-induction is advantageous in an open-coil machine has never, to my knowledge, been stated before, although on it depends the successful working of a machine of 2,000 volts or more. Silvanus P. Thompson, in his "Dynamo-electric Machinery," gives a very clear account of the manner in which an open-coil machine commutates.

To one unfamiliar with the open-coil dynamo it is always a matter of wonder that the commutator spark does not cut away the segments. As a matter of fact, it does so to a certain extent, but the current is so small, and whatever heat there is is radiated so rapidly, that the effects in practice are almost inappreciable. At this point the self-induction of the bobbin plays an important part. Were it not for this, the current in the bobbin, which is being cut out, would be reversed before the segment had reached a sufficient distance from the brush to prevent the current jumping back across the heated air space, and thus causing the machine to flash.

The design and proportioning of the field magnets are the same as in the closed-coil machines. It is in the commutator and commutation, then, that we find the most marked difference between the open and closed-coil arc dynamos, and herein lies the great superiority of the former over the latter. Take, for example, a new open-coil 125 lighter, and one of the latest closed-coil 100 light machines. In the one there are 24 segments in the commutator, while in the other there are 160. To go into details as to which is the easier to insulate and keep in repair is scarcely necessary before a society of practical managers and engineers.

Some advocates of the closed-coil dynamo, however, claim that such a small number of commutator segments causes a discontinuity in the current, and consequently a greater strain upon the insulation of the line. This is not a new objection to the open-coil dynamo, and has been answered long ago. It seems, however, to have been revived recently, and I have noticed that one builder of closed-coil apparatus lays great stress upon the fact that its machine generates an absolutely steady current, and therefore puts no undue stress upon the insulation of the line.

In 1887 Mordey, in England, made the following experiments upon a Brush machine in order to determine how much fluctuation there really was. Six converters, each made to transform from 2,000 down to 100 volts, had all their primary and all their secondary coils joined in series. The current from the Brush machine was sent through all the low-tension coils, and then, with a Cardew voltmeter, he attempted to measure the difference of potential at the terminals of the secondary or fine-wire coil. The pointer, however, remained at zero, showing absolutely no electromotive force. He then applied the wet hands across the terminals of the whole series, but with equally negative results. An experiment which I myself made not long ago confirms fully these results. The current from a closed-coil dynamo, which had 72 bars in its commutator, and which, therefore, gave practically a steady current, was

1. Read before the National Electric Light association at Cleveland, February 20, 1895.

passed through the field coils of a 125 light arc dynamo, and the fall of potential was measured with a Weston voltmeter. The machine was then run self-exciting, and the drop through the field was again taken. The currents in both cases gave identically the same readings on the voltmeter. That there is a discontinuity in the current no one will deny, but that it is so slight that no instrument less sensitive than a telephone will show it, appears to be conclusively proven by the above experiments. This conclusion being reached, it is difficult to understand how the insulation of the conductor would be more strained by an open-coil than by a closed-coil machine.

A much more vital question in connection with these large units delivering current to the line at the enormous electromotive force of 6,000 volts or more is this: What value will the electromotive force attain in case the circuit is suddenly broken? From a theoretical standpoint, basing our deductions on the manner in which the two types commutate, the open-coil machine has largely the advantage. Opening the circuit is the same, in one sense, as suddenly throwing a high resistance into the line; and when we do this, we shift the point of commutation back under the brush, owing to the reaction of the armature current being reduced. Consequently, the bobbin, which should not be cut until after its segment has passed from under the brush, short-circuits the one in parallel with it, and as a result the segment connected with this bobbin carries the arc around to the opposite brush, thereby causing the machine to flash; this short-circuits the armature, and the electromotive force drops to zero. This flash is not due to the insulation breaking down at any point, but is simply drawing the arc of a short-circuited bobbin part way round the commutator, and in this way is acting like a safety valve. The machine is not injured in any way, and as soon as the break in the circuit is repaired it is ready to again deliver current to the line. In order to prove this by a practical demonstration and to learn accurately just what value the electromotive force attained when the circuit was suddenly broken, we made the following experiment: The sparking distances, from 500 up to 9,000 volts, between two carbon pencils, one with a flat end and the other with a rounded one, were accurately determined within a few thousandths of an inch. The results are plotted in Fig. 1. It will be noticed that the curve is almost a straight line, and, let me add, it agrees very well with that obtained by De LaRue and Muller, who made quite an extensive series of experiments upon sparking distances. The terminals of the 6,250 volt machine were then connected to these carbon pencils, and the greatest distance the current would jump on suddenly breaking the circuit was determined. This distance corresponded to a little less than 8,000 volts, showing that the electromotive force had risen between 1,500 and 2,000 volts. This can be accounted for by the fact that it takes an appreciable moment of time for the arc on the commutator to be carried from one brush to the other. Owing to each segment extending about sixty degrees around the commutator, the time required to short-circuit the commutator is just one-third of what it would be in the closed-coil machine; consequently, I think the statement that in a closed-coil machine the voltage would rise to fully double its normal value, under the same conditions, would be a very conservative one. In fact, I have many reasons for believing that it would go considerably beyond this, providing, of course, that the insulation of the commutator did not break down. If this occurred,

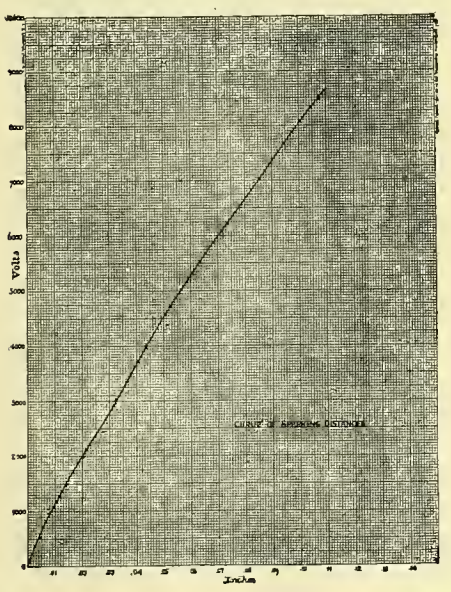



FIG. 1. LARGE ARC DYNAMOS.

the machine necessarily would be unfit to run again until repaired. This peculiarity, if I may be allowed to call it such, of the open-coil machine, is especially important where underground circuits are employed, since a break-down in the insulation, due to an abnormal rise in the voltage, is something that can only be repaired at considerable expense.

Knowing that some tests on underground circuits would be of interest to central station engineers, I arranged through the courtesy of E. A. Leslie of the Manhattan Electric Light company in New York to make some determinations as to the rise in voltage when a long underground circuit was suddenly broken. A Brush open-coil 125 light machine was connected to a 12 mile underground circuit, supplying current to 125 arc lamps. The voltmeter registered 6,850 volts at the machine terminals. The circuit was then broken a number of times with the carbon points in shunt with the break. At first the carbons were separated by a distance corresponding to 10,000 volts, and this distance was then gradually reduced until the current jumped the air space. This indicated only 5,000 volts. The carbons were then set for 6,000 volts, with the result that the current jumped twice in breaking the circuit eight times, showing that we had about reached the limit. It was then decided to try breaking the circuit near the center. Under these conditions 5,000 volts was the highest reading we obtained, but there was a marked difference in the time of discharge. In the first case there were two discharges in rapid succession within a half second after the break, while in the second case fully two seconds elapsed before the current jumped. In both cases there were two discharges before the arc was established, the first one being short and snappy, resembling a static spark. From this it will be seen that the capacity of the circuit more than counterbalanced any rise in voltage due to self-induction of the machine and line.

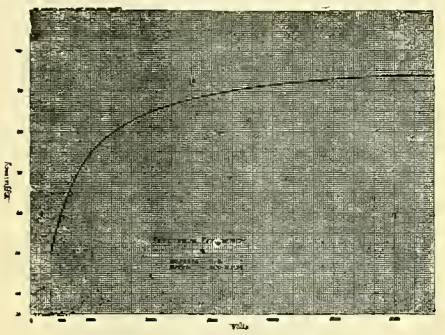



FIG. 3. LARGE ARC DYNAMOS.

With these results before us, we can safely assume that the insulation of the cable will not be overstrained by an accidental break in the line.

All these considerations led the company with which I have the honor to be connected to adhere to the open-coil type of machine in designing its large units. The Brush 125 lighter runs at 500 revolutions per minute, and its rated capacity is 125 50-volt 9.6 ampere arc lamps, or 60 kilowatts. It will, however, give 6,700 or 6,800 volts without undue heating. Its weight, including sub-base, pulley and regulator, is exactly five tons. The frame proper is made of the best grade of soft gray iron and is cast in three pieces. The two upper caps can be readily removed, thereby giving free access to the armature, which can be taken out and replaced in a very few minutes, in case of necessity. The journals are self-oiling and self-aligning, with gauge glasses, so that the amount of oil in the well can always be ascertained at a glance. The field magnet cores are hammered steel, very low in carbon, and showing very high permeability. The pole shoes are steel castings, tapered at the tips to prevent excessive heating due to eddy currents. No. 8 wire is used in the field, which is two sizes larger than on the majority of arc dynamos of other makes. The current per square inch is only 746 amperes, consequently the temperature rises but little, even after a 24 hours' run. The armature is of the well-known standard type, the only difference being that on account of the machine being four-pole, four bobbins are connected in series instead of two.

We now come to the commutator, that part of all continuous current dynamos which is a source, directly or indirectly, of more perplexity and trouble than all the other parts combined. Three objects were aimed at in designing the commutator for this machine: First, simplicity; second, durability, third, ease of repair. There are three distinct rings, each one of which is built up in sections of thoroughly dried applewood, filled with boiled linseed oil. Over this is forced a mica ring 1-16 of an inch thick, and on the sides mica disks protect the wood from the arc. Upon the mica are mounted the brass segments, and on these in turn the copper. Lignum vitæ blocks 2¾ inches long serve for insulating pieces between the segments. The brushes are the tangential type, the same as those used in connection with all open-coil dynamos of this design. An automatic regulator, for shifting the brushes and shunting more or less of the current from the field magnets as the load varies, is fastened to the front of the machine, under the commutator. The small shaft, which pauses across the front, is driven through a worm by a small belt from the armature shaft. On this shaft are mounted two magnetic clutches, which are regulated by two relays in the wall controller. The electrical energy consumed in operating the regulator is less than one-tenth of one per cent. of the output of the dynamo. The machine is absolutely automatic, from one lamp to the full capacity, and the whole load may be thrown on or off with impunity.

Fig. 2 is a characteristic curve of this machine without any regulator. The readings were all taken at the sparkless position of commutation. This is remarkable from the fact that after we get over the bend the curve is almost perpendicular and is probably the nearest approach to a constant current machine ever attained. By winding more wire on the armature we could have made this machine deliver a constant current of 9.6 amperes at all loads without shunting any of the current from the field; but this would have increased the internal resistance and also have made the machine much less efficient at light loads. By the present method of regulation we reduced the $C^2R$ loss at one-quarter load from 4,018 to 3,367 watts, or, in other words, we gain almost one electrical horse power.

Fig. 3 is a curve of the electrical efficiency. It will be noticed that this at full load reaches 94 per cent., which is accounted for by the liberal allowance of iron in the armature, thus reducing the reluctance of the magnetic circuit, and by the large size of the wire used on both field and armature. Fig. 4 is a curve of the commercial efficiency. At full load this is ever 90 per cent. and approaches very closely the efficiency of incandescent dynamos of equal capacity, but the most noteworthy point is the high efficiency shown at one-quarter load. Fig. 5 is a curve of the machine separately excited with no current in the armature. The ordinates are the volts at the armature terminals, and the abscissæ the amperes in the field. This is really a permeability curve of the magnetic circuit. By a comparison of the voltage shown here when there are nine amperes in the field with that of the machine when delivering current, the enormous armature reaction can be seen. The curve also indicates a new departure in arc dynamo design, namely, that the magnetic circuit is not worked at nearly as high a point of saturation as in the old types.

### Discussion.

S. M. Hamill, Cleveland: I naturally was very much interested in Mr. Black's paper. A man who sat for a number of years at the feet of such men as Professor Brackett of Princeton and Mr. Brush of Cleveland ought to be able to write a pretty good paper. My interest in these large dynamos is purely from the standpoint of the manufacturer and seller. The inquiries concerning large arc dynamos do not come from the new installation companies, but almost entirely from existing stations. This is natural, for the reason that nearly all our large electric light stations are quite centrally located in the large cities of the country, where real estate is expensive, where the business is growing and where it is a question either of going away farther from the center of the cities or purchasing additional real estate at great expense in order to increase the capacity, or to exchange the small dynamos for larger ones. I have in my mind, for instance, one of the largest and best managed local companies in the country, where they have two large stations quite near each other in the center of a large city, stations that have been in existence thirteen to fourteen years, where last year they had two thousand lights' capacity, and arc dynamos ranging from old ten lighters up to sixty lighters, using a tremendous amount of shafting and belting, and naturally they were inefficient dynamos. This company exchanged all its old dynamos, small and large, for a complete new outfit of twelve or thirteen large dynamos, and by so doing they obtained a great deal of space in the existing stations for increasing their business, without going to the expense of enlarging their areas. I have in mind another station where they had almost exclusively fifty to sixty light arc dynamos with a capacity of about two thousand arc lights. This station changed from 50 to 60 light dynamos to 125 light dynamos and saved a large amount of floor space, and increased the efficiency of their machines, which is a very telling point. The field, as far as manufacturers are concerned, at the present time is almost entirely along the line of exchanges from the small to the large units, and there is very little profit in it for the manufacturer.

Prof. Elihu Thomson, Lynn, Mass.: I have been quite interested in listening to the paper, as I consider it a very true exposition of some points connected with the operation and design of arc dynamos. The development of the arc dynamo, it is true, has been somewhat backward; still I do not recollect that machines were built far back in the early days which were capable of giving a curve similar to that which has been shown—a characteristic curve. The old machines were disadvantageous from the very large armature reaction, the size of the armature, the amount of wire and the dead resistance of the wire used in the construction.

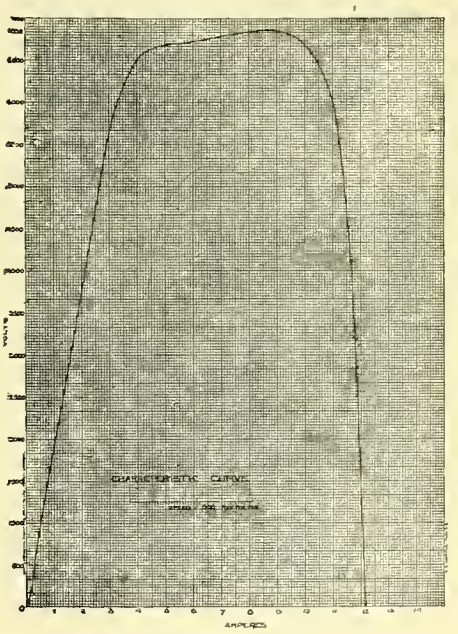



FIG. 2. LARGE ARC DYNAMOS.

The question as to whether open-coil dynamos or closed-coil dynamos are the best for arc lighting has been fully discussed in the literature of the subject for a long time. Considered purely as an electrical affair, without reference to practical uses, there can be no question but that the closed-circuit dynamo is the better electrical structure. I say considering it simply as a dynamo; but when you come to use that dynamo in the conditions of practice there may be considerations which will modify that conclusion. I am really sorry that Mr. Wood is not here, the champion of the closed-circuit dynamo. We might have had a discussion bringing out the strong points of the other side. When I first entered the business my object was to get that kind of a machine, which, put into ordinary hands—men of no experience with machines of the kind—could be run successfully and keep

the lights going, and the object was to reduce to the utmost simplicity those parts which were subject to wear and which could be injured by bad handling. Therefore the commutator was reduced to very few parts and it was constructed so that if anything happened to it, to injure the segments, it was a simple thing to take off the segments and put on others. That could not be done if the commutator contained from one to two hundred segments. In that case, it would mean that you would have to take out the whole commutator and lay it aside and get a new one, and make all the connections before you could start the machine. In the early history of dynamos we did not have experienced men to handle them. The dynamos were not put in stations with a dynamo tender of experience in charge. They were in charge of an engineer, who might know how to run his engine, but knew nothing about the dynamo, and who had a superstitious idea that that was a thing which he must not touch. We have had enough cases of this kind arise. In one case the brushes on the dynamo would not rest on the commutator and we had a communication that something was the matter with the machine and we were to send the best expert we had right along! The moment we go into a new field we have to educate men to understand how to handle the new structure, on account of its peculiarities. The fact that an arc dynamo, when it has its circuit interrupted, will not give the rise of voltage which the continuous dynamo gives, has been known for a long time.

The point of flashing was admirably brought out in the paper. The moment you begin to open the circuit of a machine it is the same thing as overloading; that is, you are putting in a high resistance. The arc follows; it amounts to so many arcs put in resistance. The potential, on account of the self-induction of the wire coils, at once begins to rise with the attempt to hold a diminished current. If at that moment the commutator, owing to its arrangement and construction, flashes over—arcs across from one side to another—you have removed the electromotive force of the armature, and if the machine, as is often the case, has a copper band in the field poles, then we have an inductive circuit parallel with the field winding, which takes out the inductive electromotive force from the field coils, and it is not surprising that there should not be a great rise in a case of this kind. Long ago the natural practice was that when we ruptured the circuit of the open coil the flashing did not ex-

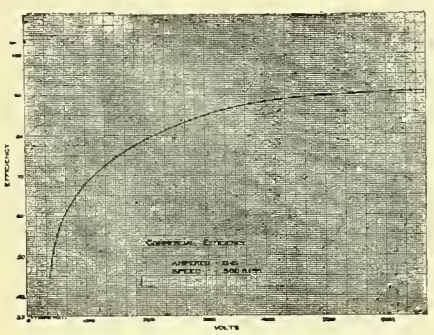


FIG. 4. LARGE ARC DYNAMOS.

tend any great distance, but it was a well known fact if you had a close coil the circuit of flash was much longer.

CALVERT TOWNLEY, Pittsburg: There is one phase of the question which I should be glad to have the opportunity of stating to the members. It has been my fortune to be in a position where the demand for large units for lighting has been heard from very quickly, and I can confirm Mr. Hamill in his statement that the pressure is very strong for large units for arc lighting. The reason why arc lighting machines seem to have been made small for so long a time is possibly not easy to answer, but it may be found in the fact that until very recent times it has been very difficult to insulate for the corresponding potentials. Looking at the problem of furnishing a large number of arc lights to a community, from one of our modern central stations, it is evident that if the conditions were not so severe as to render it otherwise, it would be advisable not only to use a machine as large as 100 or 125 lights, but in fact machines of larger capacity and insulation, of one, two, or three thousand arc lights. We should manifestly have, if possible, units of larger capacity than 125 lights, and when we get down to 60, 75 or 80 lights, the objections are greater. In some cases there have been established stations of units of two, three or four hundred lights in one machine; this being done, however, by the use of constant potential in place of constant current machinery. This is necessitated, apparently, by the use of alternating currents, and it possibly has not been brought into more general use on account of the lack of success in starting and operating the alternating current arc lamps. At the present time, however, that objection can hardly be said to exist, and the fact that there are now operating stations of considerable size using this system practically demonstrates the success of it, and is worthy of consideration. Of course with the introduction of the alternating lamp, and the ability to run power from apparatus of this character, there is a great point to be gained in large cities, particularly where underground work is necessary, when we can supply incandescent and arc lighting and power—in fact all classes of service—from the same unit; and if that unit be a large unit we can take advantage of the best economy in steam practice and the higher efficiency in dynamo construction. It seems to me that the development is bound to be in future along the lines of these larger units, and that as the electric lighting public, men who have their money and interests involved in this industry, come to know that this system is a profitable one, sucessful commercially and acceptable to municipalities, it is bound to be a very prominent factor in our interests hereafter.

I. R. PRENTISS, Cleveland: I will state that the question of line insulation with the use of larger units seems to be one of care more than anything else. Several instances have been brought to my notice where large machines were put on ordinary circuits, in which it was shown that very little trouble was experienced and also that underground work which has been started for high potential will do very nicely. The only trouble which will be practically met would be from the point of the line into the place where the light would be used, in the connecting appliances. The trouble principally arises from the moisture getting down into the cut-out box. I believe there are very few cut out boxes which will stand the ordinary high potentials of 3,000 volts, where you have a spell of wet weather for three or four days. When that point is taken care of there will be very little trouble. I do not doubt that existing lines of two or three thousand volts can be made to run at a high potential. It has been demonstrated in several instances to be practicable.

T. CARPENTER SMITH, Philadelphia: Referring to the question of the use of large units on the old lines I think some of the older members probably remember when in times of trouble they did not hesitate to put two 60 light machines together on a single circuit, which was as much strain on the insulation as a single machine. The most extreme case I know of was fifteen 10 lighters in series for an 18 ampere current. I think that was as much of a strain as would be experienced with any of the large machines being advocated. The old machines were repeatedly speeded up to give nearly the same capacity. I know 40 and 60 light machines running on 80 and 90 light circuits, and the extreme case was probably reached in New York city a few years ago during the time the wires were being put underground, when in one station they ran two sixties and a thirty in series.

MR. PRENTISS: In regard to Mr. Smith's remarks I wish to say that a practical demonstration of what can be done is that in New York city their 240 light machines run on an underground circuit.

## Mr. Beggs' Position.

The most sensational feature of the Cleveland convention of the National Electric Light association was John I. Beggs' criticism of the association's expenditures in the secretary's office, briefly alluded to in the report of March 2d. Mr. Beggs took occasion to give his views—which are pungent and interesting if nothing more—on the best policy of the association and on the relation of manufacturing and central station companies. He said:

I am interested in a great number of electric lighting companies in different parts of the United States. All that I have is invested in them. This is the second meeting of the National Electric Light Association that I have attended, because to me it is always something like a junketing affair, rather than looking after the material interests of the local companies, trying to obtain such legislation as would benefit these local companies, trying to obtain from the manufacturers of apparatus such a recognition of our rights as would protect us from their guerrilla warfare, and if this association was to rule out these associate members, as did the association of Edison Illuminating companies some seven or eight years ago and draw in five or six hundred central stations all over the United States into your association, broadening and strengthening your influence, and ruling out the very people with whom we are in antagonism, who are our worst antagonists to-day as electric lighting companies, you would do a wise thing. Who is coming in exploiting isolated plants? Who is it that is exploiting block lighting? Who is organizing companies all over this country to wreck your business, simply that they may sell apparatus? The manufacturing companies of the United States, the dispensers of apparatus and appliances of apparatus, who, in the past, have realized a profit of anywhere from two to three thousand per cent. and who have been supported by the members of this association for years.

It has been stated to me in private conversation with members of your executive committee that you have got them limited to a certain extent; but there is only one place to have them, and that is limited absolutely. Therefore, Mr. Chairman, with all due respect to all concerned, I do not consider that the business of this association is such that it demands that it shall have a private and permanent office in New York city or anywhere else. I do not agree with the idea that we should have a permanent place of meeting either. I think you should meet in the different cities of the country, so that if you are convenient to Cleveland this year, next year you may be convenient to somebody else, and thereby draw in their influence.

I would have some member of some local company, who would do the bulk of this [the secretary's] work for the bare cost of doing it, and cut the membership fee down to ten dollars; and instead of one hundred members (I assume you have one hundred members), get five hundred members, and make ourselves a power, a power with the manufacturing companies, for, gentlemen, that is where the greatest danger confronts us to-day. I may be running one type of apparatus here, in a given city, and every other manufacturer of apparatus feels that that is a proper ground for him to come in and begin a block lighting company. I have had the pleasure of paying $375,000 for one of these block lighting companies in a town of less than fifty thousand inhabitants. Therefore, I speak advisedly. Many of these companies, notwithstanding they have sold the apparatus themselves, have put their agents in a town, knowing that, particularly if you begin to make any money, that you will either buy them off, or they will organize a plant that will wreck your business. They know that you are compelled to do one thing or the other.

I throw out this suggestion because I feel the time has come when the local illuminating companies of the United States have got to combine for mutual protection. Their interests are diametrically opposed—I say it with all due respect, for I have been on both sides of the fence, their interests are diametrically opposed to what the manufacturing companies seem to think is their interest to-day. The time has come when we must have the manufacturing companies draw the line whether they are going to supply the central stations, isolated companies or block lighting.

MR. GARDENER of Pittsfield, Mass., when assured by President Francisco that the secretary gave his entire time to the association, said that he did not think that that officer was paid any too much. He would increase the salary rather than reduce it.

J. A. SEELY of New York said:

Some years ago we found this association in debt some three thousand dollars. With the aid of some of the members we raised a fund among ourselves and paid off this indebtedness. The objects of paying off the indebtedness were: First, we did not care to have the association disband; and secondly, we were not aware of its financial condition until we peeped into the box. The duties of Mr. Porter are of such a nature that they require constant attention. He answers many hundreds of letters in the course of a year. Mr. Beggs, I believe, has never been a member of this association before that I know of; and if these great institutions that he represents had come to our rescue years ago we would not have been in the position in which we found ourselves. To my certain knowledge the Edison company ignored this association for years. Your local association would not permit me to join it. I had not an Edison plant and you would not permit any man to join it, because he had not an Edison plant. It was a wheel within a wheel. We have brought this association out of debt, and we have some money, and the secretary is entitled to the credit of doing that. If the Edison people want to come into this association and join it, I have no objection. I do not believe there is a man in this room will object to any one who is qualified coming here as an active or associate member. I do object, however, to serious criticism about the expenses of this association. I do say that Mr. Porter has earned every dollar we have paid him, and I do say that every dollar has been honestly expended.

MR. BEGGS: This is not my first experience in this

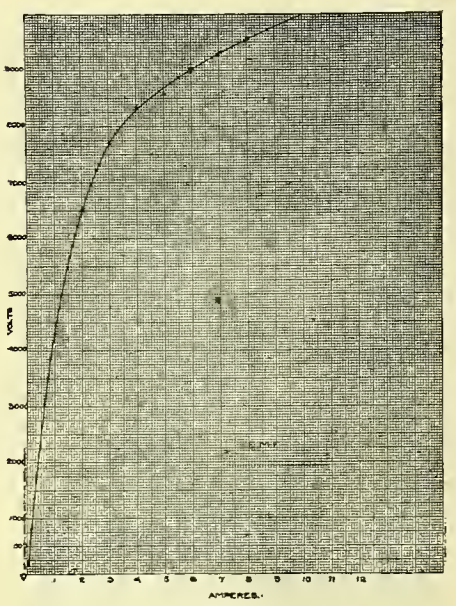


FIG. 5. LARGE ARC DYNAMOS.

association. I paid $25 at Montreal and saw quite a junket and very little business; and that is one of the reasons why many of the lightning companies throughout the country have held aloof or taken very little interest in the proceedings of this association. I recognize the power that this association might be as thoroughly as any gentleman on the floor. I would be very glad, indeed, to render any humble service I might in bringing about the results that we have a right to expect; and I have heard gentlemen state that they withdrew from this association because they considered the tax of $25 burdensome. I know many companies do not join it because of that one fact alone; and this organization would be very much stronger and much better able to accomplish that which it wants to accomplish if it had a membership of 500 illuminating companies over the United States, instead of the paltry 100 which we have. That is certainly not creditable for a national association. As the chairman has seen fit to refer to the Edison association as he has, I might say that that association has strictly confined its membership to those who are actively employed in the business of those companies. It was organized for that purpose and confined to a very limited number. You know how limited the number of Edison licensees is; we have some 60 members. These 60 members, by their contributions, have maintained that organization now for ten years. This organization, being a national one, intended to embody all the state organizations, the Edison association and other associations allied to certain types of apparatus, should have at least five hundred members. It should be the source from which the state institutions draw their inspiration and their ideas as to procedure in the various states; and that is the whole purpose of my remarks—for the work that the local companies need its assistance in. This is not my first appearance here. I paid my dues once before. I saw very little business transacted that was of value to the companies, and dropped out. I am just at present located in Cincinnati, and concluded to attend this session and see whether the changes suggested as having taken place were being realized. I wish to state that I intend no reflection at all upon the honesty of anyone. It is certainly apparent from the statement of the chairman that up to time he referred to the association had not been well managed, but was three thousand dollars in debt. I have no doubt that that period has been passed, as it undoubtedly has been,

as shown by the report. I should like to take an active part in the proceeding of this association, but I will state here that it will always be in behalf of the local illuminating companies.

## Novel Car Fender.

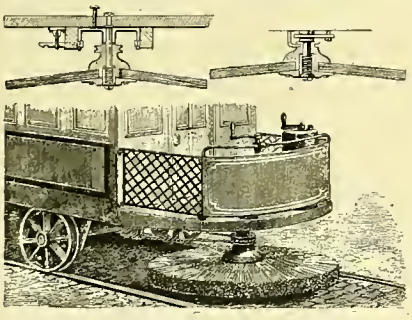
In the electric railway field the attention of inventors is now more particularly directed to underground trolley conduits and to car fenders. Among the latter the type shown by the cut is decidedly novel. It is the invention of Andrew Mohn and August J. Bottner of Hoboken, N. J. A revolving brush, of a diameter to cover the roadway to the outer side of each rail, is held under each end of the car, the brush being revolved by a mechanism connected with one of the car axles, or by a separate electric motor, if desired. When revolved from the axle, as represented in the transverse sectional view, in the upper left hand corner, the hub of the brush is journaled on a vertical shaft secured to the platform, and on the hub is a pulley connected by a belt with a loose pulley on the car axle, the latter pulley being adapted to be locked to the axle by a simple form of clutch, moved by a shifting lever. A coiled spring on the lower end of the vertical shaft, pressing upward against a washer in the hub, holds the brush normally at a little distance above the track, but the brush may be readily moved down into contact with the top surface of the track by pressure upon a pin extending up through the platform, and bearing upon a vertically sliding frame having a central tubular boss resting upon the upper end of the hub. When the motorman ceases to press upon the pin the brush is raised by the spring to its normal position. When a separate motor is employed for driving the brush, the vertical shaft is replaced by a shaft rotated from the motor, and, as shown in the upper right hand corner a change is made in the frame by which the brush is moved downward, although the movement is similarly effected by pressure upon the pin extending up through the car platform. The improvement is also designed to be valuable for clearing tracks of snow and ice. The cut is from the *Scientific American.*

## An Experiment with Thermo-electric Currents.

Usually the effect of heat in producing electric currents is shown by the action of the galvanometer combination. C. E. Guillaume in *La Nature* describes a novel method by which the result is much more readily shown and appreciated.

The instrument shown in the cut reproduced is composed of a spoked wheel, made up of two metals, the felloes of the wheel of an alloy of nickel and copper, a form of German silver, while the spokes soldered to the felloes pass entirely across the wheel, insulated from each other. In the center of the wheel a plate is fastened for a hub, with a slight depression on the under side, which rests upon a point. For the stand a candlestick may be utilized, or a pint bottle may be used. Small paper flags are hung upon the spokes and adjusted to balance the toy.

Now if heat be applied to the rim of wire a difference of potential is set up between the opposite sides of the wheel



NOVEL CAR FENDER.

which completes its circuit by the rim. Place a magnet, as shown in the cut, and the resultant action of the couple formed will be a motion of rotation. It must be borne in mind, however, that the more rapidly the change from heat to cold and the reverse is made the more effective will be the action. The wires should not be over two-tenths of a millimeter in diameter for a wheel eight to ten centimeters in diameter. The experiment illustrates the transformation of heat energy into electrical energy, and this last into mechanical energy, in a very simple manner.

By the recent fire at the power station of the Chicago North Shore Street Railway company one motor car and eight trailers were burned. The main building was not damaged. The statement that this power house occupies the site of the Edgewater electric light station that figured in the Cronin murder case is incorrect, as the latter is still in full operation.

## Wires in Boston All Going Underground.

BY J. C. EDGERLY.

The great problem of the burial of the overhead wires in Boston has been nearly solved, and Boston's big cobweb covering has been partially brushed away by the department under Wire Commissioner John R. Murphy. Mr. Murphy took charge of the department last August, resigning from the Board of Fire Commissioners to accept the position. He has just submitted his first report, which details the work done in the district north of Dover and Berkeley streets, and bounded by the Charles river, the harbor and Fort Point channel. This was the district laid out for 1894, but the report covers the work done up to February 1, 1895. The

HON. JOHN R. MURPHY, WIRE COMMISSIONER, BOSTON.

district contained 8,306,000 square feet, or a little less than one-fifth of the area of the section of the city within which the wires were to go underground before 1900.

According to the report there were 725 poles in the district, 240 fixtures, 1,348,450 feet of wire on poles, 3,677,800 feet of wire on fixtures, 91,500 feet of feed wire, and 56,800 feet of guard and span wires, a total of 5,174,550 feet of wire in the district. Of this total there was 2,425,000 feet of dead wire. From an engineering standpoint the construction of the overhead system was bad and dangerous to life and property. It was September 5, 1894, before definite arrangements were made and the work commenced. Regarding the underground electrical work done in the prescribed district the report says:

The length of trench dug since September 5th is 48,817 feet. The number of feet for single duct for telegraph and telephone service is 9,348. This includes distribution service connections. Reckoning 240 wires to each duct, the capacity of these ducts is 2,243,520 feet of single wire. The number of feet of single-duct wire conduit for arc lighting and power service is 387,845. The maximum total capacity of this conduit is 2,080,206 feet of cable. The amount of cable drawn through the ducts is 327,728 feet. The summary of the work inside the 1894 district shows a total of 398,222 feet of duct laid, 327,788 feet of cable, 204 manholes and 166 service connections. The summary of the work to February 1st, outside of the 1894 district, or in the second district, shows a total of 89,605 feet of duct laid, 114,125 feet of cable, 64 manholes and 198 service connections. As regards the removal of overhead wires so much progress has been made that only a few weeks longer will be needed to take down all overhead wires in the district prescribed for 1894. Up to February 1st about 3,000,000 feet of wire and 72 poles had been removed.

In regard to the West End street railway the report says:

Subway is complete and 11,500 feet of the underground system in use. All feed wires to be removed; also all poles except those supporting the trolley wires. Began taking down overhead wires January 31st. Total amount of overhead wire to be removed 17,897 miles. The total amount of work done consists of 35 manholes, 9,215 feet of trench, 185,819 feet of duct. This latter includes six connections from the underground service to the poles and to three terminal points. The total amount of cable placed underground by the West End railroad is 101,073 feet, leaving 10,560 feet to be drawn in. The conduits are to be used for the feed and return wires carrying current for the trolley cars, one or more ducts of the system being reserved for the telephone service of the company and possibly for a service in connection with the prevention of gas in the ducts. The subways consist of a series of cement-lined pipes laid in concrete, at a depth varying from three to ten feet below the level of the street. The manholes are located at an average distance apart of about 250 feet. Three kinds of cable are used—feed, return and telephone.

Boston Electric Light company: The amount of cable in the ducts is 158,244 feet, leaving 8,000 feet to be drawn in to complete the work. Of this 47,520 feet was made necessary in order to establish trunk-line connections between the two stations and relieve Elliot and Kneeland streets of poles. Seven underground circuits are now in use, the first being successfully operated January 1, 1895. Three hundred thousand feet of overhead wire has already been removed and the remainder is in process of removal.

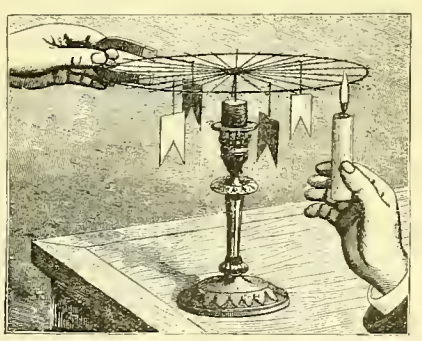
In connection with the overhead construction, especially the electric light and power wires in the city, Commissioner Murphy says:

The mass of wires strung over the roofs of buildings is something enormous. So great is the quantity, so many the different owners and so difficult is it to maintain insulation, that they cannot help being in a dangerous condition. I am of the opinion that these wires are a great fire hazard, both in causing fires and obstructing the firemen. Again they are likely at any time to be dangerous to the public and to the lives of the linemen. Poor work in many places characterizes the construction. Such is the mass and arrangement of the wires together with their defects that when they become crossed through storms and other causes, the dangers referred to must necessarily follow. Another trouble is the loss of the service of fire alarm, police, telephone and lighting wires. The way to obviate the dangers of bad overhead construction is to place the wires underground in the prescribed business district as soon as possible and correct all the overhead defects. Some idea of the enormous number of overhead wires in the city can be formed from the following facts: In the city proper, north of Dover and Berkeley streets, less than two miles in area, it is fair to say that there is 75,000,000 feet of wire. In the whole city there are, according to the plans on file in this office, 12,398 poles. It is estimated that the number of fixtures is over 50,000.

The following abstract from the report will give some idea of Boston as she is electrically. It covers the electric plants of seven large companies, some small ones and a few individual.

The total number of electric lights in use is 226,251; 219,653 of these are incandescent and 6,598 are arc lamps. In the seven large companies the number of motors in use is 4,036. The total electrical horse power employed daily for electric power purposes is 27.889, requiring for its generation 38,799 mechanical horse power. There are in the city 1,999,523 feet of underground duct, of which 740,911 feet is for electric light and power service, 1,252,076 feet for telephone and telegraph circuits and 6,536 feet for signaling and miscellaneous purposes. The number of feet of cable already in these ducts is 1,450,544. The amount of this cable employed for telephone and telegraph purposes approximates 566,000 feet of wire. The power and lighting cables are over 855,000 feet in length. For miscellaneous service 1,222,620 feet of underground wire is employed. The miles of overhead wire in the city have not been determined, except in the districts surveyed by this department. Taking these as a basis for estimates, the amount would be hundreds of thousands of miles.

These facts would appear to prove the claim that Boston is, in proportion to its population, one of the great electric centers of the country. Enormous as is the electric energy used, the growth has been mainly in the last few years. The advances have been in vast strides. In almost immediate succession have the forces of electricity been born. The uses to which it has been employed are well-nigh unlimited. The transmission of sound, light, power and heat, which rank the highest among the children of man's inventive genius, are but the first steps. What may be the future development no man knows. We can picture in our minds ideas of what is to come that appear like the impossible and yet fall far short of the reality. Wondrous is what has been accomplished, yet men say that we are but upon the threshold of still greater discoveries coming from this almost unknown and unseen power. Like all forces that serve man it must be bridled lest it become the master. The problem of finding the proper methods to rob electricity of its dangers rests upon the wire department. It is a difficult



AN EXPERIMENT WITH THERMO-ELECTRIC CURRENTS.

task and results alone will show whether that task has been accomplished.

The first appropriation to the department was $17,405 and the expenditures $14,638.89, leaving a balance on hand of $2,766.11.

The mayor of Buffalo thinks that the ashes and garbage of that city should be hauled to the Cheektowaga crematory by trolley cars. At present the cost of collecting garbage about the city is $140,000 a year, and it is said that the greatest expense is the long haul to Cheektowaga, the average haul being four miles, so that if a team makes two trips a day it is doing a fair day's work. The mayor's idea is to establish stations at Black Rock, Cold Spring, South Buffalo and East Buffalo. At these stations the garbage will be collected, so that the average haul will not be over two miles. These stations will be on the line of the trolley cars, and the garbage will be transported to Cheektowaga in closed cars fitted with motors and made to fit the tracks of the Buffalo Railway company.

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THERE is a good deal of fol de rol about much that is said in opposition to the trolley, as anyone acquainted with the facts can readily see, but it seems to be a fad in certain localities to assail every public enterprise—the greater the improvement the more the abuse—and as the trolley is just now possibly the greatest boon the American people enjoy, it is to be expected that it will have to submit to an unusual torrent of abuse. Daily newspapers, professional reformers and sensational preachers indulge in this pleasant pastime. It affords them something to do; it gives them a chance to pose as reformers and guardians of the people's rights, to keep themselves constantly before the public, and above all to annoy the street railway companies, which of itself in the eyes of many is enough to win for them eternal gratitude. Once in awhile, unfortunately for the cause of "reform," some overzealous leader in this movement "slops over" and makes himself and his followers supremely ridiculous. An instance of this kind is furnished in the reports printed in the New York daily newspapers last week of a sensational sermon on the "iron juggernaut," by a Brooklyn preacher. This sermon contained a lot of silly, sentimental nonsense. Here is a sample:

It is proposed to build a new tower for the city hall. Suppose that you were to raise a dome constructed out of the pyramidal pile of the bleached skeletons of one hundred innocent children, and then, surmounting all, suppose you should put the as yet uninjured children of the chief magistrate of the city in place of the goddess of justice, pleading with folded hands for their preservation. Above that, the father's head as he sits in the executive chair below to administer justice and safety to the people. How long, think you, would the present state of affairs continue?

So much of this unfair criticism has been printed in the daily papers that it is not to be wondered that fair-minded Brooklynites resent the assertion that they are dissatisfied with the service or the trolley system. A concise statement of the case, fairly representing the views of a majority of Brooklynites, was presented by a resident of Brooklyn in a recent communication to the New York *Sun*, and his remarks on the treatment of the company by the press, as well as his suggestions regarding the placing of responsibility for accidents where it belongs, are so timely that they are reproduced in another column. If the dissatisfied and disgruntled opponents of the Brooklyn trolley have any facts that would serve as foundation for their stories, they should present them for the consideration of the grand jury, secure the indictment of those responsible for the "trolley murders," as they are pleased to call them, and punish the offenders according to law. By confining themselves to this course they will perform their duty as good citizens, and while their reputation as "reformers" may suffer by their retirement from public view, they will confer a benefit upon the people by affording the community relief from their insufferable nonsense.

As a technical journal the *Electrical Engineer* of New York has, in the past, occupied a position of standing and influence in the electrical industry by reason of the journalistic ability and high ideals of the gentlemen responsible for it. It is therefore a matter for real regret that the journal named, for the last year or so, has given unmistakable evidence of a steady retrogression, not only in material prosperity but equally as well in an abandonment of the recognized standards of journalistic propriety. It is painful to note this decadence, and the WESTERN ELECTRICIAN would assuredly make no reference to such a delicate subject did it not feel convinced that justice to its readers demanded a prompt refutation of an implied charge of inefficiency which the *Engineer*, in its present evil days, brings against it. We refer to the claim made in the issue of March 13th under the heading of "The Bate Decision.—A Notable 'Scoop,'" and more particularly to these assertions: "Last week it [the *Electrical Engineer*] added to the long list of its 'scoops' in this line by the being the *only* electrical journal that secured and published the text given out by Judge Harlan of the decision of the U. S. Supreme Court in the famous and important Bate case;" * * * "the *Engineer* was the *first* and *only* American paper, daily or weekly, to give Judge Harlan's full text in every part of the country." These statements are not only strangely at variance with the best traditions of the *Engineer* by their flamboyancy and their awkward English, but they are untrue.

Since the *Engineer* invites the test, let us compare the service given by it and by the WESTERN ELECTRICIAN in reporting the Bate decision. We would be glad, indeed, if all interested in the manner of presenting this important news could place the two papers for that week side by side and judge for themselves. It will be noted at once that the *Engineer's* assertion that it published the full text of the opinion is absolutely false. Like the WESTERN ELECTRICIAN, the *Engineer* published an abstract; and we contend, in addition, that it was not as good an abstract as that published in this journal—that is, that it did not present such a concise and easily comprehended digest of that portion of the opinion which was essential to enable one to arrive at a just understanding of the court's chain of reasoning. Moreover, the *Engineer's* "extra" was tucked away in the back of the paper, bound in as an extra sheet between advertisements and "Trade Notes and Novelties," whereas the WESTERN ELECTRICIAN devoted over a page of its choicest space to the decision, making it the leading feature of the issue. Again, the *Engineer* had nothing but a clumsy condensation of the opinion and an editorial; the WESTERN ELECTRICIAN gave its readers, under suitable headlines, a general introduction setting forth the importance of the decision to the electrical industries; an intelligent and comprehensive abstract of the opinion of the court; a history of the case, showing how it came to be famous in electrical annals; together with the news of the immediate effect of the decision on the trade, interviews with electrical manufacturers and patent lawyers and editorial comment. In brief, the WESTERN ELECTRICIAN presented an attractively arranged *résumé* of all the features of the case that could interest electrical men, while the *Engineer* had only its fragmentary abstract and its editorial. The WESTERN ELECTRICIAN presented actually more matter than the *Engineer*—a fuller, more interesting and valuable report. Wherein, then, does the "notable 'scoop'" of the *Engineer* consist? Obviously in nothing if not in the editorial "written with the full text in hand." But we are of the opinion that the *Engineer* attaches a value to its editorials that does not obtain recognition outside of its own office.

A DECISION likely to be frequently referred to in litigation growing out of controversies over the right to employ electricity where it will prove injurious to existing plants has been handed down by the Supreme Court of Tennessee in the case of the Cumberland Telegraph & Telephone company versus the United Electric Railway company. This was a suit by a telephone company against an electric street railway company to recover damages inflicted upon the telephone plant by the contiguous railway plant. The former, by public authority and permission, had erected and equipped its telephone plant and put it into successful operation, grounding its wires upon the property of itself and subscribers and using the earth as a return circuit in accordance with the universal practice of the time in like enterprises. Afterward the railway company, by like permission, began the operation of a single trolley electric railway plant, using the earth as a return circuit and causing injury to the telephone plant by induction and leakage and from conflict of the poles and wires of the two systems. In the opinion accompanying this decision the court reviews the numerous claims of the contending parties and briefly and clearly determines the points of issue. First of all the court holds that the street railway company must exercise care and prudence to avoid injury to the telephone company, and that the latter must not obstruct the former's use of the streets if that be an "ordinary use." Between an ordinary and a strictly legitimate use of the streets it says there can be no substantial difference, and it further holds that the electric railway is a legimate use of the streets within the original general purpose of dedication and therefore an ordinary use, though the court says that it must not be understood as holding that the electric railway companies may, without making compensation, accompany such ordinary use of the streets with such extraordinary incidents as to impose new or additional burdens upon properties outside the streets that were not and could not have been contemplated and compensated for in the original taking. Having power to have avoided a conflict of poles and wires without injury to its plant, it was the duty of the railway company to do it, and, not doing so, it was liable for the expenses incurred by the telephone company in erecting higher poles to prevent its wires conflicting with those of the railway company. On the other hand, the loss by induction, it was said, could not be imputed to any fault or negligence of the railway company. The presence of the telephone company's poles and wires upon the streets caused induction, and their removal would obviate it. Induction, it was held, was such obstruction of the streets as it was forbidden to create; consequently it could not recover for the loss sustained from induction, as that resulted from its unlawful use of the streets. It was further insisted by the railway company that the telephone company could not recover the damages caused by conduction except upon the theory that it had the right to the exclusive use of the whole earth for electrical purposes, but on this point the court says that a monopoly of the earth's use for any purpose, or by any person, is, of course, inadmissible. The injury by conduction can be obviated at an expense which entails no great hardship upon either party, and therefore the telephone company, it is held, had the right to the protection of the courts in the enjoyment of its property and could recover damages for the injury from conduction. The doctrine that reason sanctions and justice approves, the court goes on to say, is that the lawful, harmless and accustomed use upon one's land alike of water, air or electricity cannot be lawfully obstructed or impaired by the injurious act of another, attended with such disturbance of natural and existing conditions and consequent loss as that caused by conduction in this case, especially when the party performing the injurious act had the power to obviate and remedy the injury or loss without greater sacrifice, comparatively, than was required of the railway company in this case to remedy conduction. It is not material that the injurious act is done upon the premises of one other than the injured party, as if the channel of a stream is cut upon adjoining lands, and the water diverted, or the waters on them arrested in their regular flow, and then turned loose in flooding quantities. Finally the court holds that it was not the telephone company's legal duty, upon the institution of the railway company's electric system, to protect itself from the injurious consequences by making at its own ultimate cost such changes in its plant as would obviate the effects of conduction. The railway company must take care of the natural and reasonable consequences of its own act. The telephone company, being in the lawful possession and enjoyment of its own property, was under no obligation to take notice of the other's approach or to get out of its path. But the telephone company could only recover such loss as necessarily resulted to it from the railway company's act. It must use due diligence to prevent unnecessary loss. The fact that it could apply a cheaper remedy would affect the amount of its recovery, but not the fact of the railway company's liability. The right of the owner to compensation for his property taken for public use does not depend upon any consideration of this sort. Altogether the opinion is the most comprehensive exposition of the merits of the relative claims of the contestants in this class of cases that has yet been recorded.

## Method for Obtaining Alternating Current Curves.

By Dr. Louis Duncan.

In some cases a telephone method for obtaining the curves of alternating currents and electromotive forces is very convenient.

The method ordinarily employed for obtaining current curves is to shunt from a non-inductive resistance in the circuit and include in the shunt circuit a contact making arrangement on the dynamo shaft, a telephone and an electromotive force, due to a constant current. This constant current is adjusted until there is silence in the telephone. When this occurs, the fall of potential due to the alternating current is equal to the fall of potential due to the continuous current, and knowing the latter, we get the value of the alternating current at the instant the contact on the shaft is made. Electromotive forces may be obtained in the same way by balancing a continuous electromotive force against the instanteous value of the alternating electromotive force when the contact on the shaft is made.

There are several difficulties in this arrangement. Any small thermal electromotive force at the contact makes it difficult to get even an approximate balance, while only one curve may be obtained from a single contact-making arrangement on the shaft. I have employed with some success a method in which some of these difficulties are elimi nated. To a telephone diaphragm, made preferably of mica, I attach a small coil of fine wire. Beneath the diaphragm are two coils wound together and so placed that the diaphragm coil is in a magnetic field due to currents flowing in them. Through the diaphragm coil I send instantaneous currents obtained from a contact-making device on the shaft, there being a battery in circuit with the coil and the contact maker. Through one of the stationary coils I send a current proportional to the electromotive force to be measured or a current obtained from a shunt on a non-inductive resistance in the dynamo circuit. The other coil has a continuous current flowing through it, which latter is measured. I now adjust the continuous current until the sound in the telephone is zero. If the coils are equal, this will mean that the continuous current is equal to the instantaneous value of the alternating current when the intermittent current is made. It will be seen that the method is independent of any small electromotive forces due to the contact and any number of curves may be obtained from the same contact-making device.

This method is fairly sensitive and gives good results. It has, however, the difficulty of all telephone methods, that unless the contact only lasts for an infinitely short time, there will always be a sound in the telephone. By making a sharp contact and after some practice, the results are good.

## Electrical Exports and Imports.

The Treasury Department has just completed the computation of the statistics covering the exports and imports of the United States during the last fiscal year, and these figures are interesting because they show: First, the customs districts from which the articles were exported and the value of the exports from each district; second, the countries to which the exports went, and the volume and value of the goods sent to each foreign country; third, the customs districts into which the foreign goods were imported, their volume and value, with the names of the countries shipping, and the value of the shipments from each country. Thus may be seen at a glance exactly the status of any industry.

The following is an exhibit of the last fiscal year's foreign business in electric light appliances, electric telegraphic and telephonic instruments and gutta percha:

EXPORTS.

*Electric Light Appliances.*

| Customs districts from which exported— | Values. |
|---|---|
| Baltimore, Md. | $ 203 |
| Bangor, Me. | 11,529 |
| Boston and Charlestown, Mass. | 5,714 |
| Delaware | 10 |
| New Bedford, Mass | 254 |
| New York, N. Y. | 512,256 |
| Passamaquoddy, Me | 796 |
| Philadelphia, Pa. | 512 |
| Brazos de Santiago, Tex. | 227 |
| Corpus Christi, Tex. | 4,103 |
| Key West, Fla. | 25 |
| Mobile, Ala. | 191 |
| New Orleans, La. | 1,120 |
| Paso del Norte, Tex. | 2,577 |
| Saluria, Tex. | 3,790 |
| Arizona | 3,257 |
| Puget Sound, Wash. | 3,647 |
| San Diego, Cal. | 8 |
| San Francisco, Cal. | 11,548 |
| Willamette, Ore. | 5 |
| Cape Vincent, N. Y. | 2,423 |
| Champlain, N. Y. | 13,276 |
| Detroit, Mich. | 28,044 |
| Genesee, N. Y. | 81 |
| Montana and Idaho | 26 |
| North and South Dakota | 3,818 |
| Oswegatchie, N. Y. | 3,720 |
| Oswego, N. Y. | 381 |
| Vermont | 36,877 |
| Total | $650,418 |

| Countries to which exported— | Values. |
|---|---|
| Austria-Hungary | $ 103 |
| Azores and Madeira Islands | 332 |
| Belgium | 2,066 |
| Denmark | 571 |
| France | 3,274 |
| Germany | 4,399 |
| Italy | 907 |
| Netherlands | 1,659 |
| Portugal | 725 |
| Russia, Black Sea | 16 |
| Spain | 58 |
| Sweden and Norway | 151 |
| Turkey in Europe | 826 |
| United Kingdom: England | 82,906 |
| Scotland | 15,279 |
| Ireland | 123 |
| Bermuda | 1,304 |
| British Honduras | 423 |
| Dominion of Canada: Nova Scotia, New Brunswick, etc. | 16,555 |
| Quebec, Ontario, etc. | 88,184 |
| British Columbia | 4,116 |
| Newfoundland and Labrador | 4,362 |
| Central American States: Costa Rica | 2,128 |
| Guatemala | 5,101 |
| Honduras | 1,063 |
| Nicaragua | 3,340 |
| Salvador | 1,650 |
| Mexico | 40,459 |
| Miquelon, Langley, etc. | 135 |
| West Indies: British | 14,691 |
| Danish | 625 |
| Dutch | 1,094 |
| French | 925 |
| Hayti | 11,124 |
| Santo Domingo | 3,952 |
| Spanish: Cuba | 40,725 |
| Puerto Rico | 5,336 |
| Argentine Republic | 32,870 |
| Bolivia | 111 |
| Brazil | 45,316 |
| Chile | 12,132 |
| Colombia | 10,889 |
| Ecuador | 3,993 |
| Guianas: British | 4,064 |
| Dutch | 341 |
| French | 191 |
| Peru | 7,115 |
| Uruguay | 3,656 |
| Venezuela | 13,550 |
| China | 5,154 |
| East Indies: British | 21,451 |
| Dutch | 46 |
| Hongkong | 11,563 |
| Japan | 3,345 |
| Russia, Asiatic | 18 |
| Turkey in Asia | 187 |
| All other Asia | 671 |
| British Australasia | 94,493 |
| French Oceanica | 844 |
| Hawaiian Islands | 5,868 |
| Philippine Islands | 2,740 |
| British Africa | 7,936 |
| Canary Islands | 412 |
| Liberia | 38 |
| Portuguese Africa | 234 |
| Turkey in Africa: Egypt | 17 |
| All other Africa | 81 |
| All other British | 182 |
| All other islands and ports | 220 |
| Total | $ 650,418 |

*Electrical Telephonic and Telegraphic Instruments.*

| Customs districts from which exported— | Values. |
|---|---|
| Baltimore, Md. | $3,704 |
| Boston and Charlestown, Mass. | 69,348 |
| Newport News, Va. | 350 |
| New York, N. Y. | 1,193,436 |
| Passamaquoddy, Me. | 541 |
| Philadelphia, Pa. | 3,525 |
| Brazos de Santiago, Tex. | 100 |
| Corpus Christi, Tex. | 33,629 |
| Key West, Fla. | 490 |
| Mobile, Ala | 60 |
| New Orleans, La | 263 |
| Paso del Norte, Tex. | 20,523 |
| Saluria, Tex. | 5,203 |
| Arizona | 815 |
| Puget Sound, Wash. | 7,486 |
| San Francisco, Cal. | 19,996 |
| Cape Vincent, N. Y. | 143 |
| Champlain, N. Y. | 54,663 |
| Cuyahoga, Ohio | 788 |
| Genesee, N. Y. | 474 |
| Huron, Mich. | 1,566 |
| North and South Dakota | 15,846 |
| Oswegatchie, N. Y. | 25,665 |
| Superior, Mich. | 63 |
| Oswego, N. Y. | 304 |
| Vermont | 75,296 |
| Total | $1,534,277 |

| Countries to which exported— | Values. |
|---|---|
| Austria-Hungary | $ 125 |
| Azores and Madeira Islands | 228 |
| Belgium | 41,618 |
| Denmark | 1,458 |
| France | 79,329 |
| Germany | 101,515 |
| Italy | 15,958 |
| Netherlands | 1,123 |
| Portugal | 210 |
| Russia, Baltic and White Seas | 7,775 |
| Russia, Black Sea | 1,094 |
| Spain | 836 |
| Sweden and Norway | 1,865 |
| United Kingdom: England | 371,656 |
| Scotland | 8,360 |
| Bermuda | 3,371 |
| British Honduras | 41 |
| Dominion of Canada: Nova Scotia, New Brunswick, etc. | 16,691 |
| Quebec, Ontario, etc. | 170,885 |
| British Columbia | 11,003 |
| Newfoundland and Labrador | 3,039 |
| Central American States: Costa Rica | 10,853 |
| Guatemala | 11,856 |
| Honduras | 1,092 |
| Nicaragua | 477 |
| Salvador | 11,520 |
| Mexico | 110,864 |
| West Indies: British | 19,514 |
| Danish | 604 |
| Dutch | 2,374 |
| French | 192 |
| Hayti | 6,460 |
| Santo Domingo | 6,486 |
| Spanish: Cuba | 143,501 |
| Puerto Rico | 5,650 |
| Argentine Republic | 29,382 |
| Brazil | 100,857 |
| Chile | 23,303 |
| Colombia | 27,623 |
| Ecuado | 3,310 |
| Guianas: British | 16,726 |
| Dutch | 45 |
| Peru | 10,713 |
| Uruguay | 1,759 |
| Venezuela | 47,983 |
| China | 2,898 |
| East Indies: British | 773 |
| Hongkong | 35,998 |
| Japan | 34,600 |
| Turkey in Asia | 50 |
| All other Asia | 90 |
| British Australasia | 7,503 |
| French Oceanica | 82 |
| Hawaiian Islands | 12,562 |
| Phillippine Islands | 4,007 |
| British Africa | 3,359 |
| Turkey in Africa: Egypt | 821 |
| All other Africa | 110 |
| Total | $1,534,277 |

IMPORTS.

*Manufactures of Gutta Percha—Dutiable.*

| Customs districts into which imported— | Values. |
|---|---|
| Baltimore, Md. | $ 19 |
| Boston and Charlestown, Mass. | 34 |
| Hartford, Conn. | 226 |
| New York, N. Y. | 30,002 |
| Philadelphia, Pa. | 314 |
| San Diego, Cal. | 1 |
| Chicago, Ill. | 55 |
| North and South Dakota | 55 |
| Oswegatchie, N. Y. | 1 |
| Total | $ 30,654 |

| Countries from which imported— | Values. |
|---|---|
| Austria Hungary | $ 36 |
| France | 298 |
| Germany | 23,930 |
| United Kingdom: England | 6,386 |
| Dominion of Canada: Quebec, Ontario, etc. | 3 |
| Mexico | 1 |
| Total | $ 30,654 |

*Crude Gutta Percha—Free of Duty.*

| Customs districts into which imported. | Pounds. | Values. |
|---|---|---|
| Boston and Charlestown, Mass. | 30,859 | $ 1,918 |
| New York, N. Y. | 463,463 | 80,572 |
| Philadelphia, Pa. | 4,441 | 1,850 |
| Total | 498,763 | $84,340 |

| Countries from which imported— | Pounds. | Values. |
|---|---|---|
| Germany | 99,803 | $25,139 |
| Netherlands | 3,083 | 1,296 |
| United Kingdom: England | 13,890 | 3,396 |
| Central American States: Honduras | 1,704 | 256 |
| West Indies: British | 8,082 | 2,579 |
| Dutch | 1,582 | 874 |
| Ecuador | 2,000 | 771 |
| Guianas: British | 1,125 | 495 |
| Dutch | 74,895 | 30,565 |
| East Indies: British | 292,599 | 18,969 |
| Total | 498,763 | $84,340 |

A recent decision in New Jersey, of interest to street railway men, was recorded in the case of Dodd against the Consolidated Traction company of Newark, in which it was held that a traction company authorized by the city to erect trolleys has the right to cut branches of trees overhanging the streets, when the act is to be considered reasonably necessary for the passage of the wires.

## The Electrical Industries of St. Louis.[1]

By William H. Bryan.

St. Louis has always held an important position in the varied applications of electricity and in the manufacture of apparatus, material and supplies for electrical work. For many years it has ranked as one of the leading cities of the world in electric lighting and railway work. A few years ago it was known positively that St. Louis outranked the world in these directions, and it is by no means certain that she has been outstripped even yet, although many of the large cities seem to have recently awakened to the advantages of electricity, and are now making rapid advancement. In St. Louis, however, the original and most extensive work was done, paving the pathway for the future, and demonstrating the practicability and soundness of electrical investments upon a large scale.

The arc lighting of St. Louis is done by four companies, who operate about 4,500 lights of a nominal capacity of 2,000 candles each. The incandescent lighting is done by three companies, which now have approximately 175,000 lights connected. The electrical equipment of these several stations aggregates 20,000 horse power. The service extends over the entire city and as far west as Kirkwood. In common with other interests they have suffered somewhat from the business depression of 1894, and their growth, while it has by no means ceased, has not been as large proportionately as in former years. The year 1895 will see extensive enlargements made, both to the plants and distribution systems. The most important advancement to be expected in the immediate future is the placing of the major part of the wiring underground, which consummation it is expected will be reached within the next twelvemonth.

St. Louis also ranks high in the distribution of electricity for power purposes. Three companies distribute an aggregate of about 4,000 horse power throughout the city. Electricity has displaced steam in hundreds of small manufacturing establishments and has recently come into quite extensive use for elevator service in tall buildings, for which it seems to be admirably adapted.

It is in connection with street railways, however, that electricity has met its widest field of work in this city. Nine companies, capitalized at about $17,000,000, operate some 275 miles of single track, running 500 motor cars, with 20,000 horse power of electrical equipment and 600 trailers. There are eight power houses, with a total electrical equipment of about 23,000 horse power. These lines carried 65,000,000 passengers in 1894, a gain of about 8 per cent. over 1893. These roads have added to their equipment during the year 1894 steam and electrical apparatus of 8,500 horse power, valued at $800,000, and have built during the year thirty-three miles of single track. The electric railway companies employ about 4,000 men regularly. Considerable extensions will be made during the coming year, and a number of suburban electric roads, connecting with existing down-town lines, will probably be built.

In electrical manufactures St. Louis ranks high. It has always been a center of the carbon industry, and continues so to this day. The manufacture of incandescent lamps has also grown to be large and important. Recently the manufacture of alternating current motors, fans and converters has been taken up and is being actively pushed. The product of these factories has become widely known, and goes to all parts of the globe.

Five large supply houses furnish electrical material and equipment. The capital invested is in the neighborhood of $125,000, and they did a gross business of about $500,000 during 1894, being just about the same as was done in 1893. These companies carry a stock valued at about $125,000, and the territory covered includes the entire Southwest.

A large number of contractors for electrical construction operate in and near St. Louis. It has been impossible to ascertain the volume of their business for 1894, but it is known to be large.

In interests closely allied to electricity St. Louis also ranks high. Four large street car factories are now in full operation, the greater part of their product being for electric railways. In this field St. Louis has for some years led the world both in quantity and value of output.

In engines, boilers, shafting and belts, entering into the equipment of electrical stations, a large business has been done.

1. Extract from the annual report of George H. Morgan, secretary Merchants' Exchange.

## The Other Side of It—A Defense of the "Deadly Trolley."

The following communication from D. J. Tapley of Brooklyn was printed recently in the New York *Sun:*

For some reason the newspapers have had a good deal to say in condemnation of the trolley car and its record of "one hundred fatal accidents" in Brooklyn. It seems to me that the case is not sized up judicially, and that most of the blame is misplaced. Nearly every fatality of this class has resulted from contributory negligence or gross carelessness, or even from suicidal purpose. The trolley has no monopoly as a source of danger. Children who are allowed to run the streets without being properly cautioned, and grown people who, from intoxication or any other cause, tempt fate recklessly, are always liable to disaster, fatal or otherwise. A larger number of people have been drowned by falling into the water from the piers, since the advent of the electric motor, than the trolley has to its credit, yet the papers have failed to harp on the deadly dock.

The trolley, by lessening the defilement of the streets, has so ameliorated the sanitary condition of the city atmosphere that it has saved many times the number of lives it has destroyed. It has furnished a quick and comfortable transit to the outlying wards, which has reduced the prevalence of grip and pneumonia among suburban passengers more than one-half. Many of your readers can recall the winter cars, with their slush-soaked straw and foul odors, and the tiresome and dangerous delays in the snow, when the passengers were forced to walk in the storm, or even to assist the wretched horses by pushing. Many a man has gone down to his grave from a cold contracted on such a trip. The trolley has saved thousands of lives by enabling the mechanic and clerk to move their little ones from the unwholesome tenements of the city to the pure air and sunshine of the country. It has added, in dozens of ways, to the sum of human welfare.

Why, then, does the press persistently attack a system which accomplishes so much good that it has become a great public necessity?

As a matter of fact, the number of accidents was decreasing regularly as people became accustomed to the danger, until the strike substituted a set of comparatively inexperienced motormen for the old hands, and placed them under the necessity of protecting their own lives as well as those of foot passengers. The workmen who were responsible for these dangerous conditions, who left their posts on the plea that the wages were so low, and the labor so onerous that they could do better in other lines of employment, are now proving their insincerity by fighting for their old places at the old price.

For a practical suggestion I propose that the foot passenger shall have the right of way on the sidewalks and the crossings, which are the continuation of the sidewalks. If the trolley injures anyone at the crossings, hold the company rigidly responsible. Let the trolley and other vehicles have the right of way at other points of the street, and if any one chooses to cross let him do it on his own risk and responsibility. Let parents teach this rule to their children and warn them of the danger of crossing in front of vehicles, and let boys stop the reckless bravado which dares such danger in wanton fun.

## Western New York Storage Battery Railroad and Power Project.

The little village of Waterport, Orleans county, New York, hopes to become a considerable electrical center by utilizing the power of Oak Orchard creek to furnish electrical power for manufacturing and for charging storage batteries for the Beecher elevated single-rail railway, which is to extend ultimately from Batavia to Lake Ontario, a distance of 45 miles. *The Electric Accumulator*, a monthly newspaper to boom the town, has already been established in Waterport. It prints the following data of the scheme:

The Equipment Construction company has been awarded a contract by the Waterport Electric Light & Power & Railroad company to build and equip four miles of the single track railway between Waterport and Lakeside Park, in Orleans county, N. Y. This line is to be built according to the Beecher single-rail system, and the equipment will consist of two motor cars operated by 30 horse power motors from storage batteries and capable of making 60 miles an hour hauling trailers. There will be four trailer cars, and if this line is successfully operated the Waterport Electric Light & Power & Railroad company proposes to extend the line eastward along the shore of Lake Ontario to Oak Orchard-on-the-Lake, and connect with Point Breeze by means of electric launches. It will also extend its line from Waterport southward through Albion and Medina to Batavia, in Genesee county, a distance of about 45 miles. At Waterport a 40-foot dam will be erected across Oak Orchard creek, which will be used as a source of power to operate the railroad and to operate mills in this vicinity. The work on the construction of the first four miles is being pushed through as rapidly as possible, and it is expected to open for traffic about June 1st.

## Dr. Carhart on Science.

At the dedication of the new Hale scientific building of the University of Colorado on March 9th, Dr. H. S. Carhart, professor of electrical engineering in the University of Michigan, delivered a thoughtful address on "The Educational and Industrial Value of Science." The following extracts show the trend of the professor's thought and are of particular interest to electrical men:

Science has not only educational value of a high order, but industrial application as well. Discovery and scientific training precede invention. The quality of mind that discovers the laws of nature is of a higher order than that which makes application of them. The genius of Faraday and Henry, who discovered the laws of magnetic induction, must not be dimmed or diminished by reduction to the level of even the greatest living inventors. The contributions of these men to the well-being, comfort and happiness of mankind can not be over-estimated. They laid the foundation in magnificent discoveries of those splendid applications which have dazzled the world in recent years. A million electric lamps nightly make more splendid the lustrous name of Faraday. A million messages daily over land and under the sea emphasize the value of Joseph Henry's contributions to modern civilization. Prior to Faraday the supporters of a medium to explain electric and magnetic action were always thrown out of court for lack of evidence; Faraday gave them a legal standing by furnishing the facts and the evidence on which they could well afford to base their case. So thoroughly intrenched in theory and practice are Faraday's conceptions at the present day that they enter into every design of motor or dynamo. They have been shot through the entire body of practice and are intertwined with every thread of electrical thought. * * *

No grander problems remain for solution than those even now confronting the electrical engineer. The swiftness with which he has already passed from one almost insurmountable task to another has amazed no one more than those most familiar with the means employed. If electrical engineering is still in its infancy, it is certainly a giant infant. It has long since outgrown its toys. With the nerve and audacity of vigorous young manhood it quails before no obstacles and acknowledges no impossibilities. Having practically banished the plodding horse from the street railway, it is getting ready to enter the lists against the locomotive. If your city is not seated near a source of power it will undertake to bring the power to you. The mountain cannot go the city, but the city can go to the mountain for its power. Electrical engineering stands at the door of the twentieth century, ready to accept the tasks that it imposes and eager to enter upon a new period of discovery and application.

The Hale scientific building is so named in honor of Horace M. Hale, LL. D., ex-president of the university. It is a large building of red and white sandstone, and presents a handsome appearance. At first the electrical apparatus and instruction will be included in the department of physics, but in time a separate department will doubtless be created.

## Manufacturer's Opinion of the Bate Decision.

Whatever may be the opinion of inventors upon the ruling of the Supreme Court in the Bate case, it is evident that the decision is heartily commended by manufacturers and consumers of incandescent lamps. The views of manufacturers are concisely presented by Louis Nahm, secretary and treasurer of the American Electric Manufacturing company of St. Louis, who, in reply to an inquiry from the Western Electrician, made the following statement of the situation:

The decision in the Bate case was no surprise to me, as I have felt quite confident that the line of decisions on the same question in the United States district courts would not be overruled by the Supreme Court. As far as the question could be determined by the district courts it has been settled by a long line of decisions, and I have expressed my opinion as to the decision of the Supreme Court on the question in many letters to customers for months past.

As to the effect of the decision on the lamp business, there will probably be some new manufacturers in the field, and in some sections of the country, where the influence of the General Electric company has prevented parties from using other lamps for fear of legal proceedings, the business will be considerably increased. I think it reasonable to suppose that consumers who have feared that the General Electric company would eventually win the case will take advantage of their freedom to buy elsewhere.

The market for a time will probably be somewhat unsettled, but it will rapidly resolve itself into a condition where the merit of the lamps will be a considerable factor.

## Death of H. C. Thom.

The news of the death of Henry C. Thom, president of the Northwestern Electrical association, at his home in Madison, Wis., on March 16th, was a sad shock to a multitude of friends throughout the West. Mr. Thom had been ill for several weeks as the result of a stroke of paralysis, but the serious character of his illness was not generally known outside of his own home. At the time of his election as president of the association on January 18th last, Mr. Thom was the picture of strong, vigorous young manhood, and it is difficult to conceive of his death. He possessed a pleasing personality and versatile talents and was universally liked. As chairman of the Republican State Central Committee of Wisconsin, Mr. Thom threw himself enthusiastically into politics, and it is now believed that overwork in last fall's campaign brought on the nervous prostration which resulted in the paralytic shock. A brief biographical sketch and a portrait were presented in the Western Electrician of January 26th. The funeral services were held on the 19th instant.

# COMMUNICATION.

## Correction in N. W. Perry's Paper.

*To the Editor of the* Western Electrician:

In looking over my paper on "Storage of Energy Essential to Economy of Working in Central Stations,"[1] read before the National Electric Light association at Cleveland, I find an error that does injustice to Mr. Halpin's method of steam storage. The figures were correct in my original manuscript, but got changed in the haste in transcribing the printer's copy. In the printed copy the fixed investment charges are made to add up $994.39, whereas they add up only $788.39. This is so palpable an error that probably none but the casual reader would fail to detect it. It, however, places this method in a wrong comparative light, and I will feel obliged if you will kindly call attention to the correction. Making the change, the total fixed annual cost per electrical horse power becomes $67 instead of $87.60, and the total annual cost $97.24 instead of $117.84, with coal at $1.75, and the total annual cost, with coal at $3.50 per ton, becomes $114.27 instead of $134.77. Substituting these figures in the final comparative statement it will read thus:

| | Recapitulation. | | Saving effected. | |
|---|---|---|---|---|
| | Coal $1.75. | Coal $3.50. | Coal $1.75. | Coal $3.50. |
| Present method, steady load.. | $48.68 | $ 65.62 | $ ..... | $ ..... |
| Present gas engine..... | 83.28 | 103.62 | 29.50 | 44.79 |
| Combined feed and steam storage ..... | 94.42 | 111.35 | 23.36 | 37.05 |
| Feed storage .... ..... .... | 97.58 | 117.58 | 20 20 | 30.82 |
| Without storage; load factor 25 per cent..... | 117.78 | 148.40 | ..... | . ... |
| Steam storage..... .... | 97.24 | 114.27 | 20.54 | 34.13 |
| Complete battery storage..... | 123.13 | 145.74 | —5.35 | +2.66 |

Nelson W. Perry.

1. Western Electrician, March 9, 1895.

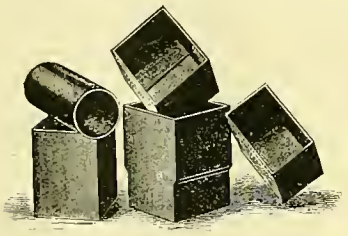
## New Battery Cell.

The Newton Rubber Works of Newton Upper Falls, Mass., as is well known, have been manufacturing battery cells for electrical purposes for a number of years. Appreciating the fact that a number of requirements of late have made it necessary that a cell be produced of greater strength and proof against the action of acid, this concern has placed upon the market a battery cell for which it claims the advantages named. Two years ago the services of Dr. Warren P. Freeman of New York were secured. Dr. Freeman combines the experience of a chemist with the knowledge of what the electrical trade demanded in this regard.

This new cell is made in the standard sizes and is guaranteed by the Newton Rubber Works to be purely acid-proof and also of such a fibrous, tough and strong nature that its manufacture does not partake of the brittle substance which enters into the battery cell generally offered for sale.

The ordinary hard rubber cells are made from a composition in which rubber is the principal part, the minor ingredients being sulphur, grout, bonedust and asphalt. This concern claims that the principal ingredient used in the manufacture of its cell, which is shown in the accompanying illustration, is rubber, while the balance contains nothing of the similar materials. It is further asserted that these battery cells are not affected by extreme temperature, but that they are available for all classes of work in this line.

Dr. Warren P. Freeman, the electrician and chemist connected with this company, is well known to the electrical fraternity, especially through the central and western states, where his first connection in the electrical trade was made with Bliss, Tillotson & Co. of Chicago, in 1870, from which firm he went to Gray & Barton of the same city, having charge of the latter firm's electrical supply department. Later he became electrician for George H. Bliss & Co. and continued in this capacity until he accepted a position with the E. P. Allis Manufacturing company



NEW BATTERY CELL.

of Milwaukee. Soon after, however, Charles H. Haskins of the same city secured the services of Dr. Freeman as manager of the telegraph and telephone departments known as the Gold and Stock Exchange. He next went with the W. F. Jarbins Manufacturing company of Brooklyn, New York, as general superintendent of its electric light and machinery department. Dr. Freeman in 1884 opened an office for general electric manufacturing and supplies at 106 Liberty street, New York, where he remained up to the time of his connection with the Newton Rubber Works. Thirty important patents in the electrical field which are at present in operation have been given Dr. Freeman, and it is stated that they are all in operation at the present time. It will be remembered that he had a prominent exhibit of several electrical devices at the Philadelphia Electrical Exhibition in 1884.

The Newton Rubber Works have a number of important electrical specialties outside of their battery cells, which will soon be offered to the electrical trade.

## New Armature Cutting Presses.

The requirements of armature work for electric motors and dynamos have led to the construction of presses which differ in essential points from those used for other styles of sheet metal work.

The usual form of armature is made up of annular disks, with notches on the outside or inside circumferences. As it is essential to have the outside and inside exactly concentric, it has been found best to adopt dies which, by cutting them simultaneously, eliminate the inaccuracies which are almost unavoidable when the cutting is done in two or more operations. In most cases the notches and key slots are also punched at the same time, all of which calls for tools having throw-out pads, in addition to the cutting parts, so as to automatically push the disks and scrap from out of the dies and punches. These throw-out pads are now usually operated by means of heavy springs, which are not only far from reliable but consume a great deal of the power of the press. The two presses shown herewith are designed to operate these throw-outs in a positive manner, and consume but little of the power of the press. It will be seen that in addition to the usual slide carrying the punch, there is a bottom slide, actuated by an outside crank connection and which operates the dies and throw-out pads through the radial slots in the bolster. Two cross pieces adjustably attached to the frame of the press, actuate the throw-out pads of the punches by striking against them on the return motion of the main slide. In the cuts the press shown in Fig. 1 is more particularly designed for cutting simultaneously the inside and outside of plain rings, with or without key notches, such as are shown on the floor in the illustration. These presses will do this class of work up to about 20 inches in diameter. These rings or disks are then sub-

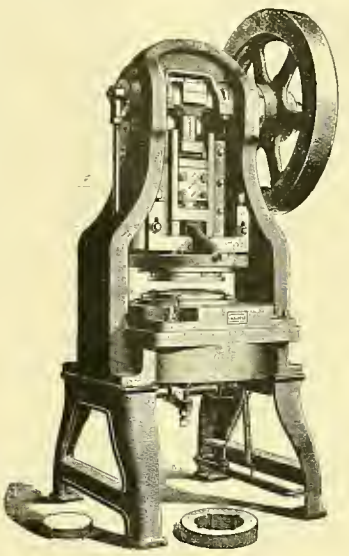


FIG. 1. NEW ARMATURE CUTTING PRESSES.

sequently notched in a machine for that purpose. The press shown in Fig. 2, on the other hand, is frequently used for cutting the whole disk, including all the notches, at one blow, and can be used for that clase of work up to 11 or 12 inches in diameter. Beyond that size, the first mentioned press is usually furnished with back gearing, and sometimes with a body casting of steel, instead of cast-iron. It can, however, be also used for plain rings, and in that case is designed to take in diameters up to 24 or 30 inches. It is also a useful machine for cutting the smaller sections for armatures of large generators, in which case the outside of the sections and the holes are mostly punched simultaneously. The machines are made by the E. W. Bliss company, Brooklyn, N. Y.

## Medbery Standard Material.

The accompanying cut illustrates the standard straight line insulator, with Medbery insulation, manufactured by the Fiberite company and sold in Chicago by the Mason Electric Equipment company. The particular advantages of

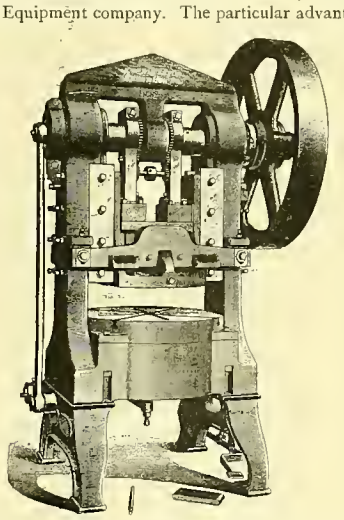


FIG. 2. NEW ARMATURE CUTTING PRESSES.

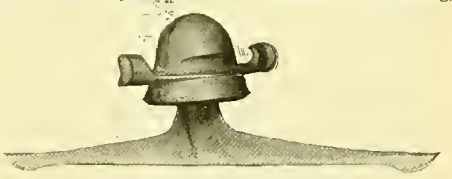
this insulator exist in the fact of its being in one piece and in the insulation being thoroughly covered by the bronze casting. This makes the complete device practically indestructible, and enables the company to sell under an absolute guarantee. The Fiberite company furnishes two improved clamps or the solder ear, either one of which can be used with its standard material.

A franchise has been obtained for the operation of an exchange of 150 instruments in Charleston, Ill. F. A. Brooks can furnish information.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, March 16.—Nikola Tesla, whose fame as a daring investigator of electrical phenomena and as a practical inventor is world-wide, is receiving the sincere but unavailing sympathy of his fellow electricians the whole country over as well as that of thousands of other admirers who are familiar with his brilliant career through newspaper reports. On Wednesday morning a big fire in the six-story factory building at 33 and 35 South Fifth avenue totally destroyed his laboratory and all the tangible results of his recent work. Mr. Tesla's workshop took up the entire fourth floor of the building, the remainder of the structure being occupied by a firm manufacturing steamfitters' supplies, whose loss is also complete. Mr. Tesla is an undoubted genius, and, as all who are acquainted with him are aware, he is of a highly sensitive and nervous temperament. He is quite prostrated by his loss, which is, of course, far beyond anything that can be expressed in dollars and cents. Like all pioneers in scientific investigation, Mr. Tesla is shy in announcing the practical results he hopes to obtain until he has produced something capable of actual accomplishment. So even his closest friends had only a general idea of the character of his recent work. It is known that he has been developing the ideas he set forth in his address and experiments on "Mechanical and Electrical Oscillators" before the World's Electrical Congress in Chicago in August, 1893, and it is believed, also, that he hoped to perfect a system to utilize in light a greater proportion of the energy now necessary for existing systems of electric illumination. Mr. Tesla had been working at an unusually high pressure of late, and was greatly discouraged at his sweeping loss. He denied himself to all callers on the day of the fire. "I am completely worn out," he is reported to have said to a friend a few days before the fire, "yet I cannot stop my work. These experiments are so beautiful, so fascinating,



MEDBERY STANDARD MATERIAL.

so important, that I can hardly tear myself away from them to eat, and when I try to sleep I think about them constantly. I expect that I shall go on until I break down altogether." A day or two after the fire, however, Mr. Tesla in a measure recovered his courage. When asked if he could give an estimate of his loss he said: "No tha would be very difficult. The loss cannot be estimated in dollars and cents. I might say a million dollars would not pay for what has been destroyed." "But you will doubtless be able to replace everything in time?" asked a reporter. "I don't know," replied the inventor, wearily. "Some things can never be replaced. A painter may have commenced a masterpiece which is destroyed while in process of completion. Nerved up by his loss he may produce another masterpiece, which will make him famous. In the case of an inventor it is different. When, at one blow, all his apparatus, his machinery, the work of months of careful study, are swept away, it is no easy matter to replace the loss."

A startling rumor to the effect that the Standard Oil company is back of a movement to monopolize the electrical manufacturing interests of the country in a gigantic combination attracted some attention this week, but it is not credited by those well informed.

The Rapid Transit Commission seems at last to have adopted a general plan of construction. Electrical men will be interested in the following provisions:

The tunnels shall not be less than 12 feet in height in the clear, and shall be 12½ feet in width for each track, except that at unusually narrow places, such as on Broadway between Eighteenth and Twenty-first streets, and between Twenty-sixth and Thirty-third streets, the width for each track may be reduced to any extent which shall leave the width not less than 11 feet. Viaducts shall be built with a width 12½ feet for each track and with footwalks on the outside in addition, three feet in width for each.

The tunnels and viaducts shall be so located that their center line shall coincide as near as may be with the center line of the street.

Provision shall be made for the placing of pipes, wires, sewers and other sub-surface structures in suitable galleries either at the side or beneath the tracks, or both, such galleries to be so arranged as to give free access for the repairing or altering of existing structures, or for the placing of new structures, and for making connections between the same and the houses at any time without disturbing the surface of the street. Whenever galleries are placed at the sides of the tunnel they shall not, in connection with the railway, occupy a greater width between houses than 70 feet, and in no place shall they come nearer than five feet from the house line.

Whenever necessary for the proper support of the street surface, the roof of the tunnel shall be of iron or steel girders, with brick or concrete arches between, supported by suitable iron or steel columns and masonry walls, or it shall be a masonry arch.

The roof of the tunnel shall be as near the surface of the street as street conditions and grades will permit. Viaducts shall be of iron or steel and masonry, or both combined. The Harlem river shall be crossed by a double-track drawbridge not less than 24 feet in the clear above mean high-water mark, with clear spans of not less than 100 feet between the center pier and bulkhead lines measured at right angles to the latter.

The general mode of operation shall be by electricity or some other power not requiring combustion within the tunnels or on the viaducts, and the motors shall be capable of moving trains at a speed of not less than 40 miles per hour for long distances, exclusive of stops.

Charles S. Bradley lectured last week at Columbia College before the New York Electrical society on "Alternating Current Motors." An interesting historical sketch of the progress of transmission of power by alternating currents was read, and the lecturer exhibited a recent type of motor invented by himself.

Admirers of Prof. F. B. Crocker's technical ability and lucid style are interested in the announcement that he will deliver a course of six public lectures on "How Electricity is Now Being Utilized" in the Library building at Columbia College on successive Thursday evenings at 8:15 o'clock. These lectures will be fully illustrated by experiments and are specially intended for professional and business men who desire to obtain an intelligent idea of the present uses of electricity. The subdivisions of his subject are: "How Electricity is Generated and Stored," March 21st; "Alternating Currents," March 28th; "How Electricity is Used for Lighting and Heating," April 4th; "The Electric Motor and Its Use in Transmission of Power," April 11th; "Electric Railways," April 18th; "The Telegraph and Telephone," April 25th. Tickets for the course may be obtained of the secretary or the president of Columbia College.

There is a rumor of a possible consolidation of the Broadway Cable company of this city, the Consolidated Traction company of New Jersey and the Philadelphia Traction company. It is believed that mutual interests might be served by the deal. The amount of stock represented by the three companies is said to be close upon $200,000,000, and the talked-of consolidation would make one of the largest corporations in the United States.

At the annual meeting of the Commercial Cable company the statement of the company's business for the year ended December 31, 1894, showed that, notwithstanding the hard times and the fact that the new third cable was not completed until August, over 10 per cent. was earned on the stock. Seven per cent., or $700,000, was paid in dividends (the usual rate), and $310,439 was carried to surplus. Early in the year the last remaining $400,000 of debentures was cancelled, leaving the stockholders in possession of the property unincumbered and free from fixed charges of any kind. While the capital stock remains at $10,000,000, the value of the company's plant has been increased to $12,250,000 by the addition to the new main Atlantic cable, by the extension of the Canso-New York cable from the landing place, at Coney Island, through the harbor to this city, a distance of 14 miles, and by the acquisition of wharf property and real estate at Halifax.

The American Telegraph Union—a labor organization—was formed recently at a meeting in Clarendon Hall. The association is strongly in favor of the government ownership of telegraphs.

The company that is equipping the cars on the Brooklyn bridge for electric light has been compelled to do some new and difficult things, and even to invent some new devices. One of the problems it has had to solve was the arrangement of the trolley pole so that it would be self-reversing. The "pole," by the way, is only about two feet long. The plan devised will, it is believed, prove successful. When a train is drawn toward the switching tracks the trolley pole on each car in succession will run free of the wire, which is here lifted to a higher level, and will stand straight up in the air until it reaches the point on the opposite track where the wire is in its normal place. Then the trolley will strike the wire and be swung down into the trailing position, but, of course, in the reversed direction, and the lights will blaze out again. It is obvious that all the apparatus must be carefully adjusted so that the connection will be made just right every time. If the trolley fails to hit the wire, or if it flies off again, the car to which it is attached will be in darkness until the other end of the bridge is reached, for it would be an awkward operation for anyone to climb on its roof and adjust the apparatus. This is one of the rather difficult problems which the electric company has solved, in the opinion of Superintendent Martin, successfully. W. F. O.

## New England News.

Boston, March 16.—It is not without the bounds of possibility that this city will secure rapid transit by some other than the Meigs steam elevated, a charter for which was granted by the Legislature of last year. There is likely to be a great deal said on the subject of rapid transit for Boston before the present Legislature adjourns, and there are many people who seem indisposed to accept the legislation of last year as a solution of the problem. A bill has been introduced to repeal the subway clause of the rapid transit act of 1894, but it is hardly probable that this will go through. A petition has also been presented from G. C. Gorham, H. C. Andrews and Otis Kimball, which asks for incorporation as an electric street railway company to operate in the city of Boston, the company to divide surplus dividends over and above 8 per cent. between the city of Boston and its own stockholders. The locations asked for are in many cases on streets where the West End railway now operates, including many of the latter's most important routes. The most sweeping legislation asked for, however, is contained in the petition from J. H. Bickford, which was presented to the Legislature on the 16th ult. This bill provides for the incorporation of the Metropolitan Elevated Railway company, with a capital of not less than $15,000,000 or more than $25,000,000, the corporation to be authorized to construct, maintain and operate by electricity elevated railways in the city of Boston and other towns and cities in the commonwealth where the consent of the boards of aldermen and selectmen may be obtained. The corporation is to deposit with the state treasurer $500,000 within 60 days from the date of the approval of the act, to secure a construction of five miles of its railway within two years from the date of approval of locations in the city of Boston. The company, on and after January 1, 1905, is to pay a franchise tax to the commonwealth of not less than 1 per cent. or more than 5 per cent. of the gross earnings of the corporation annually. Theodore P. Dresser has charge of the petition and the bill. Another bill introduced, which is of interest to the electrical world, is for an act which provides for boards of electrical examiners in cities and towns, the board in Boston to consist of five—the commissioner of wires, the fire underwriters' inspector (who shall serve without compensation), one electrical contractor, one practical wireman and one practical dynamo man, the three latter to receive $6 per day; in towns and cities having over 4,000 inhabitants the boards are to consist of but three members; in the smaller towns the selectmen are to act as examiners.

The gas and electric light commissioners have just rendered a decision of importance to the Malden Electric company. The company applied for an approval of an issue of new stock to the amount of $94,900, being the unissued balance of a proposed issue of $100,000, the proceeds to be applied to the payment of the company's floating debt, which now amounts to $140,000. The board approves the issue of new stock to the amount of $19,000 instead of $94,000. It is admitted, the commissioners say, that no considerable expenditure for extension or improvement is likely to be needed in the near future, and that from $30,000 to $35,000 will probably be available annually for this debt and dividends.

The car house of the Boston & Newton Street Railway company on Walnut street, Newtonville, Mass., was completely destroyed by fire recently, together with 11 cars and a large quantity of electrical equipment. It is supposed that the fire was caused by the short-circuiting of the current through one of the cars standing in the shed. The building with the exception of the offices and a portion of the stable was destroyed, only the walls remaining. The structure was erected about three years ago at a cost of $12,000. The total loss on buildings and contents is about $30,000, which is well covered by insurance. The only rolling stock of the company which was saved were four cars which stood outside the house on the tracks. The company will rebuild at once.

Col. N. H. Heft, president of the Bridgeport, Conn., Traction company, is to have complete supervision of the installation of electricity on the Nantasket Beach division of the New York, New Haven & Hartford steam railroad. He is the head of the company's electrical department. President Clark and Col. Heft have decided on the location of the power station, one mile from the Old Colony house station, one terminus of the line it is proposed to run by electricity. Regular coaches will be used, hauled by baggage cars equipped with motors. If successful, electric locomotives will be substituted later.

The board of aldermen of Portland, Me., has voted unanimously in favor of granting the petition of the Portland Railroad company for the privilege of equipping its street cars with electric motive power. A remonstrance signed by many of the local physicians was presented. It was based on the theory that the introduction of the trolley would cripple the local telephone service. This question was discussed and a resolution was finally passed by the aldermen expressing the sense of the board that the telephone company should overcome the difficulty introduced by the electric street car system by putting in a metallic telephone return circuit at no expense to the subscribers.

The West End Electric Railway company of this city proposes an issue of $2,275,000 bonds to retire $800,000 6's of the original constituent companies, $925,000 mortgage notes, and for other uses not known. The new bonds will bear a lower rate of interest than those to be retired.

J. C. E.

## Northwestern Notations.

Minneapolis, March 16.—The Twin City Rapid Transit company, operating all street car lines in Minneapolis and St. Paul, in its annual statement shows $116,290.95 as the net earnings for 1893, and $220,170.09 the net earnings for 1894. The total assets of the company are placed at $23,577,302.15 and the liabilities are the same, with $10,000,000 credited to capital stock and $19,575 to trainmen's deposits.

Vinton, Ia., is considering whether to put in an electric light plant.

Provo river will be dammed near Heber City, Utah, for electric power purposes.

St. James, Minn., has accepted the electric light plant put in by the Fort Wayne company.

The electric light company of Marshalltown, Ia., is reducing its rates about 3 per cent.

The Duluth, Minn., council has passed an ordinance requiring a permit to repair electric wires or do new work.

There is a citizens' ticket in the field in Emmetsburg, Ia., which favors an electric light plant and other improvements.

Miss Ida Richards, a young woman in the service of the Eau Claire Light & Power company, is reported to have invented an electric heater.

Walsh Bros. have secured control of the Burlington electric railway system of Burlington, Ia., and will make extensions and improvements on the lines at once.

The street railway company of Marinette, Wis., will extend the line three miles to the bay shore in the spring and make improvements there at a cost of $30,000.

Landlord Hayward, of the Grand Central and West hotels of St. Cloud, Minn., will wire both hotels throughout for electric light and may put in a generator.

The Edison Electric Light company of St. Paul has perfected plans for a smoke consumer, which is believed will solve the smoke problem. It will be installed at an early day.

There is a movement on foot at Duluth, Minn., to secure a reorganization of the Great Western Manufacturing company, and the prospect for an early resumption seems favorable.

The city clerk of Ashland, Wis., has ordered all street electric lights shut off under instructions from the council. This is in the interest of economy, the city being in a hard way financially.

The Waukesha Beach Railway company of Waukesha, Wis., will begin work on its power house as soon as weather will permit. Considerable improvement will be made at the beach.

The citizens of North Mankato, Minn., an unorganized village near Mankato, Minn., want an electric light plant. As they have no organization all funds will have to be raised by subscription.

D. K. Pearson is arranging to connect Grand Rapids, Minn., with Koochiching, Minn., by telegraph, giving telegraphic communication with the Rainy Lake gold fields. The tariff will be 10 cents a word.

The Tacoma Railway & Motor company of Tacoma, Wash., has been sued by the New York Guaranty & Indemnity company for $1,500,000 to recover that amount on first mortgage bonds of the company.

F. A. G. Moe has been appointed receiver for the St. Paul & White Bear Railroad company running an electric line from St. Paul to White Bear Lake, on the application of the St. Paul Title Insurance & Trust company.

E. B. Burch, chief electrician of the Twin City Rapid Transit company, addressed the Society of Engineers in Minneapolis on the subject of "The Development of Electricity as a Motive Power" at a recent meeting.

The plan of running an electric line from Sioux City, Ia., to South Sioux City, Neb., and Dakota City has been revived. The distance is four miles, and it is thought that the line will be built as soon as the river is bridged.

J. C. Hubinger, owner of the electric railway franchise in Keokuk, Ia., has discontinued the service until spring or later. The franchise provides that in winter when operation does not pay, part of the system may be suspended.

The Vermillion Water, Light & Power company of Vermillion, S. D., has been incorporated with $25,000 capital stock, and will put in a system of water works and a complete electric light plant. Work on the electric plant will begin at once.

The city engineer of Menasha, Wis., is advertising for bids for furnishing 50 1,200 candle power arc lights, with the privilege of increasing them to 65 within five years. An

exclusive franchise for five years for both commercial and domestic use will be given.

John E Webber secured a verdict against the St. Paul Street Railway company of $9,250 damages. He claims to have been nearly paralyzed and rendered nearly blind from injuries received in an accident on the Fort Snelling line, and sued for $62,000. The defense charged that Webber was shamming.

W. H. Weed and Warren Hinchey have been granted a twenty-year franchise in Weyauwega, Wis., and the village agrees to take 12 arc lights for five years at $45 per year on the moonlight schedule or $72 per annum all night for 1,500 candle power. They are given 180 days to get the plant in operation.

The White River Water Power company of Tacoma, Wash., has been incorporated with $2,000,000 capital stock under the laws of New Jersey. The company will build a plant in the Stuck valley, ten miles from Tacoma. It expects to secure 20,000 horse power and will transmit it to Seattle, Tacoma and other towns.

Commodore W. J. Kountz of Allegheny, Pa., has made a proposition to the Yankton, S. D., council to construct and maintain an electric street railway line of several miles, and Mr. Pettigrew, owner of the present street railway, has offered the line to Mr. Kountz if he will operate it. The council will probably act favorably in the matter.

Mayor Weaver of Mankato, Minn., refuses to approve the contract with the Mankato Gas & Electric Light company to provide 100 arc lamps of 1,200 candle power for $75 per year for five years, and the price for the succeeding five years to be determined by arbitration. He favors a municipal plant, and the question may be voted on at the spring election.

S. B. Livermore of St. Paul has been appointed receiver for the General Electric company of Winona, Minn., by Judge Sanborn on the application of the Old Colony Trust company of Boston. Charges of mismanagement against the ex-officials are made, and a public meeting was called at which evidence was called for against the accused, but no one responded. The books of the concern will be gone over by an expert accountant and the committee will pursue its investigations. M.

## PERSONAL.

Elmer P. Morris of Morris & MacCurdy, Indianapolis, recently called on his Chicago friends.

President J. H. Rhotehamel spent Tuesday of last week in Chicago, returning in the evening to St. Louis.

Bertram M. Downs, representing William Brookfield of New York, manufacturer of glass insulators, is in Chicago.

Wm. H. Hornberger, formerly of Elkhart, Ind., but now a resident of Sycamore, Ill., is visiting Chicago in company with his brother.

General Manager B. L. Hadley of the Commercial Electric company of Indianapolis, Ind., passed through Chicago last week.

George W. Harris, president and general manager of the Electric Power Storage company of New York, has been spending several days in Chicago.

H. J. Medbery, president of the Fiberite company of Mechanicsville, N. Y., was in Chicago on Monday. Mr. Medbery is making an extensive western trip.

General Manager Herbert H. Brooks of the American Circular Loom company was calling last week among his numerous Chicago friends. Mr. Brooks is becoming quite a Chicagoan.

## TELEPHONE.

Phenix Telephone & Manufacturing company, Chicago; capital stock, $100,000; to manufacture electrical apparatus; R. Brown, Chicago.

## TELEGRAPH.

The Chicago, Milwaukee & Lake Superior Telegraph company has been absorbed by the Postal Telegraph-cable company, and after the annual meeting of the former company it is probable that it will pass out of existence. The Postal company has long sought to obtain control of the Milwaukee company, and it was only accomplished by the quiet purchase of the stock. It was not until the Postal company assumed control of the Chicago, Milwaukee & Lake Superior lines that the Milwaukee stockholders were aware of the true indentity of the purchasers of the majority of the stock, and the discovery, it is stated, is anything but pleasing to them. It is the intention of the Postal company to extend its service in Wisconsin. The Chicago, Milwaukee & Lake Superior line consists of a single wire running from Milwaukee north through Plymouth, Sheboygan, Fond du Lac, Oshkosh, Appleton, Green Bay, Oconto, Marinette and Menomonie, through to Marquette, with a connection with West Superior. From Milwaukee to Chicago the company leased a single wire. Plans have already been perfected for the opening up of several lines running to nearly every town of importance in the state. The coming summer will be a busy one for the company. Attention will be first directed to putting the present line in shape and two carloads of heavy copper wire have been shipped to points between Milwaukee and Marquette for the rewiring of the entire line. The line will have to be practically rebuilt. Early in the spring workmen will commence setting poles for a line that is to make connections between Milwaukee, Janesville, Beloit, Madison and the adjacent country. The company will also open offices in connection with the present line in towns through which the wires run, but at which there are no offices at the present time.

## POWER TRANSMISSION.

Among the numerous schemes talked of for the electrical utilization of water powers is the following, which is heralded from Tacoma, Wash: "An immense electric power house, next in size to the Niagara Falls plant, is to be built this year in the Stuck Valley, 10 miles east of Tacoma. To carry out the project the White River Water Power company, with a capital of $2,000,000, has been incorporated under the laws of New Jersey. Water power is to be secured by tapping the White river below Buckley, from which, by a simple conveyance of an open ditch, it will be carried to Lake Tappa, near Sumner, which will be utilized as a storage reservoir. From the end of the lake, by a flume over a natural grade, the water is to be delivered to the edge of the bluff overhanging the Stuck Valley, giving a fall of 400 to 500 feet to the power house, where will be located generators capable of developing 20,000 horse power, not counting the surplus power stored in Lake Tappa, by use of which 50,000 horse power can be developed. It is calculated that Tacoma and Seattle can use 5,000 horse power and other towns 3,000, leaving 12,000 horse power to meet the natural growth of the two cities. An expert sent here by the Westinghouse company has pronounced the scheme feasible."

## TRADE NEWS.

The India Rubber & Gutta Percha Insulating company, New York has issued a neat price-list, together with other interesting data which will be appreciated by wiremen and central station managers.

Albert and J. M. Anderson of Boston report a large increase in their orders for Ætna railway insulators and the various Anderson line material during the past month, and indications now are for an unusually busy season.

The Mason Electric Equipment company of Chicago has removed its office and storeroom from 7 Adams street to 24 Plymouth place. The company is prepared to fill orders for the Medbery overhead material from the large stock carried in Chicago.

The Globe Electric Light company of Boston announces that it has concluded arrangements for the purchase of a factory, and it will take possession as soon as the present plant can be removed. The company anticipates largely increased business during the coming year and is preparing to take care of it.

Morris & MacCurdy are just finishing one of the largest electric and combination fixture contracts ever let in Indianapolis at the Industrial Training School. The firm is opening up a regular fixture department in connection with its insulating paint business, and is building a warehouse and putting in a steam plant for manufacturing Phœnix paint.

On Saturday night, March 10th, fire destroyed the sixth and part of the fifth floors of the Boylston building, Chicago, occupied by the *Street Railway Review*, and made it necessary to find new quarters at once. The offices of the *Review* are temporarily located upon the seventh floor of the Old Colony building. New headquarters on the eighth floor of this building will be made ready at once, where the representatives of the paper will locate permanently and be glad to receive their friends.

The Boudreaux Dynamo Brush company has opened an office at 423 Postal building, New York. The favorable comment passed by experts on its brush at the Cleveland convention has been amply confirmed by its reception in New York, and already a large number of orders have been booked. Hugo Benedix, the representative of the company, regards the outlook for steady business in the East as remarkably good, especially as the Boudreaux dynamo brush can be applied with equal success to anything from a fan motor to a multipolar machine.

The Dean Steam Pump company, Holyoke, Mass., is furnishing pamphlets to the trade illustrating in a condensed form several machines and specialties of the company. The company says that the pumps illustrated are selected from its regular line as examples of "up-to-date" specialties, and represent the latest and most approved designs of their separate classes. It will furnish specifications, photographs or drawings promptly on application. Sample machines of each class can be seen in any of the company's stores or at the factory and careful inspection is invited. The company has branches at New York, Boston, Chicago and Philadelphia.

The announcement that R. B. Corey, formerly general manager of the Electric Construction & Supply company, New York, has opened offices at 714 Havemeyer building, New York, will be received with pleasure by his numerous friends in the electrical business. Mr. Corey will make a specialty of imported carbons and arc lamps for incandescent circuits. Mr. Corey has had many years' experience in this line of business. He will handle a complete line of arc lamps, including plain and ornamental series, direct and alternating current lamps, twin lamps, focusing lamps of every type, photo-engraving lamps, searchlights, and complete theatrical outfits. John C. Knight, under whose patents the Electric Construction & Supply company manufactured arc lamps, will be connected with Mr. Corey. Their friends will wish them renewed success in their new undertaking.

Samples of micanite paper, cloth and plate have been distributed by the Mica Insulator company, 218 Water street, New York, together with a card containing suggestions to users of this material. The plate, from which commutator segments, rings, etc., are made, is of light color, almost transparent, showing a smaller proportion of cement than heretofore. This improvement has been attained by special machinery and greatly improved methods. The company has grown steadily, even through the general depression, and now that business is looking up, finds that it has to double the capacity of its works. Regarding the use of micanite the company says: An important point in making or refilling commutators is the necessity of applying heat during the process of building, and from long experience the following method is recommended to correct for such ills as loose bars, cement oozing out, or oil soaking in, if micanite segments or rings are used: After assembling the commutator, heat it to about 200° F., or just enough to make the micanite pliable, then tighten the bars or rings as much as possible. The pliability of the micanite will allow the distribution of unequal strains, and will counteract to a great extent irregularities in the dimensions of other parts of the commutator. Then continue the heating, but this time let it reach 400° F., or until the cement, which will have oozed out here and there, has become dry. Then retighten the commutator, either hot or cold, but preferably in both states. Do not tighten during the progress of this second heating, but wait until the cement is baked dry. When no proper arrangements are provided for heating, the commutator can be put for a few minutes inside a boiler furnace door or on a gasoline stove, or on a plate placed over a blacksmith's forge.

## BUSINESS.

The Bryant Electric company has a double-pole flush switch in stock and also 10, 20, and 30 ampere Cleveland snap switches, single-pole, admirably adapted for 500 volt circuits.

President William H. McKinlock of the Metropolitan Electric company returned to Chicago Saturday of last week after a hurried trip out of the city. Mr. McKinlock is one of the most aggressive supply men in the West, and he is always to the front where there is business to be secured.

The New York & Ohio company of Warren, O., announces that it has established an office at 213 Beery block, Minneapolis, where it will carry lamps in stock for immediate delivery. The company recognizes the necessity of having a stock of Packard lamps at a convenient distributing point for the northwestern trade.

The Mather Electric company of Manchester, Conn., reports the sale, through H. B. Coho & Co., of the *Mail and Express* building, New York city, of one 250 light and one 350 light improved Mather ring type dynamos for the new lighting plant of the Portland apartment house, Washington, D. C., Coho & Co. having been awarded the contract for the entire plant, including McIntosh & Seymour engines, piping, fittings, etc.

"Some Philadelphia Men of Letters" is the title of a neat pamphlet issued by the Gerson Electrical Manufacturing company of New York. It contains a very favorable report of efficiency tests of telephones submitted to the Department of the Interior, Washington, January 7, 1885, under the specifications of November 10, 1894, by the board of experts of the Patent Office, under supervision of the secretary of the interior. There are also numerous testimonials from Philadelphia business men who have used the company's system and recommend it highly. A list of places in which the company's telephones may be seen in everyday use is given.

The Electric Appliance company, Chicago, is entering upon an active campaign for lamp business with the original Packard lamp with platinum leading-in wires as it was made before the incandescent lamp litigation. The company is making some very strong claims regarding a rather remarkable improvement which has recently been achieved in the manufacture of the Packard lamp, by means of which it is claimed the lamp increases in candle power and efficiency during its life. The importance of such an improvement cannot be over-estimated, and, if it is true to any marked extent, it will readily be seen that the comparative first cost of the lamp drops almost out of consideration, as a small increase in candle power and efficiency during its life will result in a saving of several times the original cost of the lamp. The trade will undoubtedly investigate the claims that are being made.

The Central Electric Company, Chicago, is much elated over the marked success which iron-armored insulating conduit is meeting. This tubing, as in the case of the brass-armored interior conduit, is a still further development of the art of which the Central company was pioneer. It consists of its well-known plain insulating tubing placed within a heavy wall, lapped seamed, wrought-iron pipe, furnishing an iron armor one-eighth inch in thickness. The insulating tube is firmly attached or cemented to the interior of the iron pipe and a cross-section will show that it is so firmly consolidated with the iron that, in reality, it forms a part thereof. The flexibility of the system is maintained by the use of iron-armored insulating junction boxes, elbows and couplings. The iron-armored insulating conduit possesses all the qualities of gas or water pipe, and can be installed with equal ease by the use of tools for cutting, threading, etc. In this connection may be mentioned a number of parties now using iron armored conduit and in their respective establishments: Philip Armour, Jr.'s, house on Michigan avenue, Chicago, is equipped with it, and A. C. Slaughter's, also in Chicago, is to be equipped with it, as this conduit is called for in the specifications. In addition to this the Milwaukee city hall is to be tubed with it, also the Sioux City postoffice and the Duluth postoffice, as well as many other government buildings, including the new Interior Department building in Washington. Mr. McKinlock has reason to be satisfied with the success with which this improvement in conduit has met, and the following extract from the rules and requirements of the National Board of Fire Underwriters for the installation of wiring and apparatus for electric light and power, edition of January 1, 1895, would seem to indicate a great future for iron armored conduit: "The use of two standard wires, either separate or twin conductor, in a straight conduit installation, is approved in the iron armored conduit of the Interior Conduit & Insulation company, but not in any of the other approved conduits."

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued March 12, 1895.*

535,345. Closed Conduit Electric Railway. Edward M. Bentley, Boston, Mass. Application filed December 11, 1885.

The first claim follows: The combination with conductor of a single track electric railway, of a double track road arranged so that the single and double tracks run into one another, and provided with continuous conductors for each of the double tracks, and a movable conductor section in each of the branches of the double track portion of the railway, adapted to alternately form a continuation, whereby locomotives may pass from the single to either of the double tracks, and vice versa.

535,363. Electric Heating Apparatus. Mark W. Dewey, Syracuse, N. Y. Application filed March 12, 1894.

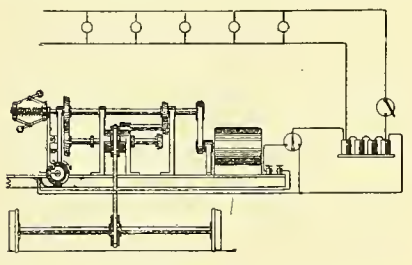
As shown in the cut, this heater comprises a plate or support a resistance conductor wound on it, and an inclosing case provided with exterior fastening devices, and with interior supports, curving over the top and bottom of the plate, whereby the heater is supported, with an air space surrounding it, the case being perforated to allow free circulation of air and open at the back to permit the heater being secured in close proximity to a wall or support.

535,370. Electric Clock Striking Mechanism. Fred L. Gregory, Chicago Ill. Application filed January 30, 1894.

One claim is given: The combination with an electrical circuit embodying an electro-magnet and a reciprocatory armature or striker carrier, of a striker carried by said armature, a switch intermediate to said armature and the electrical terminals of the circuit, means connected with said striker carrier for actuating the switch, a hold-back device adapted for engaging and arresting the movement of the striker carrier at predetermined intervals and at its mid-stroke position, and means for periodically releasing said carrier.

535,398. Conduit Electric Railway. Daniel O'Flaherty, Kansas City, Mo. Application filed March 31, 1894.

The cut shows a slotted conduit, having openings at intervals in one of its side walls and insulation rings fitting therein, an auxiliary conduit also having openings at intervals, which occur opposite the openings of the slotted conduit, casings inclosing the auxiliary conduit at corresponding intervals, and thereby surrounding the openings in the conduit, an electric cable extending continuously through and insulated from the conduit, and insulation blocks within the casings, of contact



NO. 535,443.

rods within the casings and protruding into the slotted conduit and surrounded by insulation blocks, springs engaging the contact rods and holding them normally away from the cable, a car, a motor carried thereby, and a contact shoe electrically connected to the motor and carried by the car and depending into the slotted conduit, and formed at one side with the beveled ends

535,443. Electric Lighting System. Joseph I. Conklin, Brooklyn, N. Y. Application filed July 30, 1894.

The arrangement illustrated includes the dynamo, the driving shaft connected with the dynamo and with a car axle and the battery connected with the dynamo, the governor mounted on the shaft, the pivoted lever, one end of which abuts against the movable collar of the governor the oscillating disk formed of non-metallic and non-conducting material, provided with a pin which engages with the lower end of the lever, the retractile spring connected with the lever, the peripheral metallic sections secured to the disk, the contact spring bearing against the disk and connected with a conductor leading to the battery, and a contact spring also bearing against the disk and connected with a conductor leading to the dynamo, the construction being such that when the driving shaft is at rest the lever will oscillate the disk and throw the contact springs out of metallic connection, and thereby open the circuit between the dynamo and battery.

535,464. Battery. Henri N. F. Schaeffer, Manchester, N. H. Application filed January 9, 1893.

The electrolyte for batteries described consists of a mixture of lactic acid, a mineral acid, an alkali and an antiseptic.

535,484. Electric Burglar Alarm and House Call. Henry L. Carpenter, Minneapolis, Minn. Application filed April 16, 1894.

The combination is claimed with suitable circuit closers and devices, such as doors, windows or the like, whereby the same are adapted to operate the circuits extending from the circuit closers, electro-magnetic recording devices included in the circuits respectively, a bell or alarm included therein, a moving time sheet or strip to be operated upon by the recording devices, and automatic means for opening or closing the alarm and recording device circuits at desired times.

535,488. Thermo-electric Generator. Harry B. Cox, Hartford, Conn. Application filed March 8, 1893.

A thermo-electric pile built up of sections of thermo couples, and provided with an exterior coating of plastic refractory material, the sections being electrically connected in circuit by internal electrical connections within the coating is described.

535,489. Thermo-electric Generator. Harry B. Cox, Hartford, Conn. Application filed March 8, 1893.

This mode of constructing thermo-electric generators consists in forming a cylindrical or hollow thermo pile, coating the pile with plastic refractory material, and intimately securing a metallic jacket around the refractory material.

535,490. Thermo-electric Generator. Harry B. Cox, Hartford, Conn. Application filed March 8, 1893.

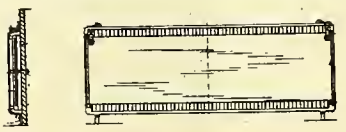
A thermo-electric pile provided with the outwardly projecting radiators from its outer surface independent of the elements of thermo couples.

535,491. Indicating System for Thermo-electric Generators. Harry B. Cox, Hartford, Conn. Application filed January 31, 1894.

This arrangement consists of a thermo-electric generator, having a water jacket which is provided with a water supply having a cut-off valve forming a circuit-maker and breaker, and an electrically operated alarm, and a circuit including the generator and the alarm and controlled by the valve.

535,511. Electrical Controller, Elmer A. Sperry, Cleveland, O. Application filed November 11, 1893.

A series motor, a plurality of exterior circuits for the motor, means connected therewith for changing the connections of the motor from one to another of the exterior circuits, a resistance controlled by these means in combination with an independent resistance permanently in one of the outside circuits controlling the current in the field magnet coils and the circuit.



NO. 535,363.

535,524. Clamp for Trolley Wires. Warren W. Annable, Grand Rapids, Mich. Application filed November 23, 1894.

The device is described as a pair of jaws having concave lower ends and a screw to separate their upper ends, loops on one of the jaws and studs on the other, the studs having laterally projecting pintles engaging the loops.

535,530. Starting Alternating Motor. Ossian Chytræus, Pittsfield, Mass. Application filed December 4, 1894.

The first claim is for the combination with an electric current motor, having field magnet poles circularly shifted relatively to one another about the armature, of means for changing some of the coils from being closed respectively upon themselves to being open, the remaining coils being in circuit with one another.

535,533. Electric Switch. Mark W. Dewey, Syracuse, N. Y. Application filed January 11, 1895.

This device consists of a cylinder of insulating material, strips of metal secured in longitudinal rows across the cylinder and projecting beyond the surface, a longitudinally movable bar within the cylinder, connected to the latter by a spline and groove, a knife switch connected to one end of the bar, an indicator carried by the same bar and rigidly secured to it, a handle on one end of the bar to operate it, and a series of contacts arranged in a row and adapted to engage the strips successively.

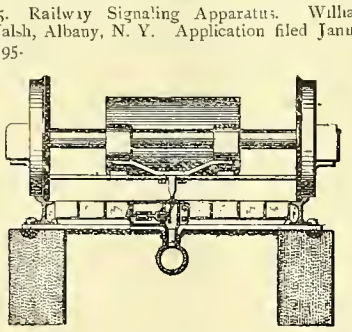
535,540. Automatic Telephone Switch. Newman H. Holland, Montreal, Can. Application filed August 10, 1894.

The switch described consists of the combination of flexibly jointed tubular ear-pieces, a spring holding them together, a single tube attaching them to the receiver, suitable contact points or terminals mounted thereon, and contact springs or pieces co-operating with the ear-pieces, adapted to be moved thereby.

535,541. Method of Constructing Secondary Batteries. Arthur Hough, San Francisco, Cal. Application filed September 14, 1893.

This method of constructing a plate for secondary batteries consists in mixing dry monoxide of lead and sulphate of magnesia producing a paste of the resultant mixture with water and sulphate of ammonia, or an aqueous solution of ammonium sulphate spreading the paste on a support and allowing it to set, then dissolving out the sulphate of magnesia

535,565. Railway Signaling Apparatus. William H. Walsh, Albany, N. Y. Application filed January 24, 1895.



NO. 535,398.

A main track separated into consecutive insulated sections, a shunt track branching from one of the sections and insulated from the section at the point where one of its rails crosses it, the shunt track having its section adjacent to the main track insulated from an adjacent section, conductors extending along the main track and electrically connected with the rails of an adjacent section, connections between the rails of the shunt track and said conductors, and a carriage adapted to move along the track and provided with brushes in position to engage the conductors and in circuit with a battery and signal.

535,579. Armature Conductor for Dynamo-electric Machines. Henry Geisenhöner, Schenectady, and Christian Sandman, Niskayuna, N. Y. Application filed January 15, 1895.

Armature or other conductors carrying electric currents, wound around spirally with twine or other suitable material, each successive convolution being spaced an appreciable distance from the preceding one for the purpose of providing, when conductors are arranged in groups or inserted in slots, a space for the circulation of air around the conductors for the purpose of insulating and ventilating the same.

535,589. Electric Arc Lamp. John C. Knight, New York, N. Y. Application filed March 2, 1894.

In an electric arc lamp there is an automatic cut-out in the shunt circuit, consisting of the movable carbon-carrying rod provided with a notch; a pivoted counter-balanced arm is mounted on the frame of the lamp, with its elevated end normally in engagement with the rod, and means for holding the arm in engagement with the rod until the rod passes out of reach.

535,615. Telephone. William W. Dean, St. Louis, Mo. Application filed September 24, 1894.

A central office telephonic apparatus is described, consisting of a bowed piece of insulating material adapted to be sprung over the head of the operator, a telephonic calling appliance secured to one end of the bowed piece and constructed to be applied over one ear of the operator, and an independently operated signal-giving device at the other end of the bowed piece, adapted to be placed near by, but free from the other ear of the operator.

535,660. Insulator. Warren J. Belcher, Hartford, Conn. Application filed January 16, 1895.

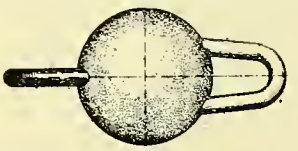
As shown in the illustration two tension members are linked, one through the other, with an insulating pressure plate between and separating them, and engaging the members to limit the rotative movement of one of the members relatively to the other of them, whereby the tension members are positively held longitudinally and rotatively out of contact.

535,679. System and Apparatus for Applying Brakes to Electric Cars. Charles E. Davis, Chicago, Ill. Application filed December 29, 1893.

In an electric brake, a retarding device, a magnetic friction surface, a source of magnetization and an iron lever arrangement between the source and surface, whereby the magnetization acts in a two-fold manner to arrest the motion.

535,692. Carbon Holder for Arc Lights. Adam W. France, Philadelphia, Pa. Application filed November 10, 1894.

A carbon holder is described, consisting of a jaw, a yoke connected therewith, a threaded boss on the ends of the yoke, a loose jaw within the yoke, a cap on the boss, and a spring interposed between the loose jaw and cap.



NO. 535,660.

535,703. Electric Cableway. Richard Lamb, New York, N. Y. Application filed July 19, 1894.

The combination is claimed of an electric locomotive suspended from a supporting cable and an adjustable ballast.

535,745. Telephone Exchange Apparatus. Charles Felix Gaston Marie Bigot de la Touanne, Paris, France. Application filed December 30, 1893.

The last claim follows: The combination with a switch socket provided with a rigid contact, of a plug provided with a resilient tip, adapted when the plug is inserted in the socket to be bent aside and form a rubbing contact with said rigid contacts.

535,796. Construction and Regulation of Dynamo-electric Machines. Charles D. Haskins, Brooklyn, N. Y. Application filed August 6, 1894.

The combination is claimed in a dynamo-electric machine of symmetrical sets of field pole pieces, the different sets being connected in multiple arc, and a rheostat placed in connection with one of the limbs of the multiple arc circuit, and adapted to vary the current flowing through the helices therein.

535,797. Regulation of Dynamo-electric Machines. Charles D. Haskins, Brooklyn, N. Y. Application filed August 6, 1894.

Claim one follows: The combination with a dynamo-electric machine, having two sets of field magnet pole pieces and connected with the circuit of the machine, of an automatic switching device adapted to control the amount of wire of the coils of one set that shall be traversed by the current, and to control the direction in which the current shall traverse the wire of the coils or a portion thereof.

535,806. Automatic Central Telephone Switch Apparatus. Franz Nissl, Vienna, Austria-Hungary. Application filed February 17, 1894.

An automatic telephone system is described, comprising a main line, including a central station, a plurality of branch lines converging to the main line each including a subscriber's station, and means at the point of convergence of the aforesaid lines adapted to automatically and successively connect the subscribers' lines with the main line for a definite period of time, of mechanism controllable from any of the stations adapted to prolong the period of connection, and means beyond the control of any of the stations adapted to automatically interrupt such connection

REISSUE.

11,478. Electrical Fixture. Luther Stieringer, New York, N. Y. Application filed December 21, 1894.

A fixture for electric lights constructed wholly or largely of metal and provided with insulated conducting wires for conveying current to and from the lamps carried thereby, in combination with a joint or section having metallic coupling portions and an intermediate section of insulating material electrically insulating the metallic coupling portions from each other, such joint being located at the upper or inner end of the fixture, and serving to electrically insulate the fixture from the grounded piping of a house by which it is supported.

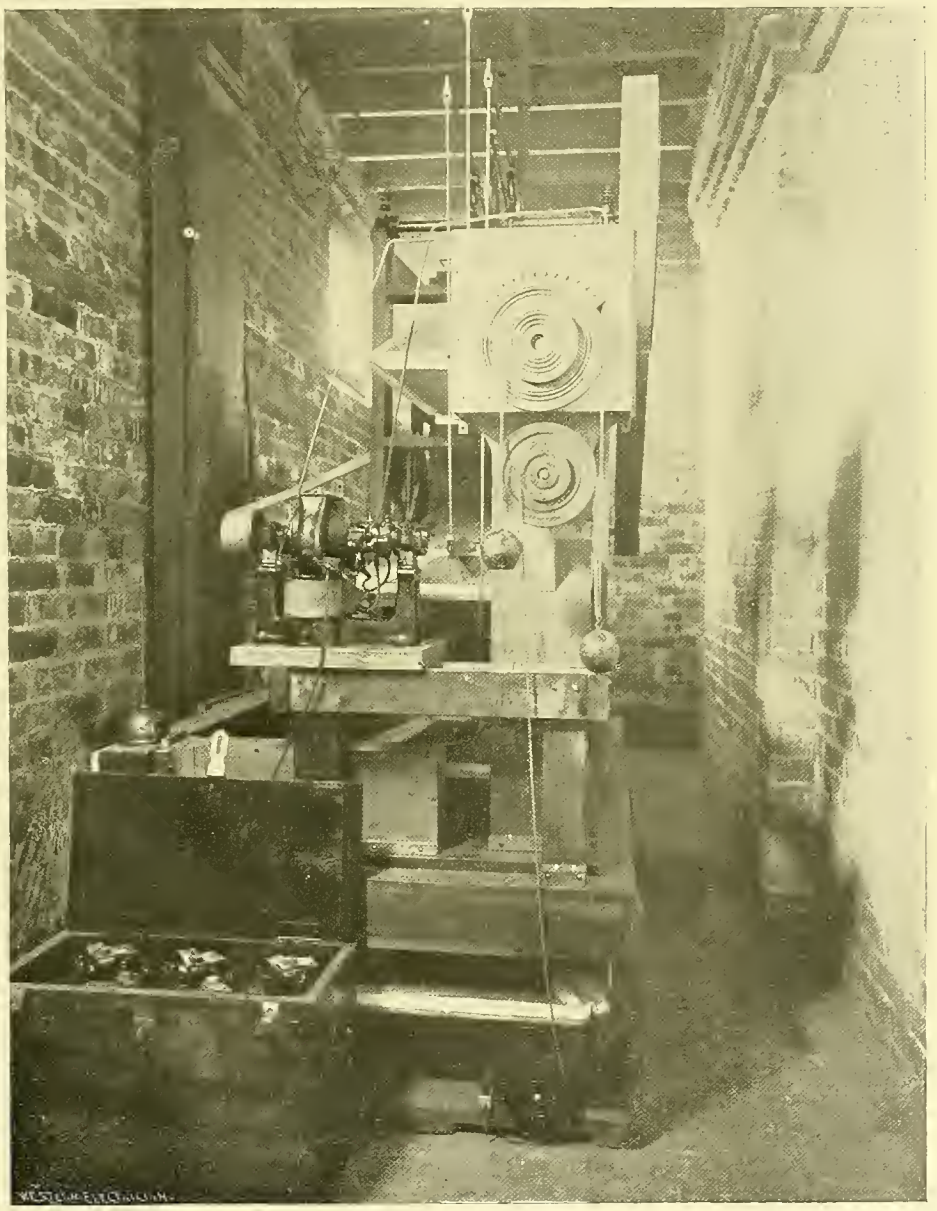
# Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, MARCH 30, 1895. No. 13


## Portable Storage Battery Outfit for Organ Motor.

An interesting and rather unusual combination of storage batteries and a low-voltage motor for operating the bellows of a pipe organ has recently been installed in the residence of ex-Congressman George E. Adams of Chicago. The mechanism is in the basement of the residence and is shown by the accompanying illustration. The novelty consists in the fact that the cells are encased in portable boxes and are sent to the North Side station of the Chicago Edison company, nearly two miles distant, for charging whenever necessary. This plan was made necessary by the absence of any lighting or power circuit in the vicinity of the house, which is on the corner of Belden avenue and Clark street.



PORTABLE STORAGE BATTERY OUTFIT FOR ORGAN MOTOR.

Eighteen chloride 100 ampere-hour cells of the type known to the manufacturers as "E 5" are encased in three wooden boxes, six in each case. One of these battery boxes is shown in the foreground of the picture. The boxes are 20 inches long, 15 inches high and 10 inches wide, and each weighs, with the batteries, about 150 pounds. They are wired in series by connecting cords with a ¼ horse power Crocker-Wheeler motor wound for 35 volts and operated at 1,300 revolutions per minute on the frame of the organ bellows. By belt connection the little motor drives a three-feeder bellows at 50 revolutions per minute. The controlling switch is on the organ, and an automatic weight-operated rheostat cuts the motor in or out of circuit according to the amount of air in the reservoir bellows in the manner usual in electric organ blowing installations. The organist has simply to turn the switch on sitting down at the keyboard; the remaining action of the mechanism is entirely automatic.

To prevent leakage the rubber jars are completely sealed. The connecting wires are made to fit plug and clamp binding posts, and no difficulty is experienced by persons entirely unfamiliar with electrical apparatus in disconnecting and re-connecting the batteries and motor. The batteries can be charged in five or six hours, and it is easy for a servant to place the three boxes in a light wagon, drive down to the station in the morning, call for them in the afternoon and have the newly charged cells all connected by evening. With one charging the batteries will operate the motor and bellows for at least 15 hours continuously, and in practice the cells are taken away for charging about once in two weeks. The interval when the power is cut off is so short that the current is really available whenever needed. This is probable the first installation in the country in which portable storage batteries are used for operating an organ motor. It has proved entirely practicable, however, and is now very favorably regarded by the builders of the organ, Lyon & Healy, who were not at all sanguine of the success of the plant. The electrical apparatus was supplied by Pierce & Richardson and installed under the supervision of F. L. Merrill. It gives a hint of the possibility of greatly extending the use of the electric current in suburban homes.

## Reported Business Agreement Between General Electric and Westinghouse Companies.

Persistent rumors are afloat in New York to the effect that the General Electric and Westinghouse companies have arrived at some sort of an understanding in conducting their business. There seems to be little doubt that negotiations have been in progress to the end of securing more amicable relations, but it is unlikely that an actual consolidation will result. It is far more probable that an agreement will be or has been reached by which ruinous patent litigation and the disastrous cutting of prices will be stopped. It would be impossible for the consolidated General Electric and Westinghouse companies or any other combination to monopolize the electrical business of the country, and no one knows this fact better than the astute gentlemen who control the great corporations named. Possibly the two companies have found that patent litigation and rate cutting are unwise and unprofitable and have agreed to compete in business on different lines and with less feverish eagerness. The following expression of opinion from a Chicago patent attorney is interesting:

"Now [after the Bate decision] the Westinghouse is free to manufacture these valuable inventions. Hence the apparent desire of an agreement or a pool, or anything that will prevent prices from being cut to low points by competition. I have observed personally and heard incidents which have confirmed me in the belief for some time that the two companies were trying to come together. The same men in New York are interested in each. They are friends. They have met frequently, I know. If an agreement has been reached I do not believe that a trust is implied. The electrical manufacturing industries of the country have reached a point where a general amalgamation would be almost an impossibility. There are several very large concerns which will not enter a combine under any circumstances. One is in this city."

The *Boston Herald* of March 26th prints this statement from a New York correspondent: "A commission composed of lawyers and electricians is to be appointed to value the patent rights of General Electric and Westinghouse. All patents owned by the two corporations, including those now involved in litigation, will be submitted to the commission, which will make a valuation. Each company will thereafter have the right to manufacture under these patents, but each must pay royalty on patents assigned to the other."

## Electrically Operated Bridge for Cleveland.

Of recent applications of electric motors none seems to have met more prompt and cordial recognition than in the operation of draw-bridges. There are several conspicuous installations of this character in Chicago, Milwaukee and other cities, and now an announcement is made that the new Columbus street bridge in Cleveland will be similarly equipped. This bridge spans the Cuyahoga river and is of novel construction, having a double swing. In reality there are two swinging bridges, supported on center piers of masonry on either side of the river and meeting and locking over the center of the stream. Compressed air is used to operate the folding apron which covers the space between the halves when the bridge is swung in position for road traffic. It also actuates the safety gates and the locking mechanism. The bridge is built of steel and has an extreme length of 279 feet, spanning a clear channel of 115 feet in width. Each half of the bridge will be revolved by a separate equipment of motors, operated on a 500 volt circuit. The bridge was designed by City Engineer Rice of Cleveland, and the contract for the entire electrical and pneumatic equipment has been awarded to Geo. P. Nicholls & Bro.

of Chicago, whose work on the electrical rolling lift bridge at Van Buren street, Chicago, has attracted much attention.

## A Method for Preventing Armature Reaction.[1]

By Harris J. Ryan and Milton E. Thompson.

In the designing of continuous current dynamo machinery probably nothing has presented so much difficulty as the problem of avoiding the various evils resulting from the magnetic effects of the current that passes through the armature of the machine. Such magnetic effects are usually spoken of as armature reaction. These evils are at the present time well known, and pretty well understood by the electrical fraternity in general, and the modern dynamo

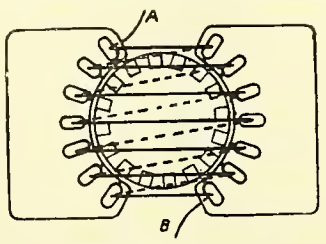
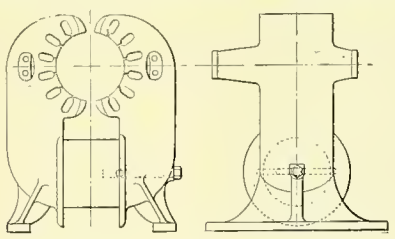



FIG. 1. A METHOD FOR PREVENTING ARMATURE REACTION.

designer who is not thoroughly well posted on the subject would be wholly unable to design machinery capable of successful competition with some of the machines now on the market. The tendency of the currents that circulate in the armature coils is to produce a cross magnetism through the core at right angles to the natural field, resulting in a distortion of the natural field of the dynamo—a piling up of the magnetic lines under the trailing pole corners, and a weakening of the field under the leading pole corners. This distortion, of course, increases with the current furnished by the machine, and if not especially provided against it may result in bringing the trailing pole corners to complete saturation, and in completely reversing the field under the leading pole corners. While this distortion is no great evil in itself, the resultant effects may be and usually are very serious evils. All distortion of the natural field of a dynamo is sure to be attended by a diminution of the field strength resulting in a falling off of the electromotive force produced by the dynamo, and if the distortion be very great no amount of compounding will cause such a dynamo to give constant potential. The most serious evil, however, arises from the fact that the weakening of the field at the leading pole corners results in a shifting forward of the neutral point or diameter of commutation of the dynamo. The amount of such shifting depends on the amount of distortion, and this in turn varies with the load on the machine. Consequently, if the brushes are set on the normal neutral point when running light, the machine will spark badly under load, and it becomes necessary to keep shifting the position of the brushes to meet every variation in load. More than this, unless the pole tips or armature lugs are saturated, a point of loading is soon reached beyond which one finds no diameter of sparkless commutation, and the output of the machine has reached a maximum at this point, notwith-



FIGS. 2 AND 3. A METHOD FOR PREVENTING ARMATURE REACTION.

standing the fact that the load may be below that allowed by a safe heating limit. These facts, as before stated, are well understood by the more competent dynamo designers, and receive the most careful consideration in the preparation of new designs. It must be confessed, however, that the principal part of the knowledge on this subject is the result of dearly bought experience and costly experiments, rather than of scientific study of the principles involved. Designers of dynamo machinery, with few exceptions, instead of aiming to prevent armature reaction, have endeavored to avoid its bad effects in various ways, and in some cases with fairly good results. The distorting effects of armature reaction become less in proportion as the reluctance of the air-gap and armature core teeth are increased, and the wiser designers of the present day, taking advantage of these facts, are producing some very creditable machines. Probably some of them still believe, as some of the very best authorities on the subject of dynamo machinery have confessed to believing until quite recently, that armature reaction is a necessary evil, and if it were possible to prevent it entirely, the whole utility of the machine would disappear at the same time.

While making a thorough consideration of the subject of armature reaction some time since, one of the authors of this paper devised a means of entirely preventing armature reaction and resulting field distortion. On looking up the literature of the subject we found, mainly through the patent office records, that there were several workers in the field at a comparatively early date, including Prof. Elihu Thomson, Messrs. Andrews and Spencer, Mather, Forbes, and possibly one or two others. The specifications given by Andrews and Spencer indicate clearly the technical side of this method for preventing armature reactions, while our part appears in the development of a plan for the practical application of the scheme technically outlined by them in 1886. This method consists in general in surrounding the armature with a stationary winding exactly similar in its magnetic effects to the armature winding, but directly opposed to it, and thus completely balancing all armature reaction. Fig. 1 is a diagram that shows the manner in which the coils are applied. Holes are provided immediately back of the pole surfaces, and through these holes are wound conductors which are placed in series with the armature. The number of ampere turns of the balancing coils crossing each pole face is equal to, and opposite in direction to, the number of ampere turns on the corresponding part of the armature.

A small bipolar machine of about 2½ kilowatts capacity was designed, constructed and tested during the spring and summer of 1891, and the results obtained were very encouraging, demonstrating beyond doubt the correctness of one's understanding of the principles involved. Since that time some half-dozen or more multipolar machines of various sizes have been designed and constructed. All employ these balancing coils with various modifications of design and gave the following results.

Brief mention of these results have been made heretofore in the literature, while a complete report of the same is now made for the first time.[1] Figs. 2 and 3 are side and vertical

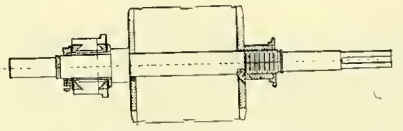


FIG. 4. A METHOD FOR PREVENTING ARMATURE REACTION.

views of the first machine; Fig. 4 is a side view of the toothed armature; and the following are the essential data of construction:

| | |
|---|---|
| Field of cast-iron, two poles | |
| Diameter of the armature core over all | 6 in. |
| Length of armature core | 6 in. |
| Number of teeth | 64 |
| Number of commutator bars | 64 |
| Armature turns per bar | 3 |
| Size of armature conductor B. & S. G. | 12 |
| Resistance of armature, ohms | .34 |
| Speed, revolutions per minute | 1,800 |
| Output, amperes | 25 |
| Output, volts | 100 |
| Turns on field, 250 of No. 7, B. & S. G. | |
| Balancing turns, wound in six grooves per pole face, 16 turns per groove, or a total of 96 turns of No. 8 B. & S. G. | |
| Resistance of balancing coils, ohms | .24 |

For dimensions of slots to accommodate balancing winding see Fig. 2.

The diagram of Fig. 5 gives the excitation characteristic at no load and a speed of 1,660 revolutions per minute. Fig. 6 is a diagram of results obtained by actual observation made on this machine when overloaded at normal excitation and speed, with and without the balancing coils. The pressure readings were taken at the brushes, and do not include the drop through the balancing coils when they were used. Characteristic I. was obtained without the use of the balancing coils; characteristic II. with the balancing coils, and characteristic III. is the same as II. with the balancing coils, when corrected for drop in pressure due to armature resistance. The same field excitation of 2,600 ampere turns was maintained at all times. It should be noted that without the balancing coils the pressure falls off uniformly and rapidly, from 109 volts at no load, to 41 volts at a load of 50 amperes, with violent sparking at all ranges of the overload. The potential differences due to the resistances of the carbon brushes were not nearly enough to reverse the currents in the coils while under the brushes, against the opposing electromotive forces produced by the reversed fields established by the powerful armature reactions. The electromotive force at the brushes falls off with a rapidity that is greater than that which would be due

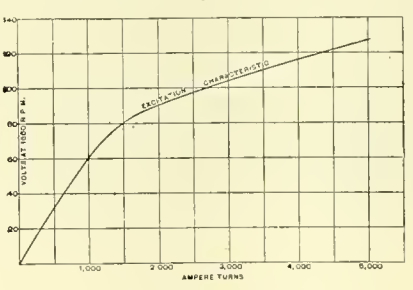



FIG. 5. A METHOD FOR PREVENTING ARMATURE REACTION.

alone to the resistance of the armature, because of the throttling action of those parts of the magnetic circuit that become saturated by the concentration of the induction by the route of the trailing pole corners. In marked contrast was the corresponding behavior of the machine with the balancing coils in circuit, as illustrated by Curve II. There was no sparking at any point of the overloading; the brushes were fixed on the no load position, that is, at the zero of field induction, and at all loads the currents in the sections were easily reversed without spark, by the potential differences that were caused by the resistance of the carbon. There was no observable falling off of the induction through the armature under load when the balancing coils were used; and this is clearly indicated by Curve III., which, as stated before, is Curve II. corrected for the fall of pressure due to the resistance of the armature.

The diagrams, with their respective legends that are given in Figs. 7 to 15 inclusive, are self-explanatory. Separate excitation was used on all the experiments on this machine. The pilot or third brush method was used for making the field explorations. In each instance the "exploration curve" is a record of the pilot brush readings, while the or-

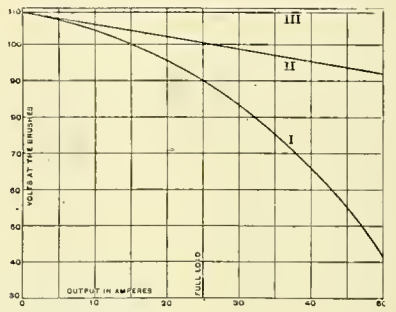



FIG. 6. A METHOD FOR PREVENTING ARMATURE REACTION.

dinates of the "magnetization" curve are proportional to the actual induction densities as deduced from the exploration curve. Fig. 7 shows that the induction is uniform over the entire pole face at no load, normal excitation and speed, as it should be without the coils. The motion of the armature conductors is from right to left. Fig. 8 shows the production of a reverse field in the presence of the brushes at a full load current, and normal field excitation without the balancing coil. Fig. 9 gives the result obtained for the same conditions, except that the balancing coil was used. The magnetization curve shows that the balancing coil slightly over-compensated the magnetic action of the armature, since the induction of the trailing pole tip is weakened, and that of the advance tip strengthened—a phenomenon just the reverse of what commonly occurs. The diagrams of Figs. 10 and 11 are for substantially the same conditions as those of 8 and 9, except that the machine was operated as a motor. The results are precisely those one would expect—the same as those obtained for the dynamo, except that the sides on which the higher inductions occur are reversed in position. Figs. 12, 13, 14 and 15 give interesting results that were obtained by lowering the field electromotive force and then operating as before. By operating as a dynamo or motor without the coil, extraordinary powerful armature reactive effects are produced. It is seen that the brushes are in the presence of a reversed field that is quite as great as the normal no-load field of 3,000 lines per square centimeter, and moderate sparking with the car-

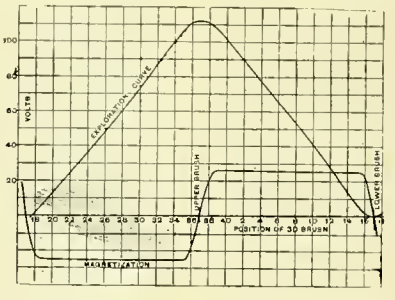



FIG. 7. A METHOD FOR PREVENTING ARMATURE REACTION.

Exploration Curve at No Load. E. M. F. 105 V. Exciting Current, 10.4 C. Speed, 1,800 R. P. M. Operated as a Motor, Without Balancing Coil.

bon brushes occurred. Here the balancing coils bring out an interesting effect. One would expect that the effects of their over-balancing action would be felt more at lower excitations. In this experiment the induction at the advance pole tip or the position of the "commutation fringe" is almost doubled from the normal no-load value instead of being diminished as is ordinarily the case. It is appreciated that the effect of such a behavior is to increase the strength of the commutating fringe at the leading pole tip in proportion to the load, thereby diminishing the range of change of the non-sparking point with metallic brushes, or enabling carbon brushes to be easily adjusted so that when in a fixed position there will be practically no sparking at all ranges of load.

The second machine that was built and which made use of balancing coils was a small one of the four-pole type with cast-iron field magnets. This machine was designed to have a capacity of 25 amperes at 80 volts, or 2 kilowatts when running at a speed of 1,200 revolutions. Fig. 16 is a diagram that shows the general design of the machine and Fig. 17 is made from a photograph of the actual machine. The essential features of the design were as follows: Type of machine, four-pole; field, cast iron in two pieces; armature, two-circuit drum winding through 58 grooves, five No. 10 B. & S. G. wires in each groove; 29 commutator bars; grooves milled out, size $\frac{5}{8}$ inch by $\frac{3}{4}$ inch; outside diameter of core 7½ inches, inside 3 inches, surface of completed armature wound with No. 14 B. & S. G. iron wire. Length of armature and poles, 6 inches each. Effective length of iron in armature core, 5 inches; magnetic leakage,

1. Read before the American Institute of Electrical Engineers, March 20, 1895.

1. "On a Method for Balancing Armature Reaction," *Sibley Journal of Engineering*, October, 1892, Vol. VII., p. 17. "Electromagnetism and the Construction of Dynamos," by Dugald C. Jackson, p. 172.

15 per cent. Field cores, 5 inches by 2 inches, with rounded ends; area, 9.14 square inches. Mean length of field magnetic circuit, 12.5 inches. Magnetic density in armature core, 5,400 gausses; in air-gap, 4,900; in the armature teeth, 8,400; in the field cores, 6,800. Field winding, mean length of turn, 15 inches, requisite exciting magneto motive force for field circuit, 1,145 gilberts; for armature, 31.3 gilberts; for air-gap, 1,258 gilberts; or a total of 2,434 gilberts; size of field wire, No. 18 B. & S. G. Number of holes for balancing coils, five in each pole-piece, even conductors per

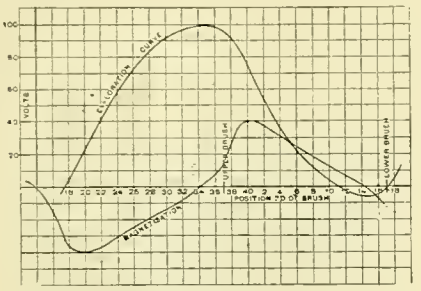



FIG. 8. A METHOD FOR PREVENTING ARMATURE REACTION.

Exploration Curve, Full Load. v. = 97. c. = .24 Exciting Current, 10 4 A. Speed, 1,800 R. P. M. Operated as a Dynamo, Without Balancing Coil.

pole or 140 conductors total. Weight of complete machine, 400 pounds.

An examination of this data discloses the fact that no regard is had for the pernicious effects that are ordinarily met with in the use of so short an air-gap with a comparatively large number of armature ampere-turns. With the use of the balancing coils no such effects were observed; the machine performed precisely in accordance with the original estimate made in designing it, and exactly as theory shows that ordinary machines would perform if armature reaction were entirely absent.

During test the machine was belted directly to a 10

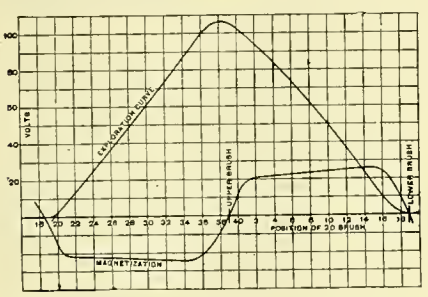



FIG. 9. A METHOD FOR PREVENTING ARMATURE REACTION.

Exploration Curve, Full Load. v. = 105. c. = 24.5. Speed 1,800 R. P. M. Exciting Current, 10.4. Operated as a Dynamo, With Balancing Coil.

horse power Sprague motor and ran at a speed varying from 1,500 to 1,650 revolutions per minute. The commutator was quite small for a four-pole machine; it had only 29 segments and was very poorly suited for the pressure of 100 volts at which it was tested. The machine was loaded down to 43 amperes at 100 volts, speed 1,650, and an exploration curve taken around the commutator. This curve is shown in Fig. 18 and clearly indicates the entire absence of field distortion. It was found that the machine would easily carry a load of 45 amperes continuously without overheating. After this curve was taken, the machine was loaded

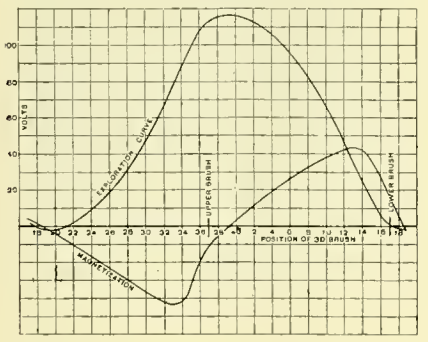



FIG. 10. A METHOD FOR PREVENTING ARMATURE REACTION.

Exploration Curve, Full Load. v. = 114. c. = 26. Exciting Current, 10.4 A. Speed, 1,920 R. P. M. Operated as a Motor, Without Balancing Coil.

down as heavily as the driving belt would permit and ran at a load of 80 amperes and 80 volts for about fifteen minutes. Under this load there was no appreciable difference from light load in the behavior of the commutator. The balancing coils were short-circuited for an instant while the machine was loaded to 40 amperes and the vicious sparking that ensued showed that the dynamo could not be operated at this load without the balancing coils. Indeed the indications were, that it would have been fatal to the welfare of the commutator, and perhaps to the armature itself, to entirely cut out the balancing coils when the machine was carrying this load. The balancing coils were then cut out and the dynamo gradually loaded down to test the performance without balancing coils. The brushes were shifted forward to prevent sparking as the neutral point changed and the potential was kept up as much as possible by cutting out field rheostat. The maximum current reached was 37 amperes at 85 volts, with field rheostat all out, and speed 1,800 revolutions per minute. At this speed and with this excitation the machine would have given 120 volts instead of 85, if the balancing coils had been used to prevent armature reaction. After a load of 37 amperes was reached, it was found impossible to raise the current by cutting down the external resistance, owing to the rapid fall of potential due to armature reaction. The capacity of this particular machine was about doubled by the addition of the balancing coils, and a comparison of the 37 amperes maximum with the 80 amperes, which was by no means the highest possible current, shows that the overload capacity of this machine may be doubled by their use.

Two more machines of the same general design as the latter were built and tested. These machines were built with field magnets of mitis metal, and the pole-pieces and armature cores were one inch longer than the machine last described. The armature windings were different from each

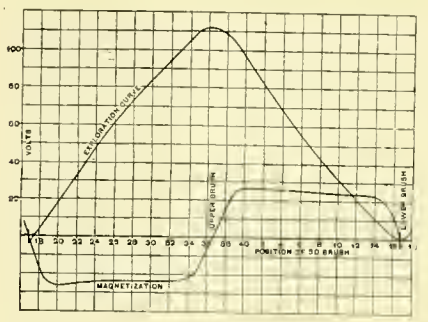



FIG. 11. A METHOD FOR PREVENTING ARMATURE REACTION.

Exploration Curve, Full Load. v. = 112 c. = 25. Exciting Current, 10.4 A. Speed, 1,920 R. P. M. Operated as a Motor, With Balancing Coil.

other and different from the cast-iron machine. One was wound with a two-circuit winding, and the other with a four-circuit winding. Total weight of each machine was 450 pounds. Each machine, after running at 1,200 revolutions per minute, carried a load of 85 amperes at 110 volts for two hours continuously, and was then loaded down to 100 amperes for a quarter of an hour. The performance of the machines confirmed in every particular the results previously obtained.

Two other machines of this same type were built—one of which was wound for a current of ten amperes at 600 volts, and the other for a current of 550 amperes at 110 volts, or 60 kilowatts.

This type of machine was found to be expensive to con-

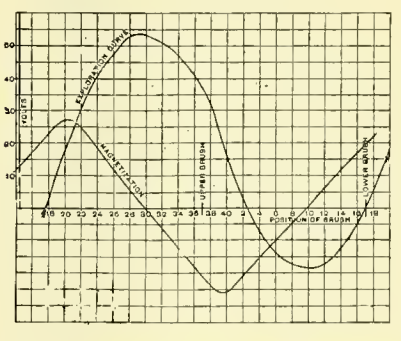



FIG. 12. A METHOD FOR PREVENTING ARMATURE REACTION.

Exploration Curve, Full Load. v. = 36. c. = 20. Exciting Current, 2.5 A. Speed, 1,800 R. P. M. Operated as a Dynamo, Without Balancing Coil.

struct, and, owing to its exceeding compactness, very hard to ventilate. The main plan in view when designing these machines was to lessen the total weight for a given output by taking advantage of the fact that when the balancing coils are used, one may greatly increase the amount of copper on a given armature, and still obtain the same satisfactory performance at the commutator. As Fig. 16 indicates, a too compact design was adopted; the ventilation was cut down so that full benefit of the large amount of armature copper was not obtained.

Machine No. 7 was therefore built with a field of the ring type. This machine embodied a number of important improvements in details of construction, as will be hereafter noted. Fig. 19 shows a photograph of the machine from the pulley end, and Fig. 20 is a view from the commutator end. Fig. 21 is a view of the armature, which was wound with No. 6 wire cable. Both commutator and armature core were hollow, and the winding thoroughly ventilated. All armature coils were wound simultaneously, and the winding was perfectly symmetrical. Fig. 22 is a view of the pole ring. This ring, which carries the six balancing coils, was made in halves, and the pole-pieces were joined together by small connecting lugs, as seen in the figure, in order to make the casting continuous. This construction permits the field coils to be wound in a lathe, and to be easily removed from the fields at will. It is also a decided advantage to have the balancing coils and the pole-pieces through which they are wound separable from the rest of the field. The following are the more important details of the design of this machine: Capacity, 91 amperes at 110 volts, or 10 kilowatts. Type of machine, six pole, ring field of steel. Armature winding of cable through grooves in core. Armature ten inches in diameter outside, by five inches inside; number of grooves, 61—six conductors per groove. Grooves, $\frac{7}{16}$ inch wide by $1\frac{1}{4}$ inches deep; number of commutator bars, 122; total number of conductors, 366. Armature core and pole-pieces, five inches long. Mean distance between poles, $\frac{3}{4}$ inch. Total magnetic flux, 1,800,000 webers; maximum density in armature teeth, 14,400 gausses. Maximum radial density in armature core, 8,500. Mean air-gap density, 5,000. Maximum field density, 14,000; length of air-gap, $\frac{1}{16}$ inch; magneto-motive force for field, 642 gilberts; for air-gap, 1,600 gilberts; for armature, 99 gilberts; total magneto-motive force, 2,341 gilberts. Fields wound with No. 20 B. & S. G. wire. Armature, 366 conductors of No. 6 cable; five holes in each pole-piece for balancing coils. Balancing coils wound with copper ribbon. Compounding, two series turns on each field coil.

| | |
|---|---|
| Weight of field casting, actual | 213 lbs. |
| " " armature core, shaft and spider | 98 " |
| " " " and commutator complete | 185 " |
| " " " copper | 48 " |
| " " copper for balancing coils, actual | 55 " |
| " " field copper, actual | 40 " |
| " " dynamo complete including base hearings, brush holders, brushes and 14x9 inch pulley | 865 " |

This machine was completed and tested in October, 1894, and the results of test were as follows: Speed of dynamo, 1,065 revolutions per minute; voltage, 110; current, 110 amperes. Time of run, one hour. Temperature of room, 71° F. Temperature of armature, 128° F. Temperature of field, 108° F. Rise of armature, 57° F. Rise of field, 37° F. Field resistance, 110 ohms. Field current, one ampere. Field energy, 110 watts. Armature resistance, .0512 ohm. Armature winding loss, 618 watts. Balancing coil resistance, .0202 ohm. Balancing coil loss, 242 watts. Series resistance, .00955 ohm. Series loss, 115 watts. Core loss, friction, etc., obtained from energy absorbed as motor running light at full pressure, 450 watts. Total losses, 1,408 watts. Total output, 12,100 watts. Gross energy absorbed, 13,508 watts. Commercial efficiency, 88.7 per cent. For lighter loads the efficiencies are given by the curve in Fig. 23. This test was made after the machine had been running

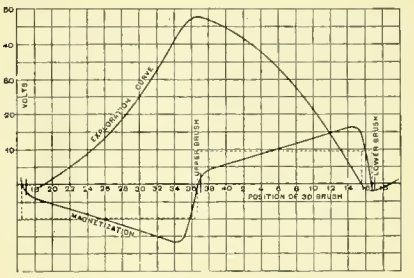



FIG. 13. A METHOD FOR PREVENTING ARMATURE REACTION.

Exploration Curve, Full Load. v. = 48.5. c. = 22.5. Exciting Current, 2.5 A. Speed, 1,800 R. P. M. Operated as a Dynamo, With Balancing Coil.

for several hours under various loads. On another occasion the machine ran one hour and twenty minutes under a load of 115 amperes at 105 volts with a rise of temperature of armature of 48° F. While carrying this load, which it will be noted is 25 per cent. above th rated full load, the pilot brush exploration curve, shown in Fig. 24, was taken. This curve shows the entire absence of armature reaction. The machine has also carried 135 amperes for one-quarter hour, and has several times been loaded down to 180 amperes for a few minutes at a time without damage.

While the balancing coils, as may have been seen from the foregoing results, entirely prevent field distortion and shifting of the neutral point, there is still something lacking for ideal commutation. In a constant potential dynamo, the following are the conditions for perfect and sparkless commutation. When a coil is short-circuited as it passes under a brush, the current in the coil must fall to zero, reverse, and rise exactly to the original value in the opposite direction at the instant the short-circuited coil is opened by the passage of the tip of the brush from the commutator bar. To bring about this reversal properly, the short-circuited coil must move during short-circuit through a field whose strength is proportional to the armature current. In other words, the short-circuited coil should move in a neutral field when the machine is unloaded, and should move in a field of considerable strength when fully loaded. The field strength required for sparkless commutation under any particular load depends first on the resistance of the short-circuited coil; second, the self-induction of the short-circuited coil; and third, the duration of the short-circuit which in turn depends on the width of brush and speed of the dynamo. Preferably the short-circuited coil should move in a uniformly distributed field. It is evident from this consideration that we do not get the conditions for perfectly sparkless commutation even where armature reaction is prevented if we attempt to commutate under pole corner. It is also evident that if armature reaction and field distortion are not prevented, we get just the opposite effect on our commutation from what we would wish—that is, our commutation field grows weaker as the current increases, instead of growing stronger as it should. From this we may set it down as a settled fact, that no dynamo of any considerable voltage and range of capacity which commutates under the leading pole corner and is not provided with some special spark preventing device or arrangement for preventing field distortion can be worked from no load to full load without sparking or without shifting the brushes. During their experimental work on balancing armature reaction, the writers devoted considerable time to the problem of

sparkless commutation, and as a result have devised an improvement to be used in connection with balancing coils, by means of which ideal commutation is attained. The device is simple, and accomplishes the desired end perfectly. It consists in bridging across the gap between the pole-pieces, attaching a commutation lug to the center of this bridge and making this lug the center of the balancing coil, the latter being provided with a few extra turns. The arrangement is shown in Fig. 25, which represents a portion of the field circuit sectioned centrally in the plane of rotation. Referring to Fig. 25, *aa* and *bb* are two field coils wound round the pole necks *C* and *D*; *g* is the commutation lug which is attached to the middle of the lugs *h i*, which latter, bridge across the gap between the pole-pieces *e* and *f*. The balancing coil (not shown) is wound through the holes *k*, *l*, *m*, *n*, *o*, *p*, with the commutation lug *g* at the center of the coil. The path for magnetism is indicated by the dotted lines. It will be noticed that a part of the magnetic lines are shunted across between the pole-pieces *e* and *f*, through the bridge lugs *h i*, and do not pass through the armature. Now when there is no current in the armature or balancing

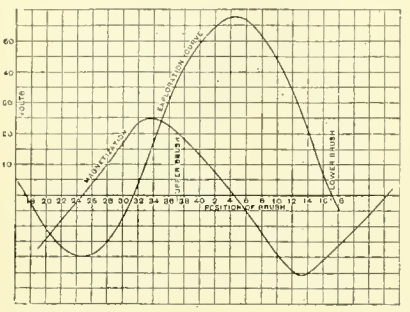



FIG. 14. A METHOD FOR PREVENTING ARMATURE REACTION.

Exploration Curve, Full Load. v. = 36 5. c. = 23 5. Exciting Current, 1.6 A. Speed, 1,600 R. P. M. Operated as a Motor, Without Balancing Coil.

coils, it may be easily seen that the fall of magnetic potential from *e* to *f* is the same by either the path through the bridge lugs, or through the armature, and that the commutation lug *g* attached to the middle of the bridge lugs, must be at the same magnetic potential as the armature teeth opposite, for the latter are connected to the middle of the armature circuit. Therefore, under these conditions, which are practically what we have when the machine is running light, there will be no field between the surfaces *R* and *S* of the commutation lug and armature respectively. If then our brushes are set so that commutation takes place while the short-circuited coil is passing under the commutation lug, we have the correct conditions for sparkless commutation. When the machine is loaded, the excess of ampere-turns of the balancing coils over ampere-turns of the armature, brings a magnetizing force to bear on the lug *g* in the direction indicated by the arrow. This tends to increase the magnetism through *h* and dimish it through *i*, but as *h* is normally saturated, there will be very little increase in its magnetism. There will, however, be a field established under the commutation lug, by the deflection of the lines from the bridge lug *i* through the commutation lug and armature, and it is evident that the stronger the current in the balancing coils, the stronger will be the field under the commutation lug. We, therefore, again have the correct condition for sparkless commutation when the machine is loaded, provided our balancing coils are so proportioned as to give us a commutation field of proper strength. From

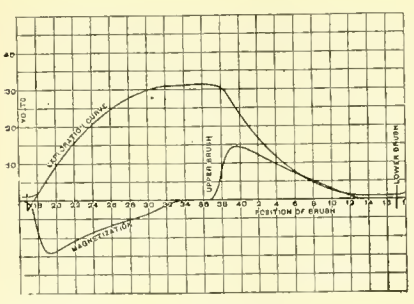



FIG. 15. A METHOD FOR PREVENTING ARMATURE REACTION.

Exploration Curve, Full Load. v. = 31. c = 24. Exciting Current, 1.6 A. Speed, 1,520 R. P. M. Operated as a Motor, With Balancing Coil.

this it will be seen that at all times the commutation field is proportional to the current, and that for all loads we have the requisite conditions for sparkless commutation without shifting the brushes.

So much for the theory of this plan, and now comes the important qustion "Will it work in practice?" We are able to answer without hesitation that such a machine performs as well in practice as in theory, and that actual tests show absolutely sparkless commutation from no load to 50 per cent. overload with fixed metallic brushes. More than this, practice confirms another theoretical advantage of this improvement which we have not yet touched upon. It will be noticed that the commutation field is obtained by the deflection of lines from bridge lug *i*, and that the lines so deflected pass through the armature, and consequently are added to the useful magnetic field. We might expect from this, and from the fact that since the brushes are midway between the poles there are no back ampere-turns, that the machines would compound somewhat without a regular compound winding. This theory was entirely sustained by actual trial. It was found under test, that by slightly shifting the position of the brushes forward or backward, it was possible to make a few of the armature turns act with, or against the field winding at will, and this without any effect on the sparkless commutation, so long as the brushes were not moved beyond the limits of the commutation field. The result of this is that by simply shifting the brushes, the compounding of the machine may be so changed that it can be adjusted at any point from 10 per cent. drop to 10

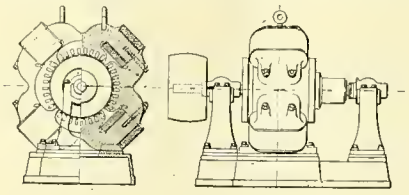


FIG. 16. A METHOD FOR PREVENTING ARMATURE REACTION.

per cent. over-compound, and this without interfering with the commutation in any way;

Thus by this simple contrivance we attain sparkless commutation without shifting of brushes, and a compounding adjustable at will. It is not claimed that the broad idea of a commutation lug is new, but the success of such a contrivance depends altogether on the way in which it is applied. Unless the magnetic effects of the armature currents are taken care of properly, a commutation lug would prove worse than useless and we would be likely to get an effect just the opposite of that desired. Thus it will be seen that the advantages which we have shown as resulting from the use of this system of commutation arise not from the use of a commutation lug alone, but from its use in connection with coils for balancing armature reactions. Direct experiment has shown that this system of commutation will not give satisfactory results except when used in connection with balancing coils. Aside from the effect on commutation, however, balancing coils have some very important advantages to which we will briefly call attention. By their use the capacity of a machine of given size and weight may be greatly increased, and the resulting machine still be far better in quality and operate more satisfactorily than those of ordinary design. The reasons for drawing this conclusion are briefly these: Since the output of these machines

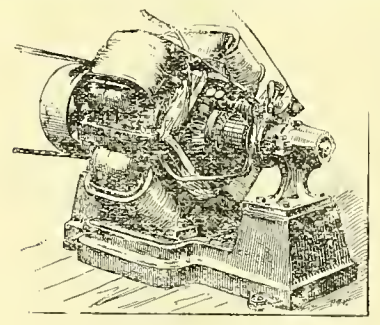


FIG. 17. A METHOD FOR PREVENTING ARMATURE REACTION.

is in no degree limited by armature reaction, it is possible to load the armature with as much copper as can be crowded onto it and to work this greatly increased amount of copper to its safe heating limit—the heating of the armature conductors being the only limit to the capacity of a given armature; and the core losses may be much less in a machine of this type, since the magnetic densities in the core may be made as low as we choose, and this will permit the armature to be loaded with still more copper.

With the standard peripheral velocity of 3,000 feet, it is easy to get an output of 20 to 30 watts per pound total weight of dynamo, and for large size of machines even still greater output per pound. With armature reaction balanced, there is no necessity for high reluctance in air-gap and teeth, and it is therefore made as low as possible for the whole magnetic circuit. The air-gap is reduced to what suffices for clearance, and the armature and field are worked at as low densities as is consistent with economy of iron. By this means from one-half to three-fourths or even more, of the ampere-turns on the field may be saved with a corre-

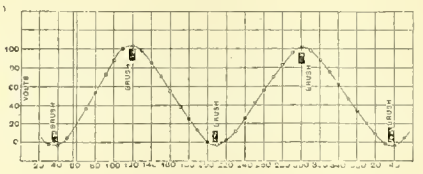



FIG. 18. A METHOD FOR PREVENTING ARMATURE REACTION.

sponding saving in field copper and field energy. This and the reduced core losses reduce the fixed losses in the dynamo to a minimum, bringing them below what is possible with the ordinary construction, and the result is a very material change in the shape of the efficiency curve of the machine. Since the fixed losses are very small, the machines will have unusually high efficiency on light loads; the efficiency curves run up very sharply and bend off to a very uniform efficiency throughout the greater part of the range of load. This is a very decided advantage where machines are expected to work under considerable range of load, as they usually are, both for lighting and power purposes. In designing machines it is also an easy matter to proportion materials according to their relative prices. Thus, with a design containing a given amount of copper, we can increase the copper slightly and reduce the iron and steel, keeping the capacity of the machine the same and thereby effect a saving in cost perhaps, or we may increase the iron and steel and reduce the copper to effect a similar saving. With ordinary designs such an adjustment as this would be out of the question, exceptat a sacrifice of valuable qualities of the machine, for the invariable rule is that the magneto-motive force of the armature ampere-turns may never exceed the magneto-motive force impressed by the field between the pole faces.

The value of sparkless commutation is almost beyond price. Commutation has long been recognized as the greatest bugbear of continuous current machinery. Whatever adds to the life of the commutator adds to the durability of the machine, and the entire prevention of sparking is, therefore, an important feature. To be able also to have the brushes permanently fixed is of decided value, and this when

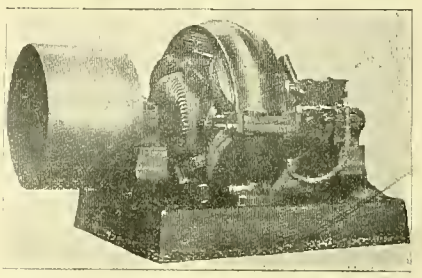


FIG. 19. A METHOD FOR PREVENTING ARMATURE REACTION.

taken with sparkless commutation makes a dynamo self-attendant to a greater degree than usual. The extra cost of applying these improvements to a dynamo is far more than balanced by the saving effected in materials, and the writers believe that the application of these methods of design in dynamos would make a pronounced and important step toward the practical perfection of this class of machinery.

## American Institute of Electrical Engineers.

At the regular monthly meeting of the council of the Institute held on March 20th, the following named associate members were elected: Thomas D. Boyles, Schenectady, N. Y.; W. J. Davis, Jr., Schenectady, N. Y.; John D. E. Duncan, Pittsfield, Mass.; William Esty, Urbana, Ill.; Joseph W. Frost, New York, N. Y.; W. L. Garrels, St. Louis, Mo.; Lucien H. Gilmore, Palo Alto, Cal.; James E. Grist, Philadelphia, Pa.; Wm. J. Hiss, Jr., Bethlehem, Pa.; Henry C. Jones, Montgomery, Ala.; Rollen N. Larrabee, New York, N. Y.; P. R. Middlemiss, New Orleans, La.; Mariano L. Mora, New York, N. Y.; Chas. T. Mosman, Schenectady, N. Y.; Ralph D. Mershon, Pittsburg, Pa.; M. J. O'Sullivan, Baltimore, Md.; Price I. Patton, Philadelphia, Pa.; Thos. A. W. Shock, Sacramento, Cal.;

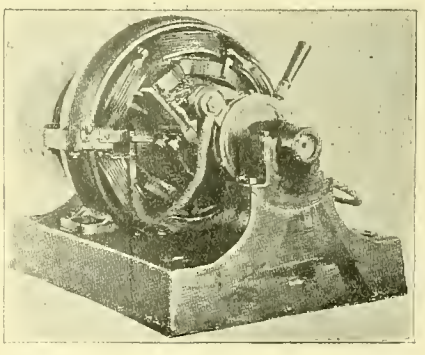


FIG. 20. A METHOD FOR PREVENTING ARMATURE REACTION.

Chas. H. Stanton, Philadelphia, Pa.; Alex. Stratton, New York, N. Y.

The following named associate members were transferred to full membership: William Henry Powell, Manchester, Conn.; Alonzo S. Kimball, Worcester, Mass.; Edgar Woods Mix, Paris, France.

As required by the rules of the Institute, the council canvassed the nominating papers received from the membership and prepared the following ticket:

For president—Dr. Louis Duncan of Baltimore.

For vice-presidents—Dr. M. I. Pupin, New York, N. Y.; W. F. C. Hasson of San Francisco, Cal.; Augus S. Hibbard of Chicago.

For managers—Carl Hering of Philadelphia, Bion J. Arnold of Chicago, Charles F. Scott of Pittsburg, Dr. Cary T. Hutchinson of New York, N. Y.

For treasurer—George M. Phelps of New York, N. Y.

The vice-presidents and managers holding over by the

rules are: Vice-presidents, Prof. W. A. Anthony, Prof. Francis B. Crocker and James Hamblet of New York; managers, Prof. Harris J. Ryan of Ithaca, N. Y., Chas. Hewitt of Philadelphia, J. J. Carty and W. J. Hammer of New York, A. E. Kennelly of Philadelphia and W. D. Weaver, Chas. S. Bradley and W. B. Vansize of New York.

At the meeting of the Institute at 12 West Thirty-first street in the evening, eighty members and guests were present. A paper on "A Method for Preventing Armature Reaction" by Prof. H. J. Ryan and Milton E. Thompson was read by the former. It is presented in this issue of the WESTERN ELECTRICIAN. The discussion was participated

FIG. 21. A METHOD FOR PREVENTING ARMATURE REACTION.

in by Townsend Wolcott, W. L. Bliss, E. A. Merrill, Dr. C. T. Hutchinson, C. S. Bradley, C. O. Mailloux, Dr. C. E. Emery, A. E. Kennelly, G. S. Dunn and Maxwell M. Mayer.

## The Connecticut Railway War.

The fight between the steam and electric railway companies in Connecticut is being vigorously prosecuted. On March 19th representatives of the New York, New Haven & Hartford and New York & New England Railroad companies appeared before the railroad committee of the Legislature to protest against the granting of charters to electric lines paralleling existing railroads. Ex-Judge John M. Hall, vice-president of the New York, New Haven & Hartford railroad, presented the following statistics showing the depreciation in receipt of fares during the past three months, which are traced directly to the competition by electric railroads where they parallel the New Haven lines between stations:

Between Norwalk and Rowayton, a loss of 50 per cent. of the entire business. Between Bridgeport and Southport, a loss of 80 per cent. of all business. Between Bridgeport and Stratford, $35 per day. Between New Haven and Woodmont station, 50 per cent. of all business. Between New Haven and West Haven, 70 per cent. of all business. Between Wallingford and Meriden, 30 per cent. of all business. Between New Haven and Lake Saltonstall, 45 per cent. of all business. Between Meriden and Yalesville, about 90 per cent. of all business. Between Southington and Plantville, practically all the business. Between Unionville and Hartford, 40 per cent. of all business. Between Hartford and Glastonbury, 30 per cent. of all business. Between Derby, Ansonia and Birmingham, 90 per cent. of all business. Between Ansonia and Derby $1,500 a year. Between Naugatuck and Waterbury, $300 a month. Between Union City and Waterbury, $170 per month. Between Waterbury and Naugatuck, 90 per cent. of all business. Between Winnipank and North Norwalk, 50 per cent. of all

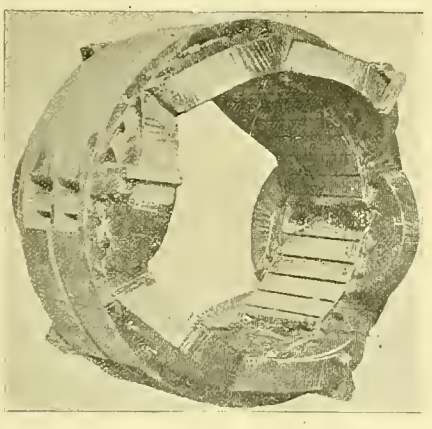


FIG. 22. A METHOD FOR PREVENTING ARMATURE REACTION.

business. Between South Norwalk and Winnipank, 90 per cent. of all business. Between Norwalk and Royalton, 50 per cent. of all business. Between Danbury and Bethel, 75 per cent. of all business.

The statements by the representatives of the different steam railroads created a great deal of comment, as the reduction in their receipts caused by electric road competition far exceeds any computation previously made.

Another point raised is that many of the electric lines are owned outside the state. James L. Cowles of Farmington, who has been attending all the railroad committee hearings at Hartford this winter, makes this assertion. He makes the following statement:

Of the $150,000 of stock issued by the New London Street Railway company, only $10,600 belongs to citizens of the state. The remaining $139,400 is divided among fifty outsiders.

The Norwich Street Railway company has issued $250,000 of stock. Only three of the stockholders in this company are citizens of the state and they hold $2,200 of the stock.

Four persons own $312,000 of the $550,000 of stock issued by the New Britain Central & Electric company, which controls not only the transportation but the lighting of New Britian by electricity.

Of the $2,000,000 of stock of the Bridgeport Traction company, $1,768,000 is owned by persons who are subject neither to Connecticut courts nor to Connecticut public opinion.

Two-thirds of the stock of the Danbury and Bethel street railway is in the hands of strangers.

Of the 16,000 shares of stock issued by the Winchester avenue railway of New Haven, 757 shares are owned by five citizens of Connecticut. The balance, 15,243 shares, is owned and controlled by seven persons outside of Connecticut.

Of the $130,000 of stock owned by the Norwalk Tramway company, $94,600, nearly three-fourths, is owned outside of Connecticut.

The *New York Tribune* gives this explanation of the state of affairs in Connecticut:

People in Wall street who comment on railroad affairs in all parts of the country are talking with amused interest about the news from Connecticut that the New York, New Haven & Hartford Railroad company is doing all that it can to hinder and hamper competition in Connecticut in the form of the electric lines. A large part of New Jersey, including all the region around Jersey City, Newark, Elizabeth and other well-known cities in that state, is gridironed with electric lines. A tremendous network of these lines, with very small meshes in the network, has been spread over the northern and eastern districts of the state of New Jersey. The great steam railroad companies, which have been doing, in previous years, so enormous a suburban traffic between New York and the cities of New Jersey, have not gone to the Legislature of New Jersey and begged that the competition of the electric lines be cut off or prevented. It is, of course, evident that when electric lines

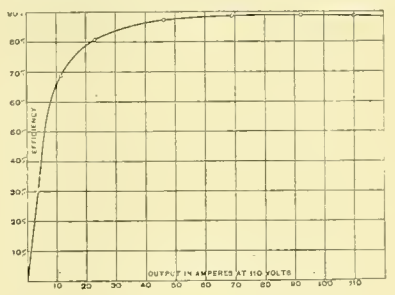



FIG. 23. A METHOD FOR PREVENTING ARMATURE REACTION.

are run in competition with great railroad systems of steam lines, the steam lines will lose a part of their short-trip traffic, but railroad managers of brains, of intelligence, of ability and enterprise, like the men who control and direct the affairs of the vast Pennsylvania railroad, do not go to Legislatures, appealing to them to save them from the competition of the trolley cars. The New York, New Haven & Hartford railroad, however, holds the Legislature of Connecticut and the whole state of Connecticut so completely in its grip that it is bold enough to ask the Legislature to refuse to grant charters to electric lines which it thinks will injure its short-trip traffic. Of course it is in the interests of the cities and towns and villages of Connecticut that the largest possible number of electric lines shall be built in order to afford the most extensive facilities for intercommunication. It is doubtful, Wall street experts say, if there is any other state in the Union in which a railroad company would have the effrontery to go before a Legislature and ask that the competition of trolley lines with the railroad should be hampered or obstructed. But Connecticut is a peculiar state, with a peculiar Legislature, and the New York, New Haven & Hartford railroad has held that state for many years with a clutch that it seems impossible to loosen.

Wall Street men who are familiar with the affairs of the New York, New Haven & Hartford railroad say that the stock of that road, to a considerable extent, is distributed all over the state of Connecticut in small holdings, each holder having a few shares. These holders of the stock of the New York, New Haven & Hartford railroad are so numerous in the state, and so widely scattered in the state that with the peculiar system of representation which prevails in Connecticut, they are able, as a rule, to control the Legislature. Hence, the New York, New Haven & Hartford railroad ventures to ask the Legislature that the competition of the trolley lines shall be obstructed, and hopes that its application will be granted.

# COMMUNICATION.

## Another Correction in N. W. Perry's Paper.

*To the Editor of the* WESTERN ELECTRICIAN:

I notice in the last issue of your journal a letter from Nelson W. Perry, making some corrections in his paper read in Cleveland. I am amazed at his action in leaving uncorrected in this letter his figures on the results of electric storage, when it was clearly shown at the convention that his figures were not only ridiculous, but false. For instance, Mr. Edgar of the Boston Edison company, owner of the largest electric storage battery plant in the world, was kind enough to publish the exact cost of this battery, and Mr. Perry's figures are 50 per cent. higher than the price Mr. Edgar's company actually paid.

Figuring batteries at a 12 hour rate of discharge, the cost per horse power hour is of course much lower than when worked at an hour and a half rate, and even when worked at an hour and a half rate Mr. Edgar's figures were $33.33 per horse power hour, which would amount to about $24 per horse power when worked at a 12 hour rate.

It is a fact which cannot be disputed that batteries can be installed to-day of central station type for this latter figure, and why Mr. Perry should insist upon stating and restating figures of which he has absolutely no knowledge I am at a loss to understand. By substituting correct figures as to

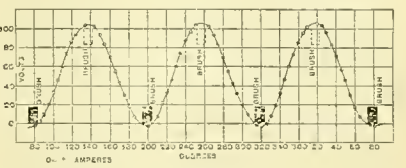


FIG. 24. A METHOD FOR PREVENTING ARMATURE REACTION.

first cost of storage batteries and the cost of maintaining the same, the results obtained are as follows:

| | Recapitulation. Coal $1.75. | Coal $3.50. | Saving effected. Coal $1.75. | Coal $3.50. |
|---|---|---|---|---|
| Present method, steady load.. | $18.68 | $65.62 | $..... | $..... |
| Present gas engine..... | 83.28 | 103.61 | 29.50 | 44.79 |
| Combined feed and steam storage..... | 94.42 | 111.35 | 23.36 | 37.05 |
| Feed storage..... | 97.58 | 117.53 | 20 20 | 30.82 |
| Without storage; load factor 25 per cent..... | 117.78 | 148.40 | . ... | ..... |
| Steam storage..... .... | 97 24 | 114.27 | 20.54 | 34.13 |
| Complete battery storage..... | 83.19 | 100.12 | 34.59 | 48.29 |

HERBERT LLOYD.

## Northwestern Electrical Association.

The summer convention of the Northwestern Electrical association will be held in Chicago in July, and although the arrangements are in temporary abeyance, owing to the recent death of President Thom, the local committee of arrangements has been appointed and will soon lay out a plan of entertainment for the visitors. This committee consists of S. F. B. Morse, chairman, Chas. E. Gregory, John Valentine, A. C. Bunce and J. W. Wolff. The Grand Pacific Hotel is very conveniently located in the electrical district of Chicago, and would undoubtedly be selected as the convention headquarters were it not for the generally regretted fact that it is to be abandoned as a hotel after April 1st. Some other down-town hotel will therefore be decided upon, and there will be no lack of accommodations for all comers. Chairman Morse will soon call the committee together for a preliminary meeting.

## Lord Kelvin on Electric Locomotion.

Lord Kelvin distributed the prizes at the Mechanics' Institute, Crewe, England, and spoke especially of electrical development in railway work. He said technical training not only offered facilities for earning a livelihood, but afforded knowledge that made life worth living. He believed every workman who felt interested in his work, whose mind was occupied while his hands were at work, would have a happier life than the workman whose mind was a blank. Technical schools offered the rising generation

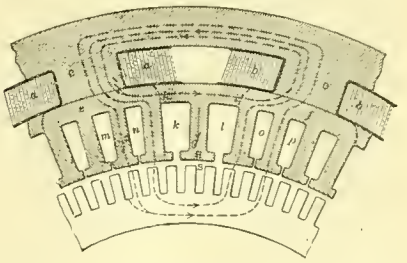


FIG. 25. A METHOD FOR PREVENTING ARMATURE REACTION.

enormous advantages, but while technical colleges could not create men like George Stephenson, they gave every man a chance of using to the utmost his natural faculties. In going through the Crewe works that day he was much struck with the new electrical development which was taking place. He himself took an intense interest in electricity early in life, and he had never ceased to take an interest in it; therefore, it had been the greatest possible pleasure to him to see electrical science brought out from mere book science, from the science of the university laboratories, to be a great auxiliary in the work of mankind. He did not predict that it would come to pass immediately, but he thought it possible that steam locomotion might be superseded on their railways by electricity. Mr. Webb, chief engineer of the London and Northwestern railway, in a subsequent address said that if the company gave instructions to have electric trains, he would undertake to have one ready in two weeks.

Western Electrician.
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WHEN the Conkling bill providing for submitting to the people of New York, Brooklyn and Buffalo the question of municipal ownership of surface roads was before the cities committee of the Assembly and the railroads committee of the Senate, E. H. Crosby of the Social Reform club of New York, David G. Archibald of New York, Samuel Gompers of the Federation of Labor, Alderman Joseph Clark of Brooklyn, Robert Baker of the same city and Henry White, as the representative of the United Garment workers of New York, favored the bill. It is remarked that movements of this kind are generally encouraged by professional "labor" leaders, while representative business men as a rule are found on the other side of the question. These socialistic doctrines do not appeal to men who have their capital invested in enterprises depending for their success upon general prosperity. Just now there is an unusual amount of interest in this movement in New York state, and the most plausible explanation is to be found in mere unreasoning sentimentality due to the recent strike. Elsewhere in this issue is presented a very sensible editorial upon this subject which appeared recently in the New York *Sun*. Many abuses that are bound to follow the adoption of this policy are pointed out. It is remarked that "reforming things by resolution is a mighty easy job," but the reflection is added that "considering that our great cities have not yet shown any satisfactory ability to govern themselves and manage their own business, what reason is there to believe that they can be any more successful in owning and managing the street railways?" While there is so much dissatisfaction with the method of conducting municipal business in large cities it seems no less than criminal to put additional power and patronage in the hands of men who are daily denounced for their inefficiency and careless methods, if indeed not for positive dishonesty.

LEGISLATIVE investigating committees seldom accomplish anything in the way of lasting improvement in the public service, although, ostensibly, that is the object for which they are created; but in the last investigation begun in New York city, including the gas meter, quarantine and electrical subway departments, there is promise of practical reform if the inquiry be honestly conducted. In the case of the electrical subway commission, there is no doubt that a careful investigation of the working of this department would lead to its abolishment. There is no excuse for continuing this costly bureau, and there is no reason why three professional politicians should be given authority to hamper and annoy the electrical interests of the city. These commissioners get $5,000 a year each, and this is only the beginning of the expense of conducting the office. Commissioner Kearney's services might be of some value to the community if they were required, but they are not at this time. There is positively no excuse for paying Commissioners Cummings and Hess $5,000 each. They are incapable of earning their salaries as commissioners. Heretofore Amos Cummings has been regarded as a high-minded citizen and a representative newspaper man, but he cannot continue in his present office and retain the respect of right-thinking men. As for Commissioner Hess, who is described as a "good fellow," he will probably retain his office, draw his salary and enjoy himself at the expense of the public, until he is removed or the office abolished.

MINISTER THURSTON, the capable and energetic representative of the Hawaiian republic at Washington, has incurred the displeasure of the Cleveland administration and his recall has been demanded by Secretary Gresham. The excuse given for this action is that Minister Thurston violated diplomatic etiquette in giving out for publication official information before it was submitted to the state department, but this may be considered a mere pretext, and a flimsy one, too, considering all the circumstances. It has been known for some time that the administration was displeased with the representative of the young republic, and as he has not evinced a disposition to make his peace with the state department, his return was considered merely a question of time. The resentment displayed against Mr. Thurston was provoked by his reply to the report of Paramount Blount and his subsequent activity in behalf of the Pacific cable project, which was defeated by the administration only after a bitter fight. In this controversy particularly Minister Thurston proved a very troublesome opponent, and he caused the Cleveland contingent much annoyance and more uneasiness. His marked ability, high personal character and manly independence gave him much prominence and influence in Washington, and his retirement will be a considerable loss to diplomatic circles. As the friend of the Pacific cable project and as an earnest advocate of American control of that enterprise, Minister Thurston won the confidence, respect and esteem of the American people.

ADVOCATES of government control of the telegraphs in this country will find food for thought in a recent report to the House of Commons. An examination of the estimates submitted for the operation of the British Postal Telegraph Department for the year ending on March 31, 1895, shows a growing deficiency. The actual deficiency for the previous year was about $2,400,000. This amount included $1,500,000, the annual interest charges on stock created for the purchase of the telegraphs. The deficit for the current year, including the same charges, is estimated to be $2,700,000, or an increase of $300,000, although the gross receipts from telegrams is expected to show an increase of about $450,000. If in the compact, thickly settled United Kingdom, after years of operation, the government postal telegraph department shows a growing deficiency, how much more uneconomical would be an experimental transfer of the telegraph lines and the opening of thousands of new stations throughout the wide and lightly settled areas of the United States? In the present condition of the national treasury the venture would be suicidal. And it is difficult to see how any great benefit could result at any time. The government simply could not conduct the telegraph business of the country as cheaply as private corporations, even on the basis of stations and lines now in existence. Would any administration dare to carry economy to such an extreme as the Western Union Telegraph company does, for instance? The service might be extended and improved, but it would only be at great cost. The expense would be borne by the whole people, while the benefit would be felt by perhaps one-tenth of the people. There would undoubtedly be considerable increase in telegraphic business; but it cannot be believed that this accession, together with even a great improvement in the service, would be sufficient to warrant an experiment so plainly uneconomic in a country with business and topographical conditions such as obtain in the United States.

ANOTHER strike in which electrical men were interested has been officially declared off, and, as usual, the misguided workmen who attempted to coerce their employers into granting their demands have been the chief sufferers. As a matter of fact it is claimed that a week after the strike was ordered the contractors had all the men they needed to carry on the work, and as these men will be retained, the great majority of strikers among the electrical workers will be out of employment. On February 18th the Brotherhood of Electrical Workers of New York ordered the strike, as the Electrical Contractors' association refused to grant the demand for an eight-hour day at once, the employers offering to compromise by granting the demand on May 15th. Last week's agreement fixes the date at May 1st, but many of the old men will not be able to find work, as the contractors will retain the men employed to take the strikers' places. Of the 400 men who went out on the strike 300 will be obliged to find new positions. Aside from this fact and the loss of prestige which the workmen's organization suffered through the failure of the strike, the new agreement does not recognize the Brotherhood of Electrical Workers, but leaves all the employes of ths contractors free to organize a new union. There is no danger that inefficient workmen will be employed, as each applicant must submit to an examination to determine his qualifications before securing employment. Of course the contractors suffered considerable loss through the strike, but they come out of the controversy with the advantage of an important victory which will greatly strengthen their organization. It is to be hoped that the lesson of this failure will not be entirely lost upon the workmen, and that hereafter they will not be so willing to engage in ill-advised strikes.

RUMORS have been in circulation during the last few weeks of a proposed consolidation between the General Electric and Westinghouse companies. Similar reports have been spread at intervals before, but have never come to anything. This journal has always maintained that it was impossible for any one company or consolidation of companies to control the electrical business because of its nature, which is widely different from that of some single material product. All attempts to control the situation so far have been failures.

With this experience it is easy to see that such a combination of interests for such a purpose would simply invite increased competition. Any well-informed electrical engineer can design satisfactory electrical machinery, and nowadays this can be done without costly experimenting. Moreover, small manufacturers, unhampered with immense interest-bearing indebtedness and enormous capital stock to pay dividends on, can enter the field and build any particular line of electrical machinery as cheaply as the larger companies. To-day without a single fundamental patent to depend on, with all classes of material that enter into electrical construction to be bought freely in open market, it is unreasonable to suppose that any such attempt will be made. On the other hand, it is quite probable that the two companies mentioned have become weary of litigation, achieving nothing and transferring their profits to the pockets of the lawyers instead of to the stockholders, and no doubt they are anxious to perfect an arrangement which will put an end to such a state of affairs. That they should attempt a policy of extermination to smaller concerns is unlikely, as they would most assuredly be worsted in the long run. On the contrary, it would seem that the agreement is to be made to put an end to profitless lawsuits. Such a course might go far toward settling and solidifying the electrical industry, encouraging capital to invest freely in the many advantageous enterprises that are open to it. Furthermore, the present prices of electrical apparatus are exceedingly low, but with the cessation of legal hostilities it is possible that the wild cutting of prices will cease, too, and goods will not be sold at a mere living profit or a distinct loss. This would mean better prices all round, in which all engaged in the industry would share. With the business outlook brightening in all parts of the country, and a good demand for apparatus, the industry is in a most hopeful condition.

No combination will ever control this entire business or drive out legitimate competition from the field—the field is open and will remain so.

## Electricity Direct from Coal.[1]

By Alfred H. Bucherer.

The endeavors of scientists and inventors to convert directly the potential energy of coal into electrical energy have received a fresh incentive from the interesting experiments of Dr. Borchers. So alluring are the rewards that follow the solution of this problem that men known for their conservative attitude in similar questions have hailed with extravagant expressions of delight the seeming results of the German electro-metallurgist. It is true the latter deserves high credit for testing his ingenious idea; yet from his own account of the facts brought out in his experiments I feel sure that as yet his endeavors have been fruitless. Such failure, it is only just to note, could not have been foreseen from the standpoint of our present knowledge of electro-chemistry. In the extensive discussion of Dr. Borchers' work, which appeared in various technical and scientific journals, one point has been altogether ignored, and this point is of such essential importance in the problem of the conversion of the potential energy of coal into electric energy that it deserves to be fully elucidated. This point is the relation of chemical to electrical energy. Dr. Borchers erroneously supposed that it would be possible to obtain an amount of electrical energy from the reaction $2CO + O_2 = 2CO_2$ that would be equal to the heat of formation of as much of the quantity of the reacting substances as take part in the transformation. Since Helmholtz has shown that such a view does conflict with facts, it is no longer legitimate to assume its correctness, still less to base upon it efficiency calculations, as was done by Dr. Borchers and Ostwald (see *Zeitschrift f. Phys. Chem.*, 1894, p. 521).

The maximum amount of work which we can derive from a chemical reaction is a definite quantity, and is independent of the kind of energy into which it is transformed. Suppose we have an unpolarizable cell and make the external resistance extremely large as compared with the internal resistance; then, if the quantity $m$ of electricity has passed through the circuit, a proportional amount of chemical action has occurred, and the heat developed in the external circuit is equal to the electrical energy obtained. On examination we will find now that, although the internal resistance was vanishingly small compared with the external resistance, yet heat has been evolved or absorbed in the interior of the cell, and it follows from the law of the conservation of energy that the heat of reaction $Q$ is equal to the electrical energy $E$, minus the heat $q$ absorbed in the cell.

$$E - q = Q$$

$$E = Q + q \tag{1}$$

$q$ can have a positive value or a negative value, according to whether heat was absorbed or evolved in the cell. If we consider one electro chemical equivalent involved in the transformation and measure $Q$ and $q$ in electrical units, then $E = Q + q$ where $E$ measures the electromotive force in volts. Helmholtz investigated the relation which $q$ has to $E$ by applying the second law of thermodynamics. The following reasoning is similar: We know that the mechanical energy of a perfect engine working between the temperature limits $T + dT$ and $T$ is

$$dW = q\frac{dT}{T}$$

$$q = T\frac{dW}{dT} \tag{2}$$

Now, since the second law of thermodynamics holds for the transformation of heat energy into any other form of energy, it must be true for the transformations occurring in a galvanic cell. Now, as mentioned above, the electromotive force of a cell measures the energy, if we consider the amount of transformation effected by one electro-chemical equivalent; *i. e.*, the work done by the passage of one coulomb. We can, therefore, substitute $dE$ for $dW$ and we have by substituting $dE$ in (2)

$$q = T\frac{dE}{dT} \tag{3}$$

and, therefore,

$$E = Q + T\frac{dE}{dT} \tag{4}$$

$$\frac{dE}{dT}$$

is the temperature coefficient, and it follows that if the electromotive force of a cell increases with temperature

$$T\frac{dE}{dT}$$

is positive, and the electromotive force is larger than the value calculated from the heat of transformation, and heat is absorbed in the cell; whereas, if the electromotive force decreases with temperature, the electromotive force is smaller than the value $Q$ expressed in electric units. Heat is evolved in the interior of the cell. Now, in some primary cells the temperature coefficient is so small that it can be practically neglected; in others, it is so great that the electromotive force as calculated from the heat of formation will give a decidedly wrong value. With a reaction that is so different from those utilized in ordinary cells, and concerning which we know so little as the one utilized by Dr. Borchers, it is not legitimate to form any conclusions as to the electromotive force obtainable.

The question now presents itself, what is then the maximum electromotive force we can expect to gain from the combination of carbon monoxide with oxygen? Is there any reversible transformation, no matter into what kind of energy, about which we do know something? There *is* such an ideal process, and I will show the reasoning by which we can arrive at the desired value. The reasoning is based on the principle of the dynamical equilibrium of chemical systems, which principle is nothing else than a disguised form of the second law of thermodynamics. When carbon monoxide combines with oxygen, not all of it is thus oxidized and at a definite temperature and pressure the composition of the resultant mixture of gases, consisting of $CO_2$, CO and $O_2$, is definite. Deville found experimentally that at a temperature of 3,000° Celsius forty per cent. of the carbonic acid is dissociated at atmospheric pressure. I have calculated from this fact that at a temperature of 0° Celsius and atmospheric pressure, the fraction of dissociated $CO_2$ is

$$\frac{1.58}{10^{34.86}}$$

If we conduct the process of combination of CO and O in such a manner that the maximum amount is being obtained, and take care that the temperature does not change, then this work depends on the initial and final condition of the gases. Now, let us suppose two gram molecules of carbon monoxide, *i. e.*, 56 grams at atmospheric pressure, react on 1 gram molecule, *i. e.*, 32 grams of oxygen, also at atmospheric pressure, in a reversible manner, and that the carbonic acid formed is likewise brought to atmospheric pressure. Then, evidently, since, as we have seen, the dissociation the carbonic acid is extremely small, the partial pressure of of the carbon monoxide in the product of the reaction must also be very small, and the carbon monoxide, while performing work, has been brought from the atmospheric pressure to an exceedingly small pressure. Now, if the partial pressure of the CO be $p_1$ then the work done is

$$W = 2\,RT\,log_e\frac{1}{p_1}$$

where $R$ is the gas constant referring to 1 gram molecule of gas and is equal to 1.98 calories. The oxygen is similarly brought from the atmospheric pressure to a partial pressure, which is one-half of the partial pressure of the carbonic oxide; for the gases being present in the ratios in which they react on each other, two volumes of CO are present to one molecule of oxygen, and the pressure of the carbonic oxide is twice that of the oxygen. Hence, the work performed by the oxygen is

$$RT\,log_e\frac{2}{p_1}.$$

Since the carbonic acid in the reaction mixture is practically under atmospheric pressure, no work appreciably is done upon it, and the total energy obtained by the reversible combination of the two molecules of CO with 1 gram molecule of oxygen is

$$W = 2\,RT\,log_e\frac{1}{p_1} + RT\,log_e\frac{2}{p_1}$$

$$W = RT\,log_e\frac{2}{p_1^3} \tag{5}$$

Since now the fraction of the $CO_2$ that is dissociated at 0° Celsius is

$$\frac{1.58}{10^{34.86}}$$

it follows that the partial pressure $p$ of the CO is

$$\frac{1.58}{10^{34.86}}$$

atmospheres. Substituting this value in equation (5) we have

$$W = RT\,log_e\frac{10^{104.58}}{2}$$

This energy refers to the chemical combination of 2 gram molecules, and is expressed in calories. To obtain the energy for the combination of one electro-chemical equivalent, expressed in electrical units, we divide by $4 \times 23039$, and we have

$$E = \frac{1.98 \times 273}{4 \times 23039}\,log_e\frac{10^{104.58}}{2}\text{ volts.}$$

$$E = 1.41\text{ volts.}$$

This is the value for 0° Celsius. The heat of formation of carbonic acid is 68,000, and the electormotive force calculated from this is 1.476. Therefore, by the equation of Helmholtz,

$$1.41 = 1.476 + 273\frac{dE}{dT}$$

$$\frac{dE}{dT} = -\frac{0.066}{273}.$$

The electromotive force therefore decreases by

$$\frac{0.066.}{273}$$

volts with every increase of temperature by 1°. At the standard temperature, 18° Celsius, the electromotive force is, therefore,

$$1.476 - 291\frac{0.066}{273}$$

$$1.476 - 0.07 = 1.406.$$

We thus see that the electromotive force is somewhat smaller than assumed by Dr. Borchers. The greatest electromotive force obtained by Dr. Borchers was 0.5 volt. The conclusion which he now draws from this result is that he has already succeeded in obtaining about thirty per cent. of the energy of the coal, whereas, the steam engine converted much less. This is another non-admissible conclusion. For in an unpolarizable, *i. e.*, reversible, cell, the maximum electromotive force is a definite value, and if another value is experimentally observed which very appreciably differs from it, then, barring secondary actions, the reaction which is expected to furnish the electric energy does not occur. To say that secondary actions depress the theoretical electromotive force is not logical in this case, for, evidently, this secondary electromotive force would have to be about twice as great as the observed electromotive force and, therefore, could not be called secondary.

The action that took place in Dr. Borchers' apparatus is most probably one that can be found among those which were investigated and published by Mr. Mond (see London *Electrician*, January 11th, and Digest *Electrical World*, New York, February 2d). It would lead too far to discuss in detail the work of Mond, and to single out the particular action to which the electromotive force of the apparatus of Dr. Borchers was due.

For reasons which were well stated by the latter, it is more expedient and apparently easier to utilize the combination of carbon monoxide with oxygen for the generation of electric energy instead of that of carbon with oxygen. The work done by Dr. Borchers, though not crowned with success as yet, is, nevertheless, of high value on account of its instructiveness. It indicates in its general features the path that has to be followed for accomplishing a most important industrial task, the fulfillment of which we hope this century will yet witness.

1. Read at the meeting of the Electrical Section, Franklin Institute, March 26, 1895.

## Electrical Power Transmission in Egypt.

The cotton growers of the United States will find themselves confronted with another competitor if the proposal just submitted by a French engineer for creating new cotton fields in Egypt is adopted. At the present moment the staple productions of Egypt consist of cereal crops, of which the value has been declining to such an extent within recent years that the revenue to the growers is from 30 to 40 per cent. less than what it was in 1882. In face of this ruinous contraction a French engineer, M. Prompt, proposes a scheme for a more efficient system of irrigation and for supplying an abundance of cheap motive power whereby it will be possible to substitute cotton and sugar cane for the cereals and establish factories for the treatment of the produce. To attain this end he proposes to utilize the cataracts of the Nile in the same way as the Niagara Falls for the distribution of power by electricity.

By a dam at Assouan 500,000,000 cubic meters of water could be stored for irrigation, while 40,000 horse power could be obtained for transmission. The power could be supplied at an exceedingly low figure, and would be sufficient for operating 130 cotton factories, giving employment to 40,000 hands and consuming about 100,000 tons of cotton, or about one-half of the entire production of the country. By this means an important home industry would be created, and the price of cotton would advance to a more remunerative level. The water kept in reserve would allow of the irrigation of 280,000 hectares of land, which could produce about 450,000 tons of sugar. These results could be still further increased by using another fall of five meters near Cairo, where there is a vast area of land favorable to cultivation of cotton and sugar cane.

It is estimated that these works can be carried out within a period of three years, and that their total cost will $8,000,000, upon which the net revenue is expected to be 10 per cent. The proposal of M. Prompt is meeting with a great deal of favor in Egypt, and if found to be practicable it is hardly likely that any difficulty will be met with in finding the necessary capital to carry out the undertaking. The establishment of an industry upon a scale large enough to consume one-half of the entire output of native cotton would probably have a strengthening influence upon the cotton trade generally, but if the undertaking proves to be only partially successful, the consuming markets will find themselves in possession of a supply of raw produce that may have the effect of bringing down prices. In any event, the project is interesting enough as showing that there is an increasing tendency on the part of European engineers to utilize electricity for industrial purposes wherever it can be done with advantage.

## Ingenious Electrical Swindle.

Enormous business has been done lately at French fairs by a man who professed to sell a rat powder that was perfectly harmless, and that struck rats dead on the spot. In order to convince the skeptical, the man first of all powdered a slice of bread with the stuff and ate a piece of it himself. Then he put the remainder under a glass case, in which a rat was kept in captivity. The rat went to eat the bread and instantly fell dead. At ten cents a box the powder went off like hot cakes, and the lucky proprietor of the specific was in a fair way to make a fortune. But the police, who in France are very active in protecting the people from fraud, looked into the matter and found that the powder was nothing but ordinary sugar. They also discovered that the case was connected with a powerful electric battery and that the moment the rat touched the bread the current was turned on, and it was thus that his death was brought about. The man was arrested at the fair of Albi.

Frank R. Green of Chicago, W. Worth Bean of St. Joseph, Mo., Joel Hurt of Atlanta, Ga., and W. J. Richardson of Brooklyn, N. Y., met in Montreal a few days ago as a committee to arrange preliminaries for the next convention of the American Street Railway association, to be held in Montreal in October. The Windsor hotel was fixed upon as the place of meeting. G. C. Cunningham, general manager, and Ed. Lusher, secretary of the Montreal Street Railway company, met the committee and assisted in the work.

## Lombard Water Wheel Governor.

In all discussions of projects for the utilization and transmission of water power, the method of governing the turbines is one of the most important points to be determined. Recent advances have been made in this line and the performances of some of the recently equipped water power plants are a revelation to those who remember the difficulties under which similar enterprises labored only a few years ago. An interesting example of this kind is found in the plant of the Baltic Power company of Baltic, Conn. This plant consists of three pairs of Holmes horizontal wheels working under 35 feet head. These wheels drive two General Electric three-phase generators. At Taftville, five and one-half miles away, two General Electric three-phase motors furnish about four hundred horse power used for driving cotton spinning and weaving machinery; they also drive the General Electric railway generators, which furnish power for the Norwich electric railway, 12 miles away; likewise they operate a 250 horse power electric locomotive used to handle freight cars between Tafts on the New York & New England road and the Taftville Mills. It should be added that one small incandescent machine is also driven

ALUMINUM BRONZE TROLELY WHEEL.

from the jack shaft at Baltic, and no unpleasant variation in the lights is noticed. The governors used in this plant are of the standard type of the Lombard Water Wheel Governor company of Boston, and are illustrated herewith. This governor consists essentially of an hydraulic piston which applies its thrust in either direction to the rack, pinion and gears at the left side of the machine. These gears transmit the motion of the piston to the gate mechanism of the turbine. The actuating force which operates the hydraulic piston is air compressed under about fifteen atmospheres (210 pounds gauge pressure). This air is contained in the cylindrical tank under the bed plate of the governor and the pressure is maintained by a pump operated by the band wheel shown on the back of the machine in Fig. 1, and on the front of the machine in Figs. 2 and 3, which show the three sizes of governors. The centrifugal governor balls actuate a perfectly balanced piston valve which stands in the circulating system. This valve has a lap of one sixty-fourth of an inch, and a motion of that amount one way or the other, as the speed varies, causes the hydraulic piston and train of gears to open or close the gates of the turbine. Fig. 4 is a diagram taken at Baltic showing the load in horse power from 6:20 P. M. to 6:50 P. M. on March 6, 1895. The figures at the bottom of the diagram represent minutes. The

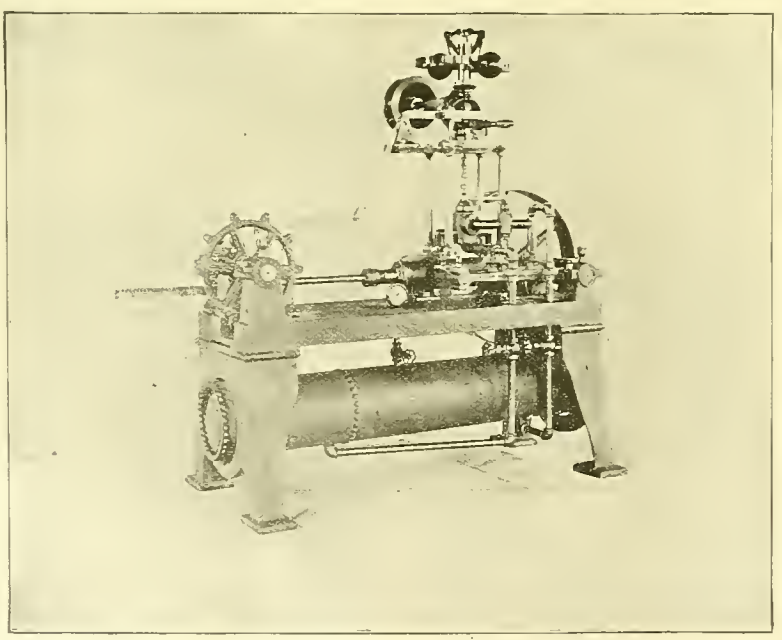


FIG. 1. LOMBARD WATER WHEEL GOVERNOR.

figures at each end of the diagram represent load in horse power; and the crooked line shows the variation of load each half minute. For convenience the load in horse power is indicated by figures where the load crosses the vertical lines—that is at half minute intervals. The figures parallel with the load line show the variation in load each half minute.

By referring to this diagram it will be seen that at 6:27 P. M. the load was 57 horse power. One-half minute later it was 273 horse power, showing an increase of load of 216 horse power in half a minute; at 6:28 P. M. the load was 446 horse power, an increase of 173 horse power in half a minute or a variation in load in one minute of 216 and 173, making 389 horse power. By following the vertical lines to the top of the diagram the variations in speed may be seen. The dotted line shows the speed at which the wheels should have run and the full line shows the speed at which they did run. The figures above the speed line show the revolutions per minute of the tachometer shaft; and the figures below the speed line show the per cent. variation from normal speed. An interesting example, showing how this governor will bring a wheel to normal speed under a wide but continuous variation of load, may be seen by referring to the record on the diagram at 6:32½ P. M. Here the speed was two-tenths of one per cent. over normal speed. A heavy load was thrown on rapidly; the speed first fell five-tenths of one per cent. under speed and then returned rapidly to where it should be, so that at 6:34 P. M. the speed was just right, though the load has increased 397 horse power.

The diagram was taken between 6:20 and 6:50 P. M., when the mills at Taftville were shut down and the load consisted solely of the Norwich electric railway and the electric locomotive—the railway load alone being much more difficult to govern than the railroad and the mill combined. At this time the plant was being driven by one pair of 33 inch horizontal turbines, controlled by a type C Lombard water-wheel governor shown in Fig. 3. This is the largest size governor made by the company, type A shown in Fig. 1 being the smallest, and type B shown in Fig. 2 being an intermediate size.

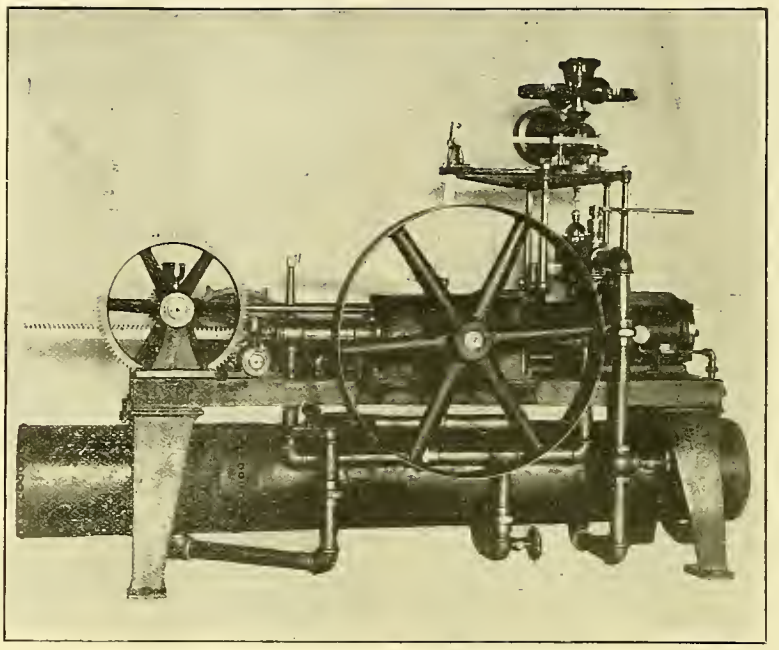


FIG. 2. LOMBARD WATER WHEEL GOVERNOR.

## Aluminum Bronze Trolley Wheel.

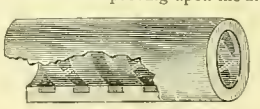
The Fiberite company, through its agent, the Mason Electric Equipment company, Chicago, is offering to the trade "a high priced trolley wheel," illustrated herewith. The annoyance of having to change the trolley wheel at frequent intervals led to a request from some of the leading companies for a wheel that would give a longer life and at the same time would be of such material as to save the wire from unnecessary wear. Experiments were made by Mr. Medbery of the Fiberite company, with the result of furnishing a wheel so satisfactory in every way that it has been adopted by many roads throughout the country. It is claimed by the Mason Electric Equipment company that a trial will convince the most skeptical of the economy of using this wheel.

## Graphite Trolley Bushing.

The Mason Electric Equipment company has just secured the selling agency for the Graphite trolley bushings made by the Graphite Lubricating company, and will carry a large stock on hand. The bushings made by this company are secured by fundamental patents. Complaints are heard at times of the very unsatisfactory wear of graphite bushings, but in the case of those made by the company named not a single complaint, it is said, has been heard during the last five years. In the cut is illustrated the bushing, and the Mason Electric Equipment company will be pleased to furnish further information.

## Applied Electricity at Oil Wells.

Charles D. Jenney of the Jenney Electric Motor company has found a new use for the electric light. Some time ago while in the oil fields of Jay county, Indiana, Mr. Jenney conceived the idea of improving upon the methods there



GRAPHITE TROLLEY BUSHING.

employed for pumping oil wells, and accordingly he devised a special type of pump to be put at the bottom of the well and special means of operating the pump by an electric motor. A well was selected and an experimental pump made and put down, but it was found that it would be necessary to take out the pump, together with the piping and rods leading to it, in order to clean out the well. After taking out about 300 feet of the piping and rods, the overhead tackle used for removing it broke and allowed the remaining 750 feet of pipe and rods, with the pump, to drop back into the well. After repeated attempts were made to take hold of the pipe and rods with fishing tools usually employed, the work was abandoned, and the old oil contractors and well workers predicted that the piping and rods, such as used, could never be withdrawn. Mr. Jenney, at this juncture, conceived the idea of lowering an electric light down into the well in order to examine the exact condition and position of pipes and rods where broken.

The apparatus made for this purpose consisted of a wooden reel, on which was wound a coil of insulated copper wire, one of the inner ends being connected to a contact ring on one side of the spool, and the other inner end to a similar contact ring on the other side of the spool. Two contact springs were adjusted to bear on the two rings respectively, thus insuring electrical connection with the coil while it was being unreeled.

The two outer ends of the coil were connected to an incandescent lamp which was lowered into the well. To protect

the lamp from injury while lowering it was enclosed in a pint fruit jar, which served as a vapor proof globe, the socket being soldered in the cap of the jar and tightly sealed. The lamp was slowly lowered into the well and carefully watched by a powerful field glass while being lowered. The top of the fruit jar served as a shield, keeping the direct rays of the light from view. The lamp employed was of 25 candle power, which brilliantly illuminated the space all around and below the lamp, so that when the ends of the pipe and rods were reached their exact position was determined. Although the rods were only three-eighths of an inch in diameter and the pipe one inch, they could be plainly seen by means of the glass, and by adjusting the lamp at the proper level the hole in the end of the pipe was plainly visible. The pipe was found to be wedged over to one side of the hole and the three steel sucker rods had a spiral position with their ends several feet below the end of the pipe. Knowing exactly what he had to deal with, Mr. Jenney lowered a special clutch device of his own design and securely clutched the pipe and rods at the first attempt, and by means of an electric motor applied to a windlass pulled the remainder of the pipe and rods out of the well without further difficulty.

The well men in the vicinity were very much surprised at this result, as they quite often are compelled to fish for months for lost tools in a well. It was also found that the electric light was advantageous for another purpose, that of settling a long disputed question of determining whether wells are drilled straight or inclined, more or less.

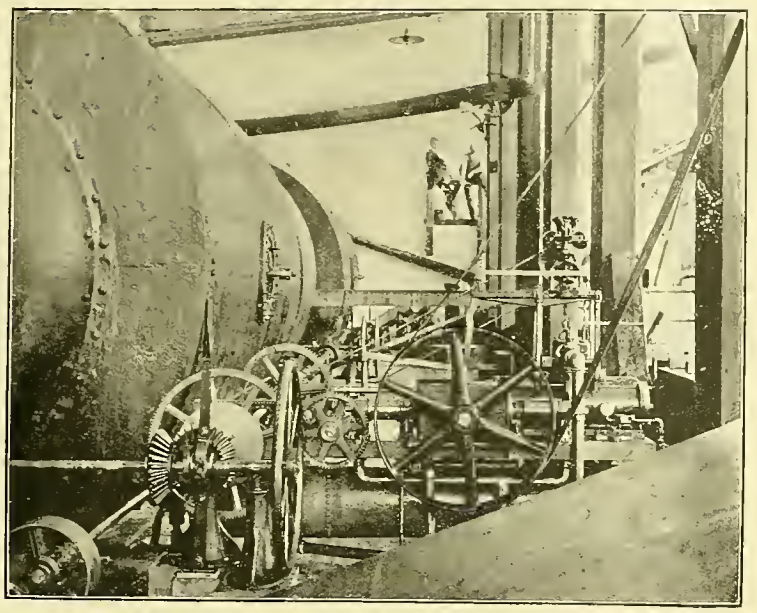


FIG. 3. LOMBARD WATER WHEEL GOVERNOR.

## Inspection of Electric Meters.

The following bill has been introduced in the New York Legislature, providing for the inspection of electric meters:

The governor of this state shall nominate, and by and with the consent of the senate, shall appoint an inspector of electric meters, who shall reside in the city of New York, whose duty it shall be, when required, to there inspect, examine, prove and ascertain the accuracy of any and all electric meters used or intended to be used for measuring, or ascertaining the quantity of electric light or power furnished by any electric light company in this state, to or for the use of any person or persons, and when found to be or made correct, to seal, stamp or mark all such meters, and each of them with some suitable device. Such device shall be recorded in the office of the secretary of state. All such meters shall have exposed indexes, and so constructed that the public can read them.

Such inspector shall hold his office for the term of five years from the time of his appointment, and until the appointment of his successor, but may be removed by the governor for sufficient cause; and he shall receive an annual salary of twenty-five hundred dollars, to be paid in the first instance out of the state treasury on the warrant of the comptroller.

Such salary shall be charged to and paid into the state treasury by the several electric light companies in this state, in amounts proportionate to the amounts of the capital stock of said companies, respectively, to be ascertained and assessed by the comptroller of the state; and in case such electric light companies, or any or either of them, shall refuse to or neglect to pay into the state treasury the amount or portion of said salary which shall be at any time by said comptroller required of them, respectively, for the space of thirty days after written or printed notice is given or sent by said comptroller to them, respectively, in the usual way by mail, to make such payment, then the said comptrolier may be and he is hereby authorized and required to collect and recover the same from any such delinquent electric light company for its or either of their said portion or amount so determined to be due, with interest thereon at the rate of 10 per cent. per annum, from the time when said notice to make such payment was given, together with the legal costs, fees and expenses of collection, in the name of the office of the comptroller under his seal, by warrant or warrants in the manner provided by the laws of this state, for raising and collecting taxes for the use of the state upon certain corporations, joint-stock companies and associations.

It shall be not lawful for any corporation, company or person, at any time after this act shall take effect, to furnish and put in use any electric meter which shall not have been inspected, proved and sealed by said inspector, except during such time as said office of inspector shall be vacant, or said inspector, after request made, shall refuse or neglect to prove and seal the meters furnished for that purpose, and except the meters in use when this act takes effect, and which may be removed for examination or repairs.

That every such electric light company shall provide and keep in and upon their premises a suitable and proper apparatus, to be approved and sealed by said inspector of meters, for testing and proving the accuracy of the electric meters furnished for use by said company, and by which apparatus every meter may and shall be tested, on the written request of the consumer, to whom the same shall be furnished, and in his presence if he desires it. If any such meter, on being so tested, shall be found defective or incorrect, to the prejudice or injury of the consumer, the necessary removal, inspection, correction and replacing of such meter shall be without expense to the consumer; but in all other cases he shall pay the reasonable expenses of such removal, inspection and replacing; and in case any consumer shall not be satisfied with such inspection of the meter furnished to him, and shall give to the company written notice to that effect, he may have such meter reinspected by the state inspecetor (if he require it) upon the same terms and conditions as above provided for the original inspection thereof.

The inspector of electric meters is hereby authorized and required to appoint deputy inspectors of electric meters, said deputies to reside wherever electric meters are manufactured in this state, and who shall, in their respective places of residence, discharge the same duties as are required of the inspectors of electric meters, and shall be subject to the provisions of this said act, such deputies to be paid by the inspector out of his salary, hereinbefore mentioned, at the rate of two dollars per day while actually engaged in the discharge of such duties, and to hold office during the pleasure of said inspector.

On and after the passage of this act, it shall not be lawful for any electric light company in this state to charge or collect rent on its electric meters, either in a direct or indirect manner. Any person, party or company violating any of the provisions of this section shall be liable to a penalty of fifty dollars for each offense, to be sued for and recovered in the corporate name of the city or village where the violation occurs, in any court having jurisdiction, and when collected to be paid into the treasury of said city or village and to constitute a part of the contingent general fund thereof. Meters must be furnished by such companies to consumers upon request.

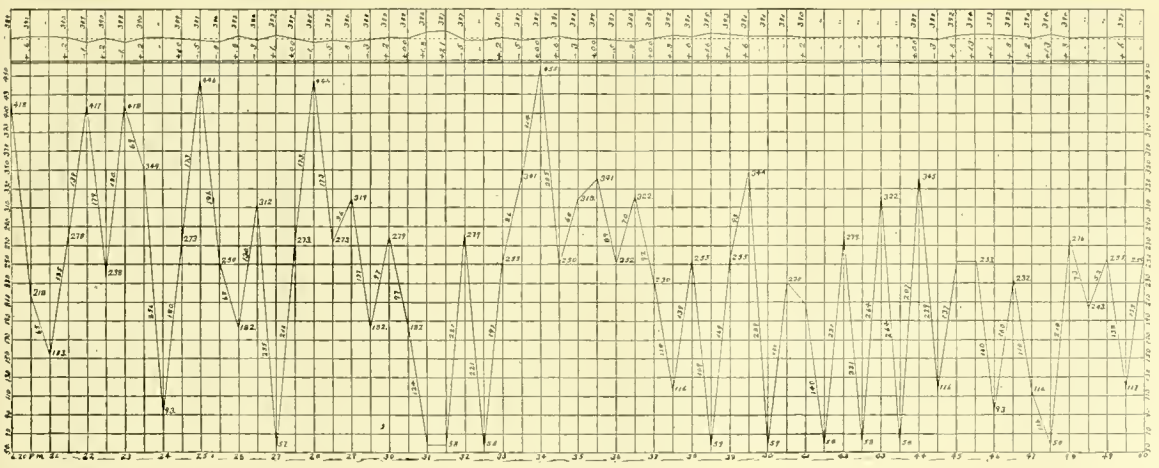


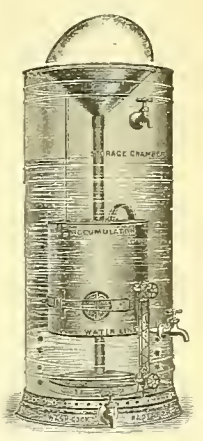
FIG. 4. LOMBARD WATER WHEEL GOVERNOR.

## Telegraphic Historical Society of North America.

The annual meeting of the newly formed Telegraphic Historical Society of North America will be held in Washington, D. C., in May. A feature of the gathering will be the attention paid to the route of the original Baltimore-Washington trial line built under Prof. Morse's supervision. There will be a display of Morse mementoes, a map of the Baltimore line, and possibly action will be taken to the end of erecting monuments to mark the termini of the route selected by Prof. Morse. Wm. R. Plum of Chicago is a director of the society.

## Tracy Oil Filter.

In the accompanying cut is illustrated the Tracy patent oil filter manufactured by the Phœnix Automatic Filter company, Racine, Wis. It is claimed that a large saving in oil bills can be obtained by the use of this filter, and waste oil can be used over and over, until taken up by the machinery by this system of filtration and purification. The device is very simple, as will be seen by the illustration. It has been highly endorsed by those who have used it, and is guaranteed to make waste oil pure and safe to use on the finest and most rapid running machinery. It has been tested by many electricians and others, and seems to meet with general approval. The Phœnix Automatic Filter company will be glad to forward descriptive matter on application.



TRACY OIL FILTER.

## Municipal Street Railways.

(From the New York *Sun*.)

A meeting was held in Brooklyn the other day for the purpose of considering the bill now before the Legislature, allowing municipal ownership of street railroads in this city, Brooklyn and Buffalo, if the voters decide that they are in favor of it. The meeting was under the direction of the Social Reform club of this town, and most of the speakers were from this side of the river. The meeting passed resolutions attacking corporations and approving warmly the bill for municipal ownership.

Probably a good deal of the feeling in favor of municipal ownership which was manifested at the meeting was mere unreasoning sentimentality due to the recent strike. The railroads were rich, the men poor; therefore we are against railroad corporations, and want Brooklyn to conduct her own railroads. That seems to be the reasoning followed unconsciously by a number of semi-socialists, clerical and

lay. But how will city ownership stop strikes on the city's lines? The only means of preventing strikes will be to pay the employes fat round salaries, such as are given to policemen and firemen. A pension system will naturally ensue. The reduction of fares will be the next step. Free transportation the next. The interest account for the purchase or construction money, the increase in operating expenses, and the decrease or total absence of receipts will give the taxpayers of any city which goes into the railroad business something to think about for a good many years. Leaving free transportation out of consideration, the expense will be a big liability for any municipality to saddle; and if it tries to run the roads at a profit, the strikes and losses of the old system will reappear.

Reforming things by resolution is a mighty easy job.

Also, considering that our great cities have not yet shown any satisfactory ability to govern themselves and manage their own business, what reason is there to believe that they can be any more successful in owning and managing the street railways?

## Heaters in the Buffalo Street Railway Power Plant.

Two 2000 horse power heaters are employed in the Buffalo street railway power plant which was described and illustrated in the last issue of the WESTERN ELECTRICIAN. These heaters were furnished by the Goubert Manufacturing company, New York, and are giving satisfaction.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, March 23.—The Citizens' Electric Illuminating company of Brooklyn, of which E. F. Peck is superintendent, extended an invitation to the leading citizens of Brooklyn to attend an exhibition of the two-phase alternating current system installed for it by the Stanley Electric company of Pittsfield, Mass. Some three hundred ladies and gentlemen were in attendence last evening and kept the company's representatives in charge of the various apparatus busy giving the information desired regarding this extensive plant. A large number of arc and incandescent lamps and a searchlight were operated in a manner to demonstrate the excellence of the system in use, whereby light and power can be supplied from the same generator and circuit. The plant of the company, located at DeKalb avenue and Rockwell place, comprises two distinct buildings. Nos. 4, 6 and 8 Rockwell place, or what is known as the old station, is a two-story brick building, 75 by 100 feet, equipped with three Wright engines aggregating 1,100 horse power, which are connected by means of jack and counter shaft to 39 forty-five light Thomson-Houston arc dynamos, with a total capacity of 1,755 arc lights of 1,200 candle power each. The new plant, Nos. 10, 12 and 14 Rockwell place, is a three-story brick and iron building, 75 by 100 feet, equipped with two McIntosh & Seymour vertical triple expansion condensing engines of a capacity of 400 horse power each, belted to two lines of shafting on the dynamo room floor, to which are belted 28 Thomson-Houston forty-five light dynamos. The steam plant is composed of nine Logan boilers, with a capacity of 150 horse power each, and six Cowles water tube boilers of a maximum capacity of 250 horse power each. Feed pumps and condensers are of the Worthington duplex type, and the feed water heaters are of the Goubert manufacture. The water for condensing and other purposes is obtained from a system of driven wells, with a guaranteed capacity of 2,000 gallons per minute. One of the features of the station is the fireproof switchboard, one of the largest in the country, which handles 96 circuits and 72 dynamos, allowing the connecting or disconnecting of any dynamos or circuits. The offices, stock room and testing departments on the third floor are handsomely furnished and well equipped. The company will add to its equipment the two-phase alternating system exhibited on Friday evening, thus providing for incandescent lighting and motor work. Up to the date of the Bate decision the company was handicapped by the Edison incandescent lamp patent controlled by the General Electric company, which practically gave a monopoly of incandescent lighting to licensed companies. Now that the field has been opened to competition, it is the intention of the Citizens' company to take advantage of the fact and offer to the public a safe and efficient service at reasonable rates. The meter system will be adopted. The company's guests were entertained at luncheon in the large office. All present joined in the wish for continued success for the Citizens' company.

On Tuesday Horace J. Morse was appointed receiver of the Long Island Traction company by the United States Circuit Court of West Virginia. This is the company which is accused of having an enormously watered capital ($30,000,000) and on which Judge Gaynor made such a spirited attack at the time of the Brooklyn strike. D. F. Lewis is the president of the company. The company was organized under the laws of West Virginia in March, 1893, with a capital stock of $30,000,000, in order to operate the Brooklyn City Railroad company, and in June, 1893, it took possession of that property under a 999-year lease, guaranteeing 10 per cent. dividends on $12,000,000 stock. The lease was nominally to the Brooklyn Heights Railroad company, but practically to the Long Island Traction company, since that company owns the entire capital stock of the Brooklyn Heights company and has guaranteed payment of dividends to lessor by special funds in hands of the trustees. This fund is kept invested in bonds satisfactory to the lessor and the lessee. The original amount was $4,000,000, but in July, 1894, $250,000 was used (as permitted by the lease) to pay the Brooklyn City rental. In January, 1894, the Long Island Traction company acquired the entire capital stock ($2,000,000) of the Brooklyn, Queens County & Suburban railroad, which is composed of the Broadway road, the Jamaica and Brooklyn road and the Broadway ferry and Metropolitan avenue. The entire system includes 245 miles of road and there are 173 miles proje ted. The roads in the system are the Brooklyn City railroad, which was organized in 1853; the Brooklyn Heights railroad and the Brooklyn, Queens County & Suburban railroad.

W. F. O.

## Northwestern Notations.

MINNEAPOLIS, March 23.—Further complications in the Winona General Electric company's affairs have arisen by the arrest of Geo. J. Gerlicher, head engineer of the plant, on complaint of the receiver, S. B. Livermore, charged with maliciously and wilfully injuring and damaging two field spools and two Edison electric light dynamos, closing the valves to the water columns in boilers and making a large hole in the water supply pipe to render useless the electric light dynamos. Gerlicher left the employ of the company February 28th, and on the same day the damage is supposed to have been done. The receiver says Gerlicher was seen to go down into the well and close the trap door after him, and while he was down there, pounding as with a cold chisel was heard. The cutting of the water pipe was discovered just in time to prevent an explosion. The oilers and night engineer resigned, saying they were afraid to work there the day following Gerlicher's resignation.

The electric light company of Ashland, Wis., has shut off all street lights under orders from the council, which does this to cut down expenses. The electric light company does not concede the right of the city to discontinue the light, claiming the franchise is with the city for both gas and electric light, but as the city had not paid a dollar in two years it was thought best to discontinue the service.

Mr. Conradson, vice-president of the Gisholt Machine company of Madison, Wis., has resigned and will devote his entire attention to the manufacture of electric motors. He is designing a steam engine to be used in connection with his motors.

J. M. Thompson and F. C. Rutan of the Wisconsin Interurban company, and James H. Elmore and Frank Vanderzee of Green Bay, representing the rival companies which propose to construct an electric line from Neenah to Kaukauna, are in consultation with a view to one company retiring and the other carrying on the road, or perhaps consolidating their interests.

The North Shore Telegraph company, with headquarters at Grand Marais, Minn., has incorporated with $100,000 capital stock.

Mankato, Minn., citizens are petitioning to vote the bonding of $15,000 for municipal electric lights at the coming election.

The advocates of municipal lighting carried the election in Independence, Iowa, overwhelmingly.

The Central Electric company of Le Sueur, Minn., has been incorporated by Wm. H. and W. A. Patten, W. H. Tomlinson, H. F. Weist and E. H. McLeod, with $25,000 capital stock.

J. B. Caterbury has formed a company of Savanna, Ill., people to build and operate a street car line in La Crosse, Wis. Work will be begun on May 1st. Horses will be used at first but electricity later.

Several hundred business men of Dubuque, Iowa, have signed contracts to use the Harrison telephone for five years, and the exchange will be put in when 600 subscribers have been secured. The Bell company, which has 500 subscribers, threatens to furnish the instruments for nothing.

J. P. Clark has assumed charge of the Tacoma Traction company, of Tacoma, Wash., and will have general direction of the extensions and improvements to be made. Work has been begun on the proposed Puyallup line and the foundation for the new power house is being laid.

J. Lindauer of Kaukauna, Wis., made the lowest bid for putting in electric lights for Menasha, Wis., offering 50 or more arc lights at $70 per annum on the Philadelphia schedule or $80 per light per annum for lighting within two hours of sunrise.

It is proposed to put in an electric lighting plant in the state capitol in Des Moines, Ia., at a cost of $10,000. The lighting bill for gas runs about $150 per month, and is, of course, heavier when the Legislature is in session.

Nora Springs, Ia., voted to grant a 20 year franchise for an electric light plant overwhelmingly at the late election.

Helena, Mont., is taking bids for furnishing 75 arc street lamps of 1,200 candle power for one to five years on the moonlight and all-night schedules, and also for lighting certain public buildings for the same length of time.

The Rocky Mountain Bell Telephone company will build lines to Butte and to Great Falls, Mont., from Helena, Mont. Copper wire will be used on both lines, and the Butte line will be completed May 1st and the Great Falls line a month or so later. In addition the company contemplates shorter lines to Butte from Great Falls, via Sand Coulee, and one from Grantsdale to Darby. The company also contemplates building into Mullan, there connecting with Spokane, Seattle, Tacoma and Portland, making it one of the longest lines in the United States. Twenty-five miles of it would have to be underground, as frequent storms make it impossible to keep a surface line in good repair for the winter months.

Winona, Minn., will vote on the question of a municipal electric plant this spring.

Des Moines, Iowa is in the swim for lower telephone tolls. C. K. Mead has applied for a franchise and offers to reduce present rates 35 to 50 per cent. if granted one. He has circulated a petition and claims to have 500 signers who agree to take his 'phone if he is granted the franchise, which will probably be done.

Belvidere, Ill., is in the throes of a lively telephone rate war, and the patrons of the exchanges are about the only ones who are enjoying themselves. The town was about the first to put in the opposing exchange and now the old company is endeavoring to drive the new comer from the field. To do this 'phones are offered free for one year. The Central Union Telephone company is taking contracts on that basis, the contract calling for $18 per year, and a receipt in full being presented when the contract is signed.

There is considerable discussion in the towns along the line of the proposed Interurban line between Neenah and Menasha over granting the franchise through the various towns. J. K. Tillotson is an applicant and Messrs. Elmore and Vanderzee of Green Bay are also. It is charged that Mayor Rosch of Menasha is favoring the Green Bay party and is ignoring advantageous offers from the other party on mere subterfuges, and rushing through the franchise without due consideration:

Fond du Lac, Wis., has an electric line which is not in operation and there is no immediate prospect that it will be. At the last meeting of the council the mayor recommended that the tracks be torn up, as they are a constant menace.

The arrangements for a reorganization of the Great Western Manufacturing company of Duluth are progressing. R. S. Munger and E. R. Gilman have charge of the matter. It is understood that nearly all of the heaviest creditors of the concern will go into the plan.

The first annual report of the Rochester, Minn., electric plant shows the cost of 69 arc street lamps to be about $28 per annum each, without computing interest on the cost of the plant or allowing for its depreciation. Austin, Minn., where the cost of fuel is about the same, pays $60 per annum each for 1,200 candle power lights, while the lamps in Rochester are 2,000 candle power.

M.

## Milwaukee, Wis.

MILWAUKEE, March 23.—A bill that is of great importance to electrical interests has been introduced into the state Legislature by Senator Buckstaff of Oshkosh. It provides that no town, village or city shall grant a franchise to any street railway, gas or electric light company, telephone or telegraph company or to any other corporation of a quasi-public character, or to any private persons for such purposes, for a longer term than twenty-one years and it is expressly provided that no exclusive franchise shall be granted. The municipal corporation shall reserve the right to buy the plant operated under such franchise at the end of the term at a price equal to the physical plant, such value to be determined by the owners and the municipality; if they cannot agree, then by a board of three arbitrators to be chosen in the usual way, and if they cannot agree, then by the Circuit Court. There are a number of similarly restrictive provisions.

The Milwaukee Board of Public Works has awarded contracts for the electric wiring of the new city hall. The Western Electric company of Chicago was the lowest bidder by $3,300 and got the contract. Its bid was $14,530. The other bidders were Duerr & Rohn of Milwaukee, who asked $20,300 for the work, and the E. G. Bruckman of St. Louis, whose figures were $17,880. The bids were based upon specifications prepared by C. G. Armstrong of Chicago. All of the wires in the building will be encased in iron pipes. The wiring plan is such that a break or grounded wire can be detected and repaired without injury to the walls and ceilings.

The annual report of the Wisconsin Telephone company

shows that the total length of the company's wires in the state is 13,494 miles. The number of instroments in use is 7,000.

The business men of Mansfield, Wis., have put in a telephone system of their own and it is understood that the people of the neighboring cities propose to take a similar step in case the Wisconsin Telephone company does not come to terms. The village board of Waukesha has been asked to grant a franchise for a new telephone exchange, to be operated in opposition to the Wisconsin Telephone company. W. F. Porter has asked the Marinette and Oconto authorities for a telephone franchise. There is a suspicion, however, that he has not the necessary financial backing and is simply trying to get the franchises for the purposes of speculation. The Wisconsin Telephone company, on the other hand, wants to get an exclusive franchise at Racine, and is said to be willing to rebuild the police and fire alarm telegraph systems with metallic circuits and to furnish fire and police telephones at $10 a year.

There is trouble between the two rival electric light companies at Appleton. The Appleton Edison Electric company was established in 1881, and its plant was the first electric light station in operation in the United States. Last fall the Citizens' Electric Light & Power company was formed by local capitalists, and last month it began business with 1,500 lights on its circuits. It uses the alternating system, and has ordered machinery for the doubling of its plant. The Edison company has announced that it will reduce the price of lights 50 per cent., and the new company was expected to meet the cut. A lively time is probable. The new machinery ordered by the Citizens' company consists of a boiler, another 400 horse power engine, two incandescent light dynamos and four arc light dynamos.

Three trolley wires at the corner of Grand avenue and West Water street fell to the ground one evening recently and twisted and turned like fiery snakes. H. B. Dewey, a commercial traveler, was enveloped in the wires before he knew it, and the spectators thought that he was surely doomed, but, after falling to the ground, he arose and walked away. The wires had been pulled loose at Grand avenue bridge by a car and at the same time the guy wire supporting the network of wires at the corner broke.

The Clintonville Electric & Power company has been incorporated with a capital stock of $8,000. The incorporators are L. M. Stewart, P. A. Stewart and D. S. Stewart. The company has a twenty-year franchise from the city, and while steam power will be used at first, a water power ten miles from town may be used eventually.

The common council of Sheboygan has decided to advertise for bids for furnishing 128 arc lights of 2,000 candle power, the lamps to be kept burning all night. The bids are to be on the basis of five years, ten years, fifteen years and twenty years. The bidders are to furnish a bond of $5,000, with two sureties, who must be residents of the state.

The reorganization of the Milwaukee Street Railway company and its auxiliary corporations has been perfected. The officers of the principal company are as follows: President, W. N. Cromwell; vice-president, Henry C. Payne; secretary, C. A. Spofford; treasurer, A. Marcus; assistant treasurer, G. O. Wheatcroft; general manager, C. D. Wyman. H. C. Payne, F. G. Bigelow and Charles F. Pfister compose a committee on operation. The Milwaukee & Whitefish Railway company has elected the following named officers: President, Henry C. Payne; vice-president, W. L. Mason; secretary and treasurer, George O. Wheatcroft. These gentlemen and Thomas W. Spence, C. D. Wyman, Charles F. Pfister, Fred Vogel, Richard Burke and Carl Landsee are directors. The new directors are Messrs. Spence, Pfister and Vogel. C.

## PERSONAL.

O. M. Rau of Milwaukee spent a few days in Chicago last week.

Thomas C. Perkins, vice-president of the Mather Electric company, Manchester, Conn., was in Chicago last week.

E. M. Izard, well known to the older members of the electrical fraternity in Chicago, has returned from California with health completely restored.

President H. H. Pattee of the Edison Illuminating company of Monmouth, Ill., spent Thursday of last week in company with W. J. Ferris of the General Electric company, visiting his many friends in Chicago.

Frank S. DeRonde, general sales agent of the Standard Paint company of New York, has been elected town clerk of Teaneck, N. J. Mr. DeRonde will undoubtedly distinguish himself in serving his fellow-citizens in this new capacity.

Sidney Sprout, formerly assistant superintendent of operation in the electrical engineering department of the World's Fair, and later assistant electrical engineer of the California Midwinter Exposition, has been spending a week or so in Chicago. Mr. Sprout is now located in San Francisco, where he is associated with Geo. P. Low as a mechanical and electrical engineer. Mr. Sprout reports a better outlook for the electrical business on the Pacific slope, and says that a large number of power transmission schemes are under discussion.

## ELECTRIC LIGHTING.

The *Kansas City Star* of recent date says: "An examination of the books of the Kansas City Electric Light company has developed the fact that the company has been systematically robbed of several thousand dollars during the past few years. The exact amount cannot be told until an expert, who is now at work on the books, makes his report, but it is said to already approximate $6,000. A. J. Coulter, who has been bookkeeper for the company since 1889, is accused of being the embezzler. He has not been actually arrested, but is under the surveillance of the American Surety company, which is on his bond. About a week ago E. R. Weeks, manager of the Kansas City Electric Light company, discovered from an examination of Coulter's books that the company was being robbed. Coulter was immediately dismissed from the company's employ and turned over to Detective Bowman of the American Surety company. He was placed in the 'sweat box' and it is said made a confession which implicated another young man formerly in the employ of the company. It is certain that Coulter must have had a confederate or else the stealing would have been discovered long ago."

## ELECTRIC RAILWAYS.

The Fishkill, N. Y., Electric Railway company has been incorporated for the purpose indicated by its name. The capital stock is $50,000, and the line will extend from Matteawan to Fishkill.

Property owners on Ellis avenue, Chicago, between Thirty-first and Forty-fifth streets, have entered a protest against the passage of an ordinance granting the General Electric Railway company the right to build, maintain and operate an electric line on Ellis avenue. The ordinance was introduced in the council a month ago and is now in the hands of the judiciary committee. A petition was drawn up and received 250 signatures, representing nearly 80 per cent. of the total frontage between Thirty-fifth and Forty-fifth streets. The petition will at once be presented to the council.

The contract for the steel work for the first section of the Boston subway, through which electric cars will run, has been let to the Pennsylvania Steel company of Steelton, Pa. The company has made extensive preparations at the plant, which will enable it to roll the large "I" beams included in the contract and which hitherto have been made by only one mill in the country. The first section of the subway will be 2,000 feet long under Boston Common, and will contain 2,000,000 pounds of steel. This contract will keep the Steelton mills busy nearly all summer.

The Marion, Ind., street railroad, an electric line leading from the city of Marion to several of the gas towns, was ordered sold by Judge Baker of the Federal Court on March 13th. The owner and projector of the line is Russell B. Harrison, son of the ex-president. The line is said to have cost $53,000, but debts have been incurred, it is claimed, to the amount of $80,000, the bonded debt being $75,000, or about one-third more than it cost to build the road. The mortgage bondholders will no doubt buy the property.

## TRADE NEWS.

William Hood has removed from 239 La Salle street, and has taken temporary quarters at 1105 Monadnock building, Chicago. On May 1st he will occupy room 21 on the first floor of the same building.

Kohler Brothers of Chicago have just closed a contract with the Union Depot Railroad company of St. Louis for forty car equipments of the Walker Manufacturing company's type. Each equipment consists of two 30 horse power motors, and the order also includes 80 Walker series parallel controllers. This is one of the largest orders yet taken by the Walker company, and as it follows a trial order for five equipments placed last fall it speaks well for the excellence of the apparatus.

The Metropolitan Electric company, Chicago, has been appointed agent for the Solar arc lamp for incandescent circuits. Its feed mechanism is so simply and adjustable that it has been found to be a most thoroughly economical and practical lamp. It is simple in construction, has a positive action of feed, no springs or dash-pot and no see-sawing. The lamp is manufactured plain or in various styles of ornamentation to meet the requirements. Samples are exhibited at the warerooms of the Metropolitan company, 186 and 188 Fifth avenue, Chicago, where a stock for immediate shipment will be carried.

The Electric Power Storage company of New York is to be congratulated upon a contract just closed by their western representative, Wm. Hood, with H. H. Porter, president of the Chicago & Eastern Illinois Railroad company, for 120 350 ampere hour accumulators for a lighting plant in his summer residence at Lake Geneva, Wis. Mr. Hood has only recently taken this company's agency in the West, and the Electric Power Storage company will doubtless see many more such results in the near future. Mr. Hood is an experienced storage battery salesman, and it is safe to say that the business of this company in his hands will prove most satisfactory.

Julius Andrae & Sons company, Milwaukee, Wis., has added a telephone department to its already large list of excellent electrical specialties. The company has secured the services of W. H. Kelsey, who is one of the best known telephone experts in the West. Mr. Kelsey installed the first telephone exchange in Milwaukee, and has had a wide experience. Until recently he has been superintendent of the Chicago, Milwaukee and Lake Superior Telegraph company, which was lately consolidated with the Postal Telegraph company. Mr. Kelsey is thoroughly posted on telephone matters, and the Andrae company is to be congratulated on securing his services.

George B. Mallory, 106 Produce Exchange, New York, N. Y., announces that he is prepared to accept commissions in the line of structural engineering for buildings, electric light and ventilation. He also gives special attention to the electrical transmission of power. Mr. Mallory is well known among the early pioneers of the electrical trade by his connection with the Edison Electric company as naval engineer in 1879. He has since been known prominently as one of the leading naval architects of the country. The steamers Connecticut, City of Seattle and Concho and the palatial steam yacht Dungeness were designed and constructed under his supervision.

The Weston Instrument company of Newark, N. J., in order to keep up with the large increase in its business, has been obliged to add several thousand dollars' worth of new machinery to its equipment, including many special tools. The factory has been operated on full time during the business depression, and, indeed, on several occasions the force has been obliged to work overtime. It is encouraging to note that the foreign department of this company has increased its capacity during the last year. At the present time the Weston instruments are sent to all parts of the globe. It is probable that the company will soon be obliged to seek more commodious quarters for its factory.

An interesting electric power transmission plant is in process of installation by the General Electric company at Rochester, N. H., for the operation of the Wallace shoe factories. The three-phase system has been adopted. The generator will be a 140 kilowatt or about 190 horse power machine wound for 560 volts, as the distance of transmission is insignificant. The motors will be of the induction type, without commutators or moving wires, and will be operated without the use of transformers. These motors will be 500 volt machines, of 5 horse power, 15 horse power, 20 horse power and 25 horse power capacities. Another generator to be used principally for lighting will shortly be added.

The Beacon Vacuum Pump & Electrical company, Boston, has issued a circular announcing that it is again prepared to furnish "the Beacon" all glass lamp. Among the claims made by the manufacturers for this lamp are the following: "It is the only lamp exhausted wholly without the use of mercury, and therefore the only lamp which does not contain mercurial vapor. This is a very decided advantage, as this vapor is acknowledged to be an efficient cause of the interior blackening of the bulb and to otherwise lower the candle power of a lamp by its injurious action upon the filament. Our filament is of the highest standard and enables us to give high efficiency, coupled with great durability. In addition to this, our glass work is perfection, and our patented mount has no equal." The company has discontinued the manufacture of the "New Beacon" lamp, which has been on the market during the last year.

The Goulds Manufacturing company has just begun the erection of a new addition to its extensive works at Seneca Falls, N. Y. The construction of this building is necessitated by the steadily increasing business in triple power pumps. The building will be a modern structure, two stories in height with basement for storage of castings, length 86 feet and width 35 feet. The frame work, beams, columns and roof truss will be of steel. The main room for heavy machines and erecting purposes will be 22 feet high and served by an electric bridge crane of 10 tons capacity. The gallery will divide one side into two stories for lighter machine tools. The walls will be of brick, while the skylight and upper windows will be glazed with ribbed glass. The entire main floor is designed to stand a uniform strain of 400 pounds to the square foot, although a limited area is capable of bearing 600 pounds to the square foot. It is expected that the building will be completed about June 1st.

The Union Brass Manufacturing company confessed judgment in the Circuit Court, Chicago, on March 20th, to several banks and private individuals. The first was in favor of the Fort Dearborn National Bank of Chicago for $2,513, the second was to the Atlas National Bank for $5,513, the third to the Hide and Leather National Bank of Chicago for $2,513, the fourth to the National Bank of Illinois for $13,113, the fifth to A. C. Becker & Co. for $4,013, and the sixth to Francis W. Holbrook for $2,813. The company was organized in January, 1894. The president is G. D. Van Vliet and the secretary is Francis W. Holbrook. J. McGregor Adams was one of the principal stockholders, but he withdrew his interest previous to the failure. The plant of the corporation is at 123 Ontario street. Attorney G. G. Willard, counsel for the National Bank of Illinois, which forced the execution of notes, said: "The failure of the concern is due to a lack of capital and insufficient means to meet current expenses. The corporation asked for further loans in order to enable it to settle with its creditors. But my client was unable to grant this request, which resulted in the company going to the wall."

By the 1st of May the Wallace Electric company of Chicago will have removed one door north of its present location, the address being changed from 307 to 305 Dearborn street. The new store is much larger and better arranged than the old and will afford the company very materially increased facilities for displaying and shipping goods and for office work. Twice the space of the present quarters will be available, and the increasing business of the company will thus be accommodated. Among the company's agencies of comparatively recent acquisition the following may be named: The Boston incandescent lamp, R. B. Corey's arc lamps for all circuits, the Electric Selector & Signal company's electric light and power controllers, Whittingham electric heater and the Macallen electric railway material. In its new store the company will be enabled to carry and display a complete line of house goods of all descriptions, and will be prepared to fill orders promptly. Messrs. Wallace and Hine, as the western agents of the Stanley Electric Manufacturing company, also report that the outlook for the western output of the Stanley two-phase generators and motors is excellent. It is considered a flattering augury that several customers have already duplicated their orders.

## BUSINESS.

The Bryant Electric company has a very neat device in the shape of a cleat and rosette combined to be used with work using porcelain cleats.

The Beacon Vacuum Pump & Electrical company of Boston, Mass., reports that there is a rush for the "old Beacon" incandescent lamp, so long and favorably known on the market. Extra apparatus has been ordered, so that the company can meet the demand.

The Electric Appliance company is doing a fine business with "O. K." weatherproof wire and is laying in an exceptionally large stock for the coming spring business. The company claims to be in a position to ship a weatherproof wire order of any size from the Chicago stock immediately on receipt.

The Perkins Electric Switch Manufacturing company of Hartford, Conn., has been working day and night in preparing its factory for the manufacture of incandescent lamps. With his usual push, General Manager J. J. Gates will shortly be in shape to fill orders for incandescent lamps in any quantity.

The Mather Electric company of Manchester, Conn., has received through J. Holt Gates of Chicago the order for five 100 kilowatt multipolar generators, with station equipment, for the new station of the Indiana Electric Railway company of Goshen, Ind. This contract was secured against strong competition, and reflects credit on Mr. Gates, and shows that the merits of the new Mather multipolar apparatus are widely appreciated.

In response to an inquiry from Western Manager Markle of the Electric Storage Battery company, Superintendent Swiler of the Wisconsin School for the Deaf at Delevan, Wis., writes under date of January 28th: "The Chloride battery which you put in for us last May has given perfect satisfaction. It has not been repaired in any way, and shows no signs of deterioration whatever. We burn 40 lamps in the early part of the evening and about 12 all night from it."

The E. P. Gleason Manufacturing company of New York reports very large sales of Stalactite lamps for incandescent lighting, the new design being in great demand. In the other departments the electrical trade is showing unusual volume over that of the preceding months of the year. A large share of this business is from the central and western states.

The Electric Selector & Signal company of New York is very busy in placing a large number of its selectors on the circuits of the various central stations through the country. It has such a demand that extra men have been placed to attend to the installing of the apparatus. The device has the merit of saving power and recommends itself highly to the managers of electric lighting stations.

General Sales Agent F. S. DeRonde of the Standard Paint company, New York, reports that business has greatly improved of late, and that all agents say that their recent sales will show a large increase over those of the corresponding months of last year. One very large order of two carloads of rubberoid felt was received last month for lining the hull and refrigerating department of the new American liner St. Louis. The increased business has made it necessary to employ additional help at the factory.

Timothy W. Sprague, who has offices at 53 State street, Boston, and 253 Broadway, New York, announces that he is prepared to furnish advice in all engineering questions in connection with mining. Mr. Sprague's experience includes five years with the power and mining department of the General Electric company and its predecessor, the Thomson-Houston company, and a year with Westinghouse, Church, Kerr & Co. In the special line which he proposes to develop he says what is required is not the work of a mining engineer nor an electrical engineer, but a combination of these two lines, obtained only by practical experience. The requirements of each mine are a problem in themselves, not only as to what can be accomplished, but how to accomplish results best and cheapest in the end. Heretofore this work has been done by representatives of the manufacturing companies furnishing apparatus.

Julius Andrae & Sons company, Milwaukee, Wis., has just completed an installation consisting of incandescent lights as well as a fire alarm system in the new high school of Oconto, Wis. The company is completeing a similar contract in the high school building at Janesville, Wis. The Andrae company has also secured the contract for wiring the new hotel which has been erected in Marinette, Wis. This installation calls for over 300 incandescent lights, together with a combination guest call and fire alarm system. The building will be one of the finest in the state and everything in it will be up-to-date.

The General Electric company has received from the Concord Land & Water Power company a very flattering testimonial on the three-phase plant installed at Concord, N. H. This plant has been fully described in the WESTERN ELECTRICIAN. The General Electric company announces that it has been awarded the contract for the electrical apparatus to operate the new water pumping station which will soon be constructed at Canandaigua, N. Y. The power house will be located at the foot of Main street on Canandaigua Lake and will contain one 100 kilowatt three-phase generator delivering current at 2,080 volts. This will be driven by a steam engine. The current will be transmitted to the pumping station, 18,000 feet distant, on the shores of the lake, 1,500 feet from reservoir. The pump house will be occupied by two one million gallon pumps, directly geared to 100 horse power induction motors, wound for 2,080 volts and turning at 600 revolutions. The duplication of the pumping system has been determined upon in order that the work may be effected continually even should one pumping equipment break down. An automatic signal alarm will indicate at the power house when the reservoir is full.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued March 19, 1895.*

535,810. Spring Winding Means for Printing Telegraph Instruments. John Burry, Long Island City, N. Y. Application filed May 12, 1894.

Claim 1: In a printing telegraph or other machine, the combination with the escapement of an automatically wound main spring, and gearing containing a spring connecting the main spring and escapement and operating the escapement wheel.

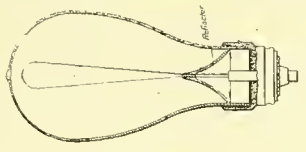
535,838. Incandescent Electric Lamp. William S. Lowe, Lima, O. Application filed October 15, 1892.

The cut illustrates an incandescent lamp, having a conical shaped reflector in the upper portion, the base of the reflector beginning near the point where the outside cap ends, and extending down to a point at the stub through which the filament enters.

535,840. Electric Arc Lamp. George R. MacIntire, New York, N. Y. Application filed July 5, 1894.

This lamp, as shown in the cut, contains a supporting plate, carbon holders supported by it, a single long rod secured to the plate, a globe holder and a latch whereby the holder may be secured to the plate, and an arm secured to the globe holder and having a sleeve to encircle the single rod, whereby the globe holder may be released from the plate and lowered upon the long rod and swung laterally thereon.

535,841. Electric Arc Lamp. George R. MacIntire, New York, N. Y. Application filed July 5, 1894.



NO. 535,838.

A supporting base, a series magnet supported therein and bored axially, an armature placed below the magnet and having a rod extending up through the bore of the magnet, a carbon supporting carriage, a guide therefor, an actuating shaft therefor supported on the rod, and means to actuate the shaft.

535,842. Electric Arc Lamp. George R. MacIntire, New York, N. Y. Application filed July 10, 1894.

In an electric lamp is claimed the combination of arms mounted to swing toward each other, carbon holders supported by the arms, a screw-threaded shaft, a traveling nut mounted on the shaft, and intermediate means between the nut and arms to swing the latter.

535,865. Electric Sign Changing Device. William Sears, Boston, Mass. Application filed February 19, 1894.

In an apparatus for operating a series of connected signs the claim is made for an electric motor, having a pole armature, a mechanism for transmitting motion from the motor to a fabric containing a series of signs, a mechanism operated by the motor for opening the motor circuit and closing the "stop circuit," a mechanism operated by a clock train for opening the "stop circuit" and closing the motor circuit and "stop circuit" and motor circuit.

535,917. Induction Coil. Albert F. W. Meyer, Blue Island, Ill. Application filed November 27, 1894.

An induction coil is described, having a spool, primary and secondary wires coiled side by side about the spool and separated by interposed insulation, the number of secondary coils exceeding by one the number of primary coils, and soft iron expanded heads on the opposite ends of the spool.

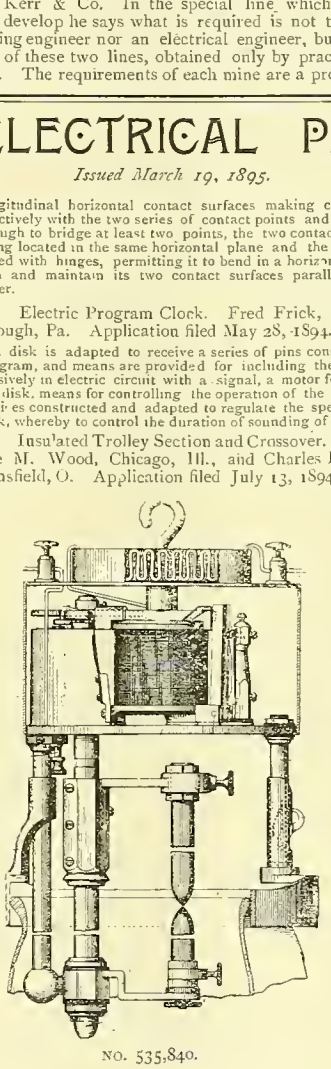
535,936. Conduit Electric Railway. Fred P. Bergh and Charles W. Tarbox, New York, N. Y. Application filed May 25, 1984.

A conduit is provided with two series of contact points connected respectively with the positive and negative sides of the supply circuit, in combination with a contact shoe having two longitudinal horizontal contact surfaces making contact respectively with the two series of contact points and each long enough to bridge at least two points, the two contact surfaces being located in the same horizontal plane and the shoe provided with hinges, permitting it to bend in a horizontal direction and maintain its two contact surfaces parallel to each other.

535,948. Electric Program Clock. Fred Frick, Waynesborough, Pa. Application filed May 28, 1894.

A disk is adapted to receive a series of pins constituting a program, and means are provided for including the pins successively in electric circuit with a signal, a motor for moving the disk, means for controlling the operation of the motor and devices constructed and adapted to regulate the speed of the disk, whereby to control the duration of sounding of the alarm.

535,971. Insulated Trolley Section and Crossover. Montraville M. Wood, Chicago, Ill., and Charles K. King, Mansfield, O. Application filed July 13, 1894.



NO. 535,840.

The combination in a trolley insulating device is claimed of tongues to which the trolley wire is to be attached, plates rigid with each tongue, projecting lugs on the plates, a piece of insulating material provided with caps, having lugs on the end which are adapted to fit between the lugs on the plates and a bolt or the like passing through such lugs, so as to hold the parts together.

535,993. Closed Conduit Electric Railway. James F. McLaughlin, Philadelphia, Pa. Application filed October 23, 1894.

An electric railway provided with a conduit composed of sections having switch boxes connected thereto by laterally extending necks, in combination with supports having extensions forming the bottoms of the switch boxes is described.

536,032. Alternating Current Motor. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed November 17, 1892.

The arrangement is clearly shown in the accompanying cut, and the claim is made for the method of rotating the polar line or lines of a magnetic field of force, produced by energized circularly arranged field magnet coils, which consists in dephasing with reference to each other the alternating currents of the same period, passing through distinct branches of the coils by producing a difference between the self-induction of the circuits by difference of static capacity.

536,035. Apparatus for Automatically Limiting Speed of Electric Cars. Louis S. Wright, Philadelphia, Pa. Application filed December 8, 1894.

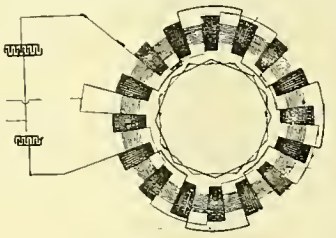
In an electric car, comprising a motor, a controller system and a brake system, there is employed a governor and means for driving it in conformity with the speed of movement of the car, actuating mechanism, a primary source of power for driving the actuating mechanism, and an engaging device operated by the governor and commanding the connection between the primary source of power for the actuating mechanism and the controller and brake systems.

536,076. Collapsible Conduit for Electric Railway Conductors. Harry C. Grant, New York, N. Y. Application filed September 17, 1894.

An electric railway system, having an underground conduit with a support therein, a casing composed of elastic metal plates of semi-elliptic cross-section mounted on the support above the bottom of the conduit, an insulated main conductor within the casing, and contacts also carried by the casing to be brought into electrical connection with the inclosed main conductor by a passing car.

536,095. Protective Device for Electrical Appliances. Joseph J. O'Connell, Chicago, Ill. Application filed November 23, 1894.

This device comprises in combination two conducting plates placed with parallel surfaces closely adjacent to each other, but separated for a portion of their area by a thin air space, the plates being adapted for connection respectively with an electric circuit and with the earth, and a supplementary interposed piece of textile fabric or similar sieve-like material, adapted to intercept disintegrated particles, but offering no impediment to the disruptive discharge across the air space.



NO. 536,032.

536,100. Automatic Toll Box for Telephones. Howard C. Root, Brooklyn, N. Y. Application filed November 30, 1894.

This arrangement is for pay stations having a signal to indicate the coin put in, and an audible signal producing movement controlled by the coins, in combination with a telephone set and circuits controlled by the signal producing movement to close the transmitter circuit independently of the telephone hook while the coin is passing through the toll box.

536,153. Tip for Flexible Electric Conductors. Charles H. McEvoy, Lowell, Mass. Application filed February 4, 1895.

A flexible electric conductor, comprising a conducting core, a non-conducting covering and a conducting needle connected to the core, and having a hook which passes through the covering to retain the covering on the core.

536,104. Electro-magnetic Signal. Theodore Spencer, Cambridge, Mass. Application filed September 10, 1894.

In an automatic annunciator the combination is claimed of a signal plate or target provided with a complementary actuating arm fulcrumed between the plate and arm and normally retracted by gravity, an electro-magnet adapted to be included in a signaling circuit, an armature therefor, and an armature lever or rod secured at one end to the armature and controlled thereby, and engaging the complementary actuating arm by its farther end with a light pressure during the retraction of the armature, and thus permitting the signal plate to remain out of view, but with sufficient force to elevate the signal plate into a horizontal position for the purpose of display when the armature is attracted to the poles of the magnet.

Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, APRIL 6, 1895. No. 14

## Storage Batteries in Maywood.

The successful operation of the storage battery locomotive installed last year in the tinplate factory of Norton Bros. company in Maywood, Ill., a suburb of Chicago, and described in the WESTERN ELECTRICIAN of October 27, 1894, induced Edwin Norton, the vice-president of the company, to consider the subject of an electrical installation for his residence, and it was finally decided to use current from the dynamo plant at the factory, conveying the "juice" to a storage battery plant located at the residence. As the factory is in operation 24 hours a day for almost the entire year and is supplied with duplicate electrical plants, there could scarcely ever be any failure in the supply of current. As, however, the storage battery would have to carry the entire lighting of the residence for any special occasion, it necessitated quite a liberal installation. There are nearly 300 lamps connected in the house, and in addition there will be a one-half horse power motor for blowing a pipe organ, another motor of the same size for pumping water, a small motor for operating a lathe, and still another for a sewing machine. The current is conveyed to the batteries at a pressure of 220 volts over a No. 4 wire. The distance from the house to the factory is 4,000 feet. The battery is located in a small room in the stable, and the house is connected to the switchboard, which is also in the stable, by a heavy No. 1 cable. In addition a pair of pressure wires are run between the house and the switchboard. The features of this interesting plant are shown by the group of illustrations on this page. The battery plant and a portion of the switchboard are shown in the larger picture on the left, while a general view of the house and stable and a view showing the wiring between the two are given on the right. A separate picture of the switchboard is given in Fig. 2. The pole line conveying the current from the factory to the house is shown in the lower right-hand picture in Fig. 1.

The entire installation occupies an exceedingly small space. The switchboard was built by the Cutler-Hammer Manufacturing company just previous to the late fire in that company's shop. The instruments are of the Weston pattern. A distinct novelty on this board is the employment of an automatic end-cell switch for regulating the voltage of the house. This is the first and only one in this part of the country, and in operation has given extremely satisfactory results. There are fifteen contacts on the outside ring, each corresponding to one cell, so that the voltage of the house may be reduced from that of 58 cells to that of 43. Automatic over-charge and over-discharge switches are provided, also an automatic back pressure switch.

The battery racks are of exceedingly solid construction, and the cells themselves are supported on oil insulators of a special type furnished by the Electric Storage Battery company. The 58 cells of the installation are of the chloride accumulator type, "E 15," 350 ampere hours each. The operation of the entire plant is very simple, all the attention necessary being to close the switch for storing the batteries and supply evaporation in the cells. The first operation is performed by one of the house servants, and all needed care of the battery and electrical apparatus is performed by the electrical department at the factory.

Another interesting, although smaller, storage battery house-lighting plant in Maywood is that in the residence of W. L. Gifford, secretary of the Norton Bros. company. This insulation is a duplicate in small size of Mr. Norton's house plant, but of much less detail. It consists of 28 cells of chloride accumulator type "E 5," 100 ampere hours each, and the controlling devices, as shown in Fig. 3, consist of two fusible cut-outs one for the charging lines and one for the house circuit, a double-pole switch inserted in the charging circuit, an automatic back pressure switch and a hand end-cell switch. The controlling apparatus is installed in a pantry. There are about 30 lamps of 52 volts each connected up in the house, and the battery is ample to run all of them for a short time if necessary. The charging current is carried to the house by a No. 10 wire, taking current from one side of the three-wire factory system. Mr. Gifford's residence was formerly supplied with current from the local lighting station, using the transformer system, but this service has been entirely discontinued.

FIG. 1. STORAGE BATTERIES IN MAYWOOD.—RESIDENCE INSTALLATION FOR EDWIN NORTON.

## Inspection Trip of Wisconsin University Students.

As usual during the spring intermission the junior students in electrical and mechanical engineering at the University of Wisconsin will make an inspection tour. The party will leave Madison on Wednesday of examination week at 5:10 P. M. Inspections in Chicago will begin on Thursday morning, and the following named works will be visited by the electrical engineers: Thursday, works of Illinois Steel company at South Chicago, works of Pullman company at Pullman; Friday, works of Siemens & Halske Electric company at Grant Locomotive Works, works of Western Electric company; Saturday, electric power plant of Metropolitan Elevated railway, works of Fraser & Chalmers, electric plant at the Auditorium; Monday, electric plants of the Chicago Edison company, cable railway

plant, electric railway plants. On Monday evening the party will leave for Milwaukee. On Tuesday the works of the Pabst Brewing company, the Pabst power house, the power house of the Milwaukee Street Railway company and the central exchange of the Wisconsin Telephone company will be visited. On Monday, Tuesday and Wednesday electrical students may, if they desire, leave the main party and join the mechanical students in visits to the great industries of Joliet, Waukegan and Milwaukee. The seniors will make their annual tour later on.

## Arc Carbons and the Rating of Arc Lamps.[1]

By L. B. Marks.

At the last convention of the National Electric Light association a special committee on the rating of arc lamps submitted a report, which was adopted and ordered printed in full in the standard rules of the association. The report reads as follows:

"Recognizing the difficulty, if not the impossibility, of measuring with any degree of accuracy the illuminating power of the arc lamp and the great necessity for a more precise definition and statement of the obligation of the producer of electricity for illuminating purposes to the consumer thereof, be it

"*Resolved*, That in the opinion of this convention what is ordinarily known as a 2,000 candle power arc lamp is one requiring on the average 450 watts for its maintenance, measurements being made at the lamp terminals, where no sensible resistance is included in series with the arc; in case such resistance is used it must be excluded in the measurements of the voltage."

This resolution naturally suggests the inquiry as to how far the candle power produced depends upon the watts consumed. In the present paper attention will be confined to the part played by the arc carbon in this important relation.

It is, of course, well known that the so-called 2,000 candle power arc really gives a mean candle power of only 300 to 600, the candle power at the angle of maximum illumination seldom being greater than 1,200 and often as low as 700. In an elaborate series of comparative tests made by the writer[2] several years ago there was found to be a variation of over 80 per cent. in the candle power of commercial arc light carbons consuming the same energy. Quite recently Professor W. M. Stine[3] has reported on a number of tests, the results of which show a variation of about 30 per cent.

The difference in the quality of arc carbons is well brought out in the accompanying table, in which values are given for the hissing point and the flaming point of various American and foreign products respectively.

In order to determine these values, a pair of carbons was placed in a lamp and burned for twenty to thirty minutes. After the point had been well formed the carbons were gently brought together until the arc hissed. A voltmeter connected to the terminals gave the potential difference. The lamp was then adjusted for a silent arc and the mechanism so arranged that the rod was held rigidly. The carbons were then allowed to burn away until they flamed, the voltmeter being carefully watched meanwhile. Before the flaming point was reached the instrument would invariably fluctuate, due to "jumping" of the arc. At the flaming point there was a marked drop in the potential, as indicated by a voltmeter. Great care was taken to secure perfect alignment of the upper and lower carbons.

The results given in the table are an average of three different tests of each pair of carbons. The carbons were all intended for a current of from eight to ten amperes, nine and one-half amperes being used in the tests. The total length of a pair of carbons was ten inches in each case.

It will be noted from the table that the range, that is, the difference in volts between the hissing point and the flaming point, varies greatly with different carbons; thus, while carbon No. 4 (see table) has a range of only 11.4 volts, carbon No. 3 has a range of 34 volts. Both of these carbons are sold by representative American manufacturers, the former being a squirted petroleum coke carbon and the latter a moulded coke carbon. The hissing point of the cored carbon averages over ten volts lower than the solid. The hissing point of American cored carbons (Nos. 15 and 16) does not vary much from that of foreign (Nos. 17, 18, 19), but the range of the latter is fully ten volts greater than that of the former, and exceeds that of any of the American products tested, cored and solid. In the case of some makes of cored carbons not recorded here, it was impossible to measure the hissing point with any degree of accuracy, because the deposition on the negative of small portions of the core thrown out by the positive at low potential differences. Carbons Nos. 11, 17, 18 and 19 in the table are of foreign manufacture, all the others being home products.

The amount and nature of foreign matter in a carbon have much to do with the commercial efficiency of the latter, and determine to a large extent the range of the carbon.

It has been the desire of central station men to obtain, and the aim of the manufacturer to produce, an absolutely pure petroleum coke carbon, thinking that this would, in a large measure, solve the candle power question so far as uniformity is concerned. The writer is of the opinion, however, that an absolutely pure coke carbon, if such could be commercially manufactured for arc lamps, would not meet the requirements of central station practice to day. Carbons 12 and 13 (see table) are taken from two batches made with special reference to purity. It will be noticed that one of them hissed at 53.7 volts and the other at 52.

To be operated at maximum efficiency, these carbons would require more than 55 volts at normal current and under no conditions in practice would they give satisfactory service at less than 55 volts average—fully five volts higher than that of good commercial carbons. In connection with the potential difference required for maximum candle power in a given case, it is interesting to refer to a test reported by Professor H. S. Carhart, in which a pair of commercial carbons designed for use on full arc circuits showed a maximum efficiency at about 55 volts. These carbons at 10 amperes and 45 volts gave 450 candle power.

Thus it is of the utmost importance to the carbon manufacturer to test not only the range of his carbons, but also the voltage at which they give maximum efficiency. The importance of steadiness in arc lamps has been very well shown by the introduction of cored carbons. Here, again, we are confronted with the question of candle power in relation to the consumption of energy. If we assume that a 450 watt arc gives nominally 500 candle power with efficient solid carbon sticks, we must make an allowance of at least from 15 to 20 per cent. for reduction in candle power for the same energy when substituting an efficient cored carbon stick. Yet, for indoor illumination the consumer is better satisfied with the cored carbon than with the solid.

Reference has already been made to current density. It would be entirely out of the question to designate a given current density for commercial light carbons, yet, in attempting to formulate a relation between candle power and energy expended in the lamp, the question of current density must necessarily be considered.

Schreihage[1] deduced the law that for homogeneous carbons of the same make the candle power varies inversely as the diameter. He states that this relation, as is to be expected, is not completely satisfied in the case of the mean horizontal candle power especially when the carbons are very small or very large.

| Number. | Structure. | Diameter. (Inches.) | Basic Material. | Process of Manufacture. | Hissing Point. (Volts.) | Flaming Point. (Volts.) | Range. (Volts.) |
|---|---|---|---|---|---|---|---|
| 1 | Solid | ½ | Petroleum Coke | Molded | 43.6 | 71.3 | 27.7 |
| 2 | Solid | ½ | Petroleum Coke | Molded | 48 2 | 79.0 | 30.8 |
| 3 | Solid | 7/16 | Petroleum Coke | Molded | 45.7 | 79 7 | 34 0 |
| 4 | Solid | 11/32 | Petroleum Coke | Squirted | 51.3 | 62.7 | 11 4 |
| 5 | Solid | ½ | Petroleum Coke | Squirted | 47.3 | 75.0 | 27.7 |
| 6 | Solid | ½ | Lamp Black | Squirted | 47.2 | 70.8 | 23 6 |
| 7 | Solid | 7/16 | Lamp Black | Molded | 43.0 | 67 3 | 24.3 |
| 8 | Solid | 7/16 | Lamp Black | Squirted | 43.7 | 76 8 | 33.1 |
| 9 | Solid | 7/16 | Gas Black | Squirted | 46. | 70.7 | 24.7 |
| 10 | Solid | 7/16 | Gas Black | Molded | 41.3 | 74.3 | 33.0 |
| 11 | Solid | 7/16 | Not Ascertained | Squirted | 41.7 | 75 3 | 133.6 |
| 12 | Solid | 7/16 | Pure Coke | Molded | 53 7 | 73.7 | 20.0 |
| 13 | Solid | 7/16 | Pure Coke | Molded | 52 0 | 72.5 | 19 5 |
| 14 | (+), 7/16 hole (−), solid | ½ | Petroleum Coke | Squirted | 42.8 | 60.7 | 17.9 |
| 15 | (+) cored (−), solid | (+), 7/16 (−), ½ | Petroleum Coke | Squirted | 35 0 | 61 7 | 26.7 |
| 16 | (+), cored (−), solid | ½ | Petroleum Coke | Squirted | 31 3 | 58.7 | 27 4 |
| 17 | (+), cored (−), solid | (+), ½ (−), 7/16 | Not Ascertained | Squirted | 31.3 | 70.7 | 39.4 |
| 18 | (+), cored (−), solid | 7/16 | Not Ascertained | Squirted | 32.3 | 66.3 | 34.0 |
| 19 | (+), cored (−), solid | (+), ½ (−), 7/16 | Not Ascertained | Squirted | 31.7 | 71.3 | 39.6 |

When we consider that as a means for securing long life, flat carbons and "twin" carbons have been more or less used, we are reminded that in connection with the available candle power per watt expended in the arc lamp the shape of the carbon must be given due consideration.

A consideration of alternating current arcs opens up another field in the discussion of candle power, wherein the carbon point plays an important part. In the commercial operation of alternating current arcs, cored carbons are almost exclusively used. The constituency of the core has much to do with the efficiency of this type.

The comparison of the candle power of a commercial alternating current arc with that of a direct current arc consuming the same energy, as measured at the carbon points, shows that the former gives less illumination than the latter. So important is the relation of the carbon point to efficiency of the alternating current arc that the substitution of a solid carbon for a cored carbon in this form may reduce the candle power and decrease the efficiency to such an extent as to make the lamp unmarketable.

Thus far, we have discussed arcs which burn with free access of oxygen. In the case of inclosed arcs, or those which are operated in small bulbs, to which the air has very limited access, the conditions that govern the relation of watts to candle power for the open air arc are more or less modified. With inclosed arcs, purity of the carbon is very important, and in some applications of these arcs the objections which stand in the way of commercial utilization of pure carbon electrodes in open air arcs do not apply.

The importance of details in the manufacture of carbons cannot be overestimated in the consideration of this subject. With the carbon maker rests the task of supplying a uniform and efficient product; but even with the best carbon product it would seem advisable to discard the term "2,000

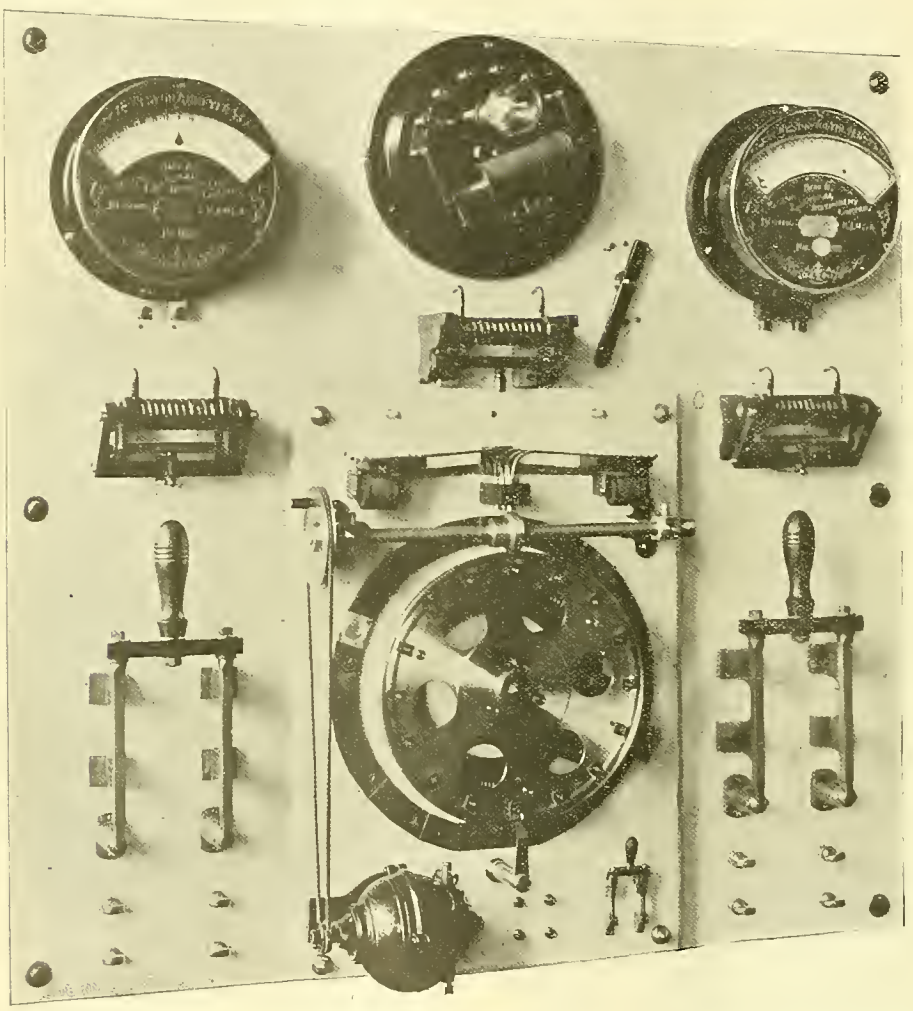


FIG. 2. STORAGE BATTERIES IN MAYWOOD.—SWITCHBOARD IN EDWIN NORTON'S STABLE, WITH NEW AUTOMATIC SWITCH.

1. Read before the annual convention of the National Electric Light association, Cleveland, February 19–21, 1895.

2. L. B. Marks: "Life and Efficiency of Arc Light Carbons." *Transactions* American Institute of Electrical Engineers, vol. viii., Nos. 6 and 7, 1890.

3. W. M. Stine: "Influence of Arc Light Carbons on the Candle Power." Western Electrician, September 15, 1894; New York *Electrical Engineer*, October 3, 1894. See also *Electrical World*, February 23, 1895.

1. M. Schreihage: *Centralblatt für Elektrotechnik*, No. 22, 1888.

candle power" or "1,200 candle power" as applied to arc lamps.

Measurement of the wattage, provided for in the resolution of the committee on the rating of arc lamps appears to be the true solution of the problem. The central station manager will undoubtedly find it to his interest to furnish good carbons, and, if he demands them, the carbon manufacturer will supply them. To quote Captain William Brophy: "The sooner you sell your light as power, the sooner this trouble will end; and I advise every man in the future to sell his lamp at 450 watts, or whatever is necessary, and bury out of sight the term '2,000 candle power.'"

DISCUSSION.

E. F. PECK, Brooklyn: The question of carbons is exceedingly interesting to me at present, as our company is in dispute with the authorities as to the candle power of our lamps versus the candle power of lamps furnished by a competing company. I had a letter from the inspector of gas asking me to have this association give the companies a rating on lamps burning $\frac{7}{16}$, $\frac{1}{2}$ and $\frac{5}{8}$ carbons; and he also raised the question as to what is the proper size for a carbon to give a certain candle power at a given energy. I do not know whether this association desires to put itself on record as giving standards for various sizes of carbons or not; but it seems to me the arrangement for a 2,000 candle power light as given to us at Washington really means nothing, as we find by experiment that we can get varying candle power, using that amount of energy, by using different density of carbons and different size carbons. I would like to get information from someone here who has made experiments giving the candle power by different sized carbons, as to what the relative difference is in candle power as governed by the size of the carbon?

MR. MARKS: In reply to Mr. Peck's question, I may say that the reference in the paper to current density partly answers his inquiry. It was stated there that within certain limits the candle power varies inversely as the diameter of the carbon; that is, in the assumption, of course, that the current be constant and the carbons be of the same batch and homogeneous. You will remember that H. Nakano, now professor of electrical engineering in the University of Japan, deduced a law for the relation of efficiency of the carbon to diameter. His results confirmed the conclusion reached by Schreihage and indicate that the radiant efficiency is almost inversely proportional to the diameter.

Thus we see that as far as the operation of arc lamps at maximum efficiency is concerned, the limitations of life of the carbon would cut a very important figure with the central station man. It is well to remember that invariably a gain in light efficiency for a given grade of carbon is accompanied by a loss of longevity of the carbon points. You all know that ordinarily a soft carbon will give you a better light than a hard one of the same diameter. If you use a hard carbon of small diameter you may obtain the same efficiency as with a soft carbon of larger diameter. Again much depends upon the character of the basic material and the binder used in the manufacture of the pencils.

In the table which you have before you, your attention has been called to the wide difference in the performance of commercial carbons operated under the same conditions. If you will refer to carbons Nos. 6 and 7, which are made of lamp black, you will note that the latter, which has a molded structure, acts differently from the former, which is a squirted pencil, or one made by forcing the plastic mixture through a die. These carbons, though made of the same material and carbonized in the same way, give quite different results in service, and I am quite sure if you decided that a $\frac{7}{16}$ inch pencil of the No. 7 type gave the best results as to candle power for a given current and difference of potential, you would find that on substituting a pencil of the No. 6 type, a smaller diameter would be necessary to obtain the same light efficiency.

Again, though carbons of a certain diameter may be suitable for one purpose of illumination, change in the character of distribution of light desired may prove them to be less suitable for another. Even if the same current be used and the same watts expended in the lamp, it would be impossible to designate a particular size of carbon to meet all cases of distribution.

When we consider that variations are apt to creep in throughout the process of carbon making, we are brought face to face with another and graver obstacle in the way of considering a standard such as proposed. Variations in the character and size of grain of the pulverized crude material; in the nature of the binders; in the constituency of the mix; in the pressure in molding or squirting, as the case may be; in the duration and temperature of carbonization, etc.—all these are more or less familiar to you and need no comment. But after all, why lay so much stress upon the diameter of the carbon or the candle power of the arc? Does it make any difference to us whether an arc lamp gives 500 or 1,000 candle power if the light is not available? As tersely stated by Prof. Houston the other day, what we want is a method of measuring illumination at the surface which is lighted, and not at the source of illumination. And right here comes up another point bearing on the selection of a carbon for a special purpose. A carbon arc that may be well adapted to bringing out the colors of natural objects may fall somewhat short if the power of its illumination as applied to black and white be considered. For one purpose a carbon of particular structure, operated at a high voltage, may give the best results, while for another a different structure and low voltage may be required. In fact, the candle power of an arc, per se, is in some respects a meaningless term and does not give a true expression of the value of the light.

As Dr. Edward L. Nichols has shown, "Luminosity is the factor which we must take into account in seeking a complete expression for the efficiency of any source of illumination, and the method to be pursued in the determination of the luminosity must depend upon the use to which the light is to be applied. In a picture gallery, for instance, or upon the stage, the value of an illuminant increases with the temperature of the incandescent material out of all proportion to the candle power, whereas candle power affords an excellent measure of the light to be used in a reading room."

Thus it is clear that the quality of the light as distinguished from its candle power must be carefully considered in the selection of a carbon and in the proper operation of a lamp intended for a particular kind of illumination. You are all familiar with the preponderance of the longer wave lengths, or those at the yellow end of the spectrum, in arcs operated on direct incandescent circuits. Contrasting these arcs with the constant current series arcs, the latter show a decided richness in the shorter wave lengths, or those at the violet end of the spectrum. In the former case cored carbons are used; in the latter, solid. The analysis of the core tells the story. If time permitted I should like to dwell on various phases of the subject other than those already taken up, but I trust that what has already been said will cover the scope of Mr. Peck's inquiry.

PROF. B. F. THOMAS, Columbus, O.: I am not a member of this association, and now have the pleasure of attending one of your meetings for the first time; but, as some of you know, I have been more or less interested in the questions involved in lighting by incandescent and by arc lamps, and noting the title of this paper on the programme which was sent to me, I brought with me the results of some work which has been done recently at the State University at Columbus, bearing on the point under discussion. I thought it might be interesting to the members to know what the results of that work were. The work was undertaken with particular reference to the bearing of facts upon the proposed watt rating of arc lamps which grew out of the discussions of the Electrical Congress during the World's Fair. The measurements consisted in the determination of the amount of light given by the amount of carbons, not when they were mounted in arc lamps, but mounted in rigid holders, the length of the arc adjusted to a definite amount by means of the chain of the arc formed by a lens upon a screen. The strength of the current passed through the carbons was ten amperes. The candle power was measured by means of the Weber portable photometer. The carbons upon which measurements were made consisted of ten or more pairs of carbons obtained from nearly all the central stations in the state of Ohio. The carbons were obtained by students of the university from their homes, or by their friends at home, from lots of carbons that were in regular use in street lighting service, for the purpose of getting at the facts as to the light actually given by the carbons. The point of investigation was to determine how much variation there is in the candle power afforded by arcs which are maintained at an expenditure of a constant amount in watts.

The watts that we made use of in the investigation were a little higher than the rating adopted by this association, namely, about 500 watts, as nearly as we could judge. Our machinery was adjusted so as to work steadiest at 10 amperes, and with the arc length we find commonly maintained in lamps in Columbus we found that sometimes 51 or 52 volts was required to maintain the arc in that condition.

With this brief explanation as to what the work consisted in, I may briefly run over the results, without, of course, naming the makes of carbon upon which the measurements were made. Readings were taken at different angles in the lower hemisphere; but without stopping to read the results showing the variation at different angles, I will give the results at 45 degrees, which it has been found is about the angle at which the light is produced.

I find in the case of the first make of carbons tabulated that at 45 degrees the variation of candle power measured is between 18.55 and 14.22. These readings which I give you are the results of the averages of readings taken from six to 10 pairs of carbons of the individual make, and readings taken in each case by different observers, so as to eliminate as far as possible personal error and to get as nearly as possible a basis for judging of the uniformity of performance of a given make. The variation in the candle power of this make show 23.3, with a variation of 3 per cent. in watts. The candle power relation is widely different from the relation of watts. Second make, similar data, variation in candle power 8.86 to 14.29 or 38 per cent.; 2 per cent. in watts. The next make shows a variation of 55.6 candle power, 7 per cent. variation of watts; candle power 977 to 2,200. Here is a reading of 2,200. These readings are worked up by my students, and are abundantly substantiated by individual work of my own. The next make of carbons gives a variation of 39.8; 2.2 watts variation. Next, candle power variation 20.48 to 13.70, or 33 per cent. for 2.3 variation in watts. Next, 40.3 in candle power; one-half of 1 per cent. in watts. Next, 45 candle power, with 0.6 of one per cent in watts. Next, 26 variation in candle power, with 2.8 variation in watts. Next, 44.7 variation in candle power, 3 in watts.

The foregoing will answer in part the question which was partly answered by Mr. Marks as to the influence of size, etc., whether the carbons are coated or uncoated. The difference between them is shown here at 45 degrees. The average candle power of all makes with uncoated carbons is 1,677; with coated carbons, 1,474—half inch size; seven-sixteenths and uncoated, 1,611; coated, 1,450.

In both these cases the smaller carbon has the smaller candle power. Of course, this is not to be taken as conclusive, because the point of investigation was not to determine the influence of size, and I should say, from a scientific point of view, there are many points left out of this investigation.

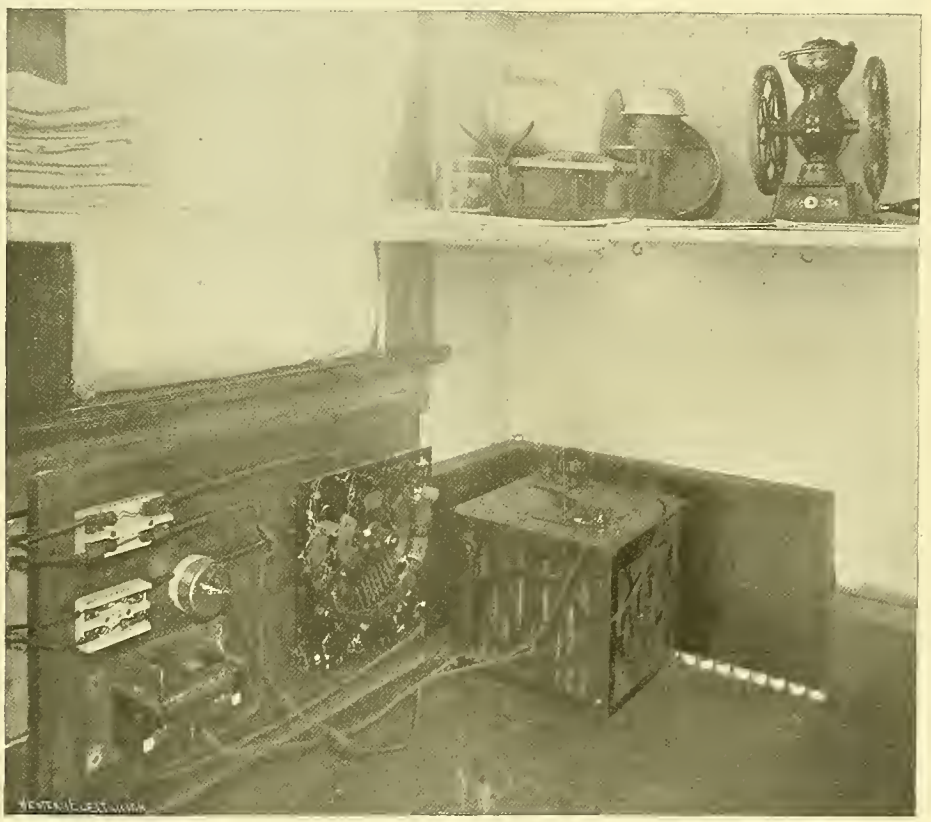


FIG. 3. STORAGE BATTERIES IN MAYWOOD.—CONTROLLING APPARATUS IN A PANTRY.

Not being a member of your association, it would, of course, be improper for me to argue upon the question of the propriety of the watt rating, but I have done so much work in the matter, and am so interested in the success of your work, that I may, perhaps, be pardoned for expressing myself on the question. I think the watt rating is simply taking a step in one direction which does not tend in any degree to remove the trouble which you all experience, and you are simply changing the ground, that is all. My idea as to what should be done I have privately urged for some time. It is substantially that set out in Messrs. Houston and Kennelly's paper, read at this meeting, that the proper basis for a contract between a municipality and a corporation, the object of which contract is the lighting of the streets of a city, is the illumination that is produced upon the street. I care not whether the light be done by electricity, arc or incandescent lamps, or by gas or gasoline. What the citizens want is light upon the streets, and if your contract will specify the degree of illumination required to be satisfactory, under the usual weather conditions obtaining in a given place, and you name that in your contract, and then determine at any time when the question arises whether you have that illumination or not, you will have an easy means of settling your controversy. There will be no question of arc lamps, candle powers, or anything of the sort. Find out what the fact is as to the illumination which your contract calls for.

JAMES I. AYER, New York: I do not agree with the last speaker that in rating the arc lamp by wattage we have made no progress. We have gotten from an absolutely indeterminable thing, candle power, to something we can put our hands on. When we contract for watts we can furnish them. It may not be the best way, but it prevents imposi-

tions on the central station manager. It is known that it is a very crude method of determining; but as yet nothing has been proposed other than the instrument offered here, which seems to me an impracticable device. Prof. Thomas tells us he gets a variation of 45 per cent. in candle power, with a change of $\frac{3}{8}$ per cent. of wattage. That is a very extreme difference. It does not seem as though we find much of that in ordinary practice, and it is an extreme case. It is an unstable thing we get our light from—the carbon. There is nothing uniform about it, and there is no way of determining what character or size of carbons are best adapted to particular cases. I think we would all welcome something which will definitely determine the amount of illumination to be given people at a definite distance from the light, or any point on the street under usual conditions. In having wattage, we have something definite; if we give you that, there it is; it we do not, you can talk to us.

E. A. ARMSTRONG, Camden, N. J.: I thought better things of Mr. Peck than what he stated here about our definition of what a two thousand candle power light was, meaning nothing at all. When we agreed, in giving a two thousand candle power light, to furnish 450 watts, we met the conditions as well as they could be met. The truth of the matter is that candle power is the measure of light, and we cannot change it, and we must make ourselves conform to that in some way; and we did the best we could when we selected the standard of watts.

MR. MARKS: A few words with regard to Prof. Thomas' remarks. The data submitted by him are certainly interesting and directly in line with reports contained in the paper. We are all aware of the occurrence, but probably not of the magnitude of the variations he refers to. However, though it is only too true that the candle power for the same watts may differ fifty or one hundred per cent. or more with different carbons, yet for reasons given in my previous discussion, I do not see how the association could be benefited by adopting a standard of candle power. From a practical standpoint it seems to me that it would be just as unwise for the central station manager to sell his lamps as a three hundred or a five hundred candle power lamp as it would be to sell it as a twelve hundred or a two thousand. There is of course no doubt of the value of making some measurement of the illumination, and, as has been suggested, the proper place to measure the illumination is not at the lamp, but at the place which is lighted. In one case we may find that distribution is the all-important feature, the intensity of the maximum rays being of secondary importance, and in another vice versa. Though the same amount of energy be supplied in the case of two lamps trimmed with special carbons, one of them, whose candle power is much less than the other, may be preferable, because of the quality of the light.

Before closing I wish to call your attention to a test in which two carbons, tested for mean hemispherical candle power, showed 456 and 486 candle power respectively. On being tested for efficiency they showed 11.71 and 10.01 per cent. respectively. The efficiency referred to here is the radiant efficiency or ratio of luminosity to total radiation. The current in each test was nine amperes and the potential difference 45 volts. One of the carbons was a squirted coke carbon, the other a moulded.

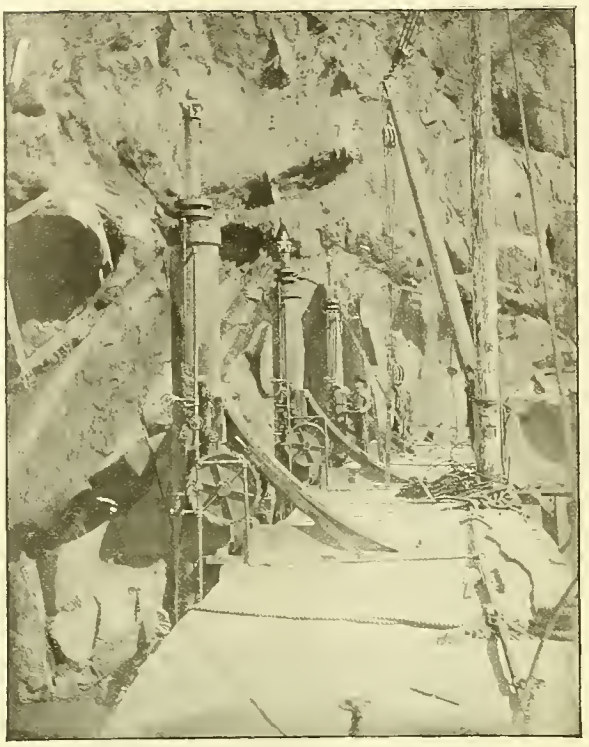
It will be noted that the carbon showing the higher candle power had lesser efficiency. It seems quite probable that in this case the difference in the quality of light explains the discrepancy.

## Electrical Transmission of Power from Folsom, Cal.

On the Pacific Slope great interest is manifested in the plant, now nearly completed, by which the Sacramento Electric Light & Power company proposes to utilize, by electrical transmission, the power of the American river at Folsom, Cal. This is, indeed, a fine installation, and one which, in size and detail, presents many instructive features. It is the more interesting in that the scope of the scheme, which, at the commencement of the hydraulic work in 1866, was limited in its range, has been very greatly extended by the alliance between water power and electricity which modern invention has brought about. The transmission is over a distance of twenty miles.

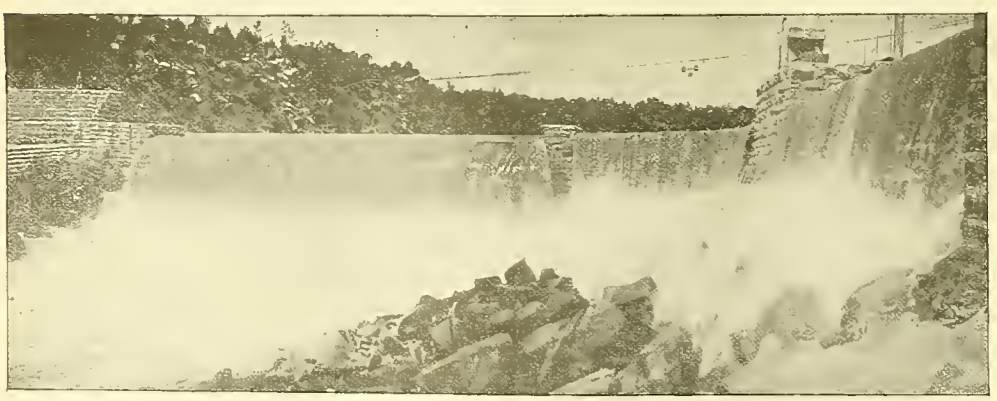
The work as at first conceived embraced a dam across the American river, near Folsom, and the utilization of the water primarily for power purposes, and, in the second place, for the irrigation of the surrounding country. The plan was modest in its proportions and remained so for many years, but the introduction of electricity immediately magnified it into a grand scheme contemplating the utilization of about 5,000 horse power for transmission purposes and 1,200 horse power for use in the state prison located by the side of a special state power house. The accompanying views of the work explain themselves.

The first step was taken in 1866, when the foundation for the dam was laid. Some years later the California state government contracted with the power company, and, in exchange for water power privileges and certain grants of land for prison buildings, agreed to supply convict labor. In 1888 a new contract was effected, the size of the dam and canals as indicated in the original plans was greatly increased, and under these new plans the work, pushed forward vigorously, is now rapidly nearing completion.



ELECTRICAL POWER TRANSMISSION FROM FOLSOM, CAL.—HEADGATES AT THE DAM.

The dam is a massive structure of granite laid in Portland cement. It is 650 feet long, 89 feet high in the center, 87 feet wide at the base, 25 feet wide at the crest, and contains about 48,590 cubic yards of solid masonry. It is provided with a heavy wooden shutter or flashboard six feet high, which, at high water, is lowered into a recess in the crest of the dam. At low water this shutter is raised by hydraulic pistons; the depth of the basin is increased by six feet and additional storage capacity for the waste water provided. Normally, the dam forms a storage basin or reservoir three and one-half miles long and has a capacity of 13,000,000 cubic yards of water.



ELECTRICAL POWER TRANSMISSION FROM FOLSOM, CAL.—THE DAM, FROM BELOW.

At each side of the dam are massive granite bulkheads and three head-gates operated by hydraulic machinery, each head-gate being 16 feet wide. The West Side canal is not yet completed, but is designed to be 40 feet wide at the top, 30 feet wide at the bottom and 6 feet deep. It is intended principally for irrigation purposes.

The East Side canal is completed from the dam to the site of the power house, a distance of about two miles. It is 50 feet wide at the top, 40 feet wide at the bottom and eight feet deep, having a capacity of about 87,000 cubic feet of water per minute. The canal, divided into three sections, follows the bank of the river for about two miles, and is constructed partly of masonry, partly in deep solid rock cuts and partly by earth cuts and fills. Just before it reaches the power house of the Sacramento Electric Light & Power company it has been widened into an immense log basin to hold the logs of the American River Land & Lumber company, which company is about to erect at this point a large sawmill to be operated entirely by electricity.

The power house of the Sacramento Electric Light & Power company is situated at the extreme end of the canal where a fall of 55 feet is available at high water. It is on the west side of the town of Folsom, where an immense cut in solid rock has been made, about 60 feet deep, 100 feet wide, and 150 feet long, from which a channel 40 feet wide leads to the river. In this cut the foundations for the machinery and the granite walls, piers and arches of a two-story building have already been laid, and the structure is progressing rapidly.

At the power house the canal makes a sharp turn at right angles and widens out into a forebay 150 feet long, 100 wide and 12 deep, which forms a settling basin for debris. It is divided into two distinct parts by a wall provided with suitable gates, so that one side may be cleaned out while the other is in operation. At the lower end of each section of the bay a sluicing gate connects with the lower river by a sluicing canal, and through these the sand and debris will be carried away and kept from the wheels.

The contract for the entire mechanical and electrical equipment was awarded to the General Electric company in September, 1894. The contract for the hydraulic apparatus was let to the S. Morgan Smith Water Wheel company. This latter apparatus will consist of four pairs of wheels of the McCormick horizontal shaft turbine type, enclosed in steel cases, having steel inlet pipes eight feet in diameter, and double discharge tubes. By this arrangement in pairs, the end thrust is neutralized and sufficient power and speed are developed to allow of direct connection to the generators. The governors used will be of the Faesch-Picard type and will be supplemented with heavy fly-wheels on the water wheel shaft. Each pair of wheels will have a capacity of 1,260 horse power at 300 revolutions per minute. They embody all that is latest and most improved in hydraulic practice and are of larger capacity than any hitherto constructed in this country, with one exception. They will be operated under a head of 55 feet. The hydraulic plant also includes two special horizontal wheels for the exciters for the alternating current dynamos. The water, after having passed the turbines, will be discharged through tunnels under the power house into irrigation canals for distribution over the country south and east of Folsom.

The generators will be four in number and will be of the General Electric three-phase alternating current type generating current at 800 volts potential. The armature shafts will be directly connected to the shafts of the wheels by means of flange couplings. Each generator will have a capacity of 1,000 horse power and will weigh about 30 tons. These machines will be the largest three-phase generators yet constructed.

The water wheels and generators will be located on the first floor of the building, sixteen feet above the level of the water in the tail race, but will not occupy the same room. Between the wheel room and the generator room a heavy masonry wall has been built. The openings through which the turbine shafts will pass will be small and the wall will serve to protect the electrical machinery from the possible entrance of water. The water wheel regulators will be in the dynamo room, and the operator will thus have full control of the hydraulic machinery in sight of the electrical instruments on the switchboard. Both dynamo room and wheel room will be provided with traveling cranes.

In the second story of the power house, directly over the dynamo room, the sub-station step-up transformers will be installed. In these transformers the potential, generated at 800 volts, will be raised to 11,000 volts, and connections to the line will be made through marble switchboards equipped with the necessary switches and fuses.

Special provision to prevent shut-down by accident or unforeseen contingency has been made in the pole line, which will be double from the Folsom power house to the Sacramento transformer sub-station and will run along the line of the Sacramento and Placerville railway as far as the city. Twenty-six hundred 40-foot round cedar poles, 16

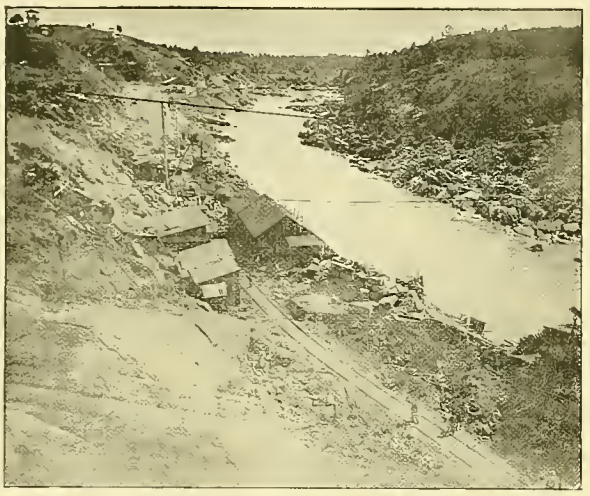
inches in diameter at the butt, are used for this purpose, and each will carry two cross-arms for two circuits of three wires each. Each circuit will consist of three bare copper wires supported on double petticoated porcelain insulators especially designed and made for this installation at the porcelain factory of the General Electric company at Schenectady. Each insulator before shipment is exposed to a test of not less than 25,000 volts alternating current. Each three-wire circuit can carry the output of one dynamo, and any dynamo can be thrown on any line, although they will all be operated in multiple. While repairing or testing, a line may be cut out or grounded.

The sub-station at Sacramento will be a fire-proof two-story brick building which will be divided into four parts—the step-down transformer room, the motor, railway and arc dynamo room, the shop and testing room, the store room. In the transformer room the transformer switchboards will receive the terminals of the 10,000 volt transmission lines and operate the different combinations of the transformers. The step down transformers, of the air blast type, will vary in size according to the duty required of them, and the secondaries can deliver current at 125, 250, 500, 1,000 and 2,000 volts for incandescent lighting and motor service. In the main room will be three 300 horse power three-phase synchronous motors of the standard General Electric type directly connected to a line shaft. This shaft, which will be provided with clutch pulleys, will drive several 500 volt continuous current railway generators and a number of arc dynamos. The incandescent lighting, commercial arc lighing and stationary motor work in the central portion of the city will be effected on a ow tension modified Edison three-wire system, by feeders from the secondaries of the step-down transformers supplying current to a network of mains. The motors will be of the three-phase induction type, and can be connected to the mains at any point. The street and commercial arc lighting will be done on the constant current series system, while outlying motors will be operated from higher potential lines with individual transformer reduction, or will be high potential synchronous motors.

Great credit is due to the ceaseless efforts and indomitable energy of the men who have brought this great enterprise to a successful conclusion, chief among them being Albert Gallatin and H. P. Livermore. The first, a prominent citizen of California, well known in connection with many successful undertakings, is president of the Sacramento company, while the latter, to whom the water power came down as a family legacy, is general manager. This installation will cover a practical transmission of power over a longer distance, it is believed, than has ever before been attempted. Embodying, as it does, problems of general distribution of electrical power for all uses to a distant city, it will attract attention in the world of science and industry.

## Electric Pacemaker.

A novel application of electric power supplied by the San Jose and Santa Clara Railroad company is under consideration. The current is to operate an electric tricycle for cutting out the pace on the wheel track. This invention is credited to Wilbur J. Edwards, who was the bicycle champion of the Pacific coast two years ago. It was exhibited at the cycle show held last month in San Francisco. It is operated by trolley connection, but the trolley is at the side instead of on the top. The conductor will circle the track. The machine will be in charge of a motorman, and can be run up to a speed of a mile a minute. The wheels of the machine are 30 inches in diameter. In the patent claim it is set forth that the object of the invention is to provide a mechanism which is especially adapted as a pacemaker, to be used in trials of speed for bicycles in connection with a wind break or shield, which will protect the rider from the resistance caused either by the wind blowing directly against him, or the current formed by his own rapid speed. The vehicle is three-wheeled, and is provided with a seat from which the operator manipulates the controlling mechanism. From the front part of the frame of the machine trolley poles extend toward the sides, and carry a trolley wheel which engages the conducting wire. To the machine frame is secured the wind shield, which consists of plates of sheet steel meeting in front at an acute angle, and opening out toward the rear so as to encompass the vehicle and at the same time to provide a space of sufficient width for the protection of the rider from the wind so long as he remains close to the machine. The apparatus is intended to run on any track, and it is retained in its working position by a framework, one side of which is fixed to the vehicle, while the other extends inwardly to a line parallel to the inner curb of the track, and having journaled upon it vertical guide rollers. These rollers travel on a permanent guide, which is fixed parallel with the curb in such a manner that when the guide rollers travel upon that guide the vehicle will be constantly retained at an even distance from the inner line or curb. This electric pace-making tricycle has been favorably pronounced upon by several well-known electrical experts of San Francisco, and should its practicability be thoroughly demonstrated it will doubtless become an important factor in the lowering of existing bicycle records.



ELECTRICAL POWER TRANSMISSION FROM FOLSOM CAL.—THE RIVER NEAR THE DAM.

## Central's Trolley Line Between Buffalo and Niagara Falls.

The New York Central & Hudson River Railroad company has decided to equip its road between Buffalo and Niagara Falls with electric motors, and have the new system in readiness for the summer traffic. The idea was suggested by the proposed paralleling of the road by a trolley company. The officials of the Central thought that if a new company could build and equip a road and make money there was no reason why the New York Central, with its fine roadbed, stations and appliances, could not make the change at a profit.

H. Walter Webb, third vice-president of the Central, said:

Yes; it will be an electric branch before long. We are surprised that we did not think of the idea before, and are still more surprised to find how cheaply we can make the change. Our tracks up there are not in use all of the time, and it will be possible to run frequent trains at a high rate of speed, to accommodate local traffic, in a way that would be impossible on a steam railroad. This power to operate our trains can be obtained from the Niagara Falls Power Company, in which some of us are heavily interested. Special cars of the observation pattern will probably be built, so as to give passengers a fine view of the river and falls.

The present plan contemplates a trolley system of such power that the improved coaches can be drawn over the line at the same rate of speed as at present. The fares will be reduced and the comfort will be far greater, as there will be no cinders, smoke and other inconveniences of a steam railway. We hope to have the road ready when the excursion season opens, at the latest, as there is little to be done in making the change.

Another official of the same company is reported to have said:

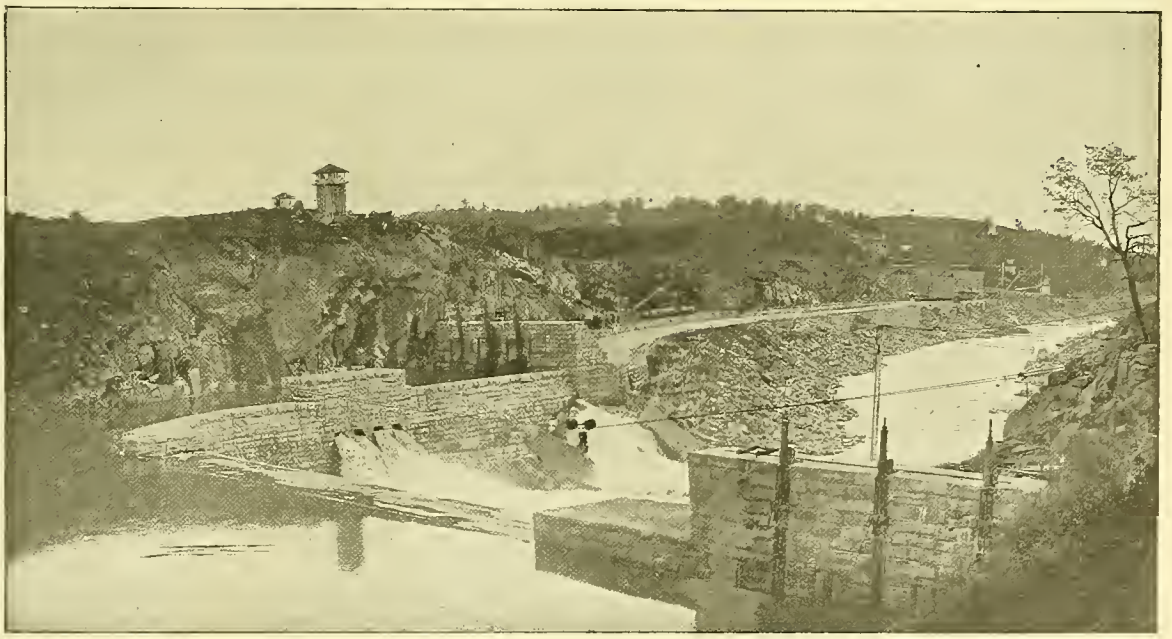
In adopting electricity for the road from Buffalo to the Falls, the officials are merely making an experiment, and if it proves successful, which it undoubtedly will, the trolley system will be extended to Lewiston and, perhaps, over other portions of the company's system. And I should not be surprised if, before another year passed, electricity was adopted on the Charlotte road between Rochester and Lake Ontario. It has been talked of from time to time, and I am of the opinion that the Buffalo-Niagara innovation is a forerunner of such changes in other parts.

The announcement of the Central's determination to install electric motors on such an important branch of its system of course caused no little flurry in electric railway circles.

## Telephone Rates Reduced.

The Bell Telephone company has been obliged to reduce its rates in Western New York. On March 25th it announced that, beginning April 1st, rates would be materially reduced in Batavia and elsewhere in Western New York where there are stations, except Buffalo and Rochester. The new rates will be as follows: Residence 'phones on lines where there are three or more 'phones, $2 per month, reduced from $3; business places on party lines, $2.50, a reduction of $1.50 per month; long distance 'phones $5 per month instead of $6, and for 'phones on private lines the rates will be $4.50 instead of $5 as heretofore. The company has been forced to this reduction by competition. The opposition company in Batavia already has an exchange established and is operating some 50 or 60 'phones at rates under those charged by the Bell company.

The Susquehanna River Electric company, which was recently incorporated in Baltimore, has purchased the plant of the Susquehanna Water Power & Paper company, near Conowingo. The plant carries with it about one and a half miles of water front on both sides of the river, between Conowingo and Octoraro creek. With this purchase the electric company now controls about six and one-half miles of water front on the Susquehanna river, having a fall of 100 feet and affording excellent power to generate electricity. The buildings of the Water Power & Paper company will be coverted into an electric plant at once. All the present machinery will be taken out and the interior remodeled into a power house. The promoters of the electric company say that they expect to have their plant in operation within a year.



ELECTRICAL POWER TRANSMISSION FROM FOLSOM, CAL.—DAM, GATES AND CANAL ON THE AMERICAN RIVER.

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HIGH WATER MARK

CIRCULATION, 16,630.

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MUCH interest will attach to the annual report of the American Bell Telephone company, a summary of which is presented elsewhere in this issue. It is true that an excellent showing is made, although there is a decrease noted which may be explained by the general depression in business throughout the country. Only a brief mention is made of the Berliner case, the effect of the Bate Refrigerator case on the Edison carbon patent, and the issue of additional stock, but this is explained by the fact that the term covered in the report did not include these transactions. The figures presented give an excellent idea of the vast interests involved, and will furnish an excellent field for the student of statistics.

FOLLOWING so closely upon the determination of the Consolidated company to give a thorough test of the trolley system in New England, the announcement that the New York Central company would substitute electric motors for its present equipment on its Niagara Falls branch has awakened no little interest in railroad circles. The Pennsylvania Railroad company decided a few weeks ago to substitute electric power for steam on its branch line between Burlington and Mount Holly, N. J., and it is probable that a successful demonstration on the Mount Holly branch will direct the attention of the Pennsylvania company to the feasibility of using electric motors on two of the tracks between New York and Philadelphia. This latter experiment, tried with all the circumstances of heavy travel, would afford an excellent test of electricity as applied to this class of railroad transportation.

THE electric railway companies of Pennsylvania have received a severe blow in the recent decision of the Supreme Court of that state in placing a new interpretation upon the street railway act, by which the trolley-car companies do not share in the state's right of eminent domain. It is said that this decision very seriously affects the valuation of an investment of no less than $50,000,000 in electric railway properties, already in existence or projected in good faith. The decision must be accepted as good law and a correct interpretation of the act, of course, but it is perfectly proper to assume that it does not represent the existing state of public opinion in Pennsylvania. In the country districts particularly the farmers very generally realize that the rural trolley road is their friend, and the state organization of the Patrons of Husbandry is on record, we believe, as favoring the conferring of the right of eminent domain on the electric railway companies. With this powerful aid, the trolley companies should be able to secure suitable statutory relief from the Legislature, which is the only hope of escape from the provisions of the old act, as set forth by the court.

TELEPHONE companies throughout the state of New York are making a vigorous fight against the enactment of the proposed law regulating telephone rates. It is held that the Legislature has no right to arrange a schedule as proposed in the bill under consideration, and the telephone companies are appealing to other corporations operating under public franchises to assist them in their fight, but thus far very little encouragement has been received. It may be assumed that business men and capitalists deplore the necessity of appealing to the Legislature to regulate telephone rates, but there seems to be no other way of securing the reduction demanded. Advocates of the bill contend that they are willing to allow the companies a fair return upon their investment and that the law provides for this, but the companies naturally wish to avoid submitting their books to the inspection of state officials. Since the bill was originally introduced it has been materially amended by its friends in the interest of the companies. The rate has been raised from $78 to $125 in New York and from $66 to $85 in Brooklyn. The companies are not to be held even to this schedule if they can show that the rates are not remunerative. Moreover, they are not required to make any reduction until the expiration of six months after the passage of the act. In view of the almost universal demand for a reduction of rates and the opening up of the telephone field to other companies, it would seem that some concession might be made by the Bell companies, greatly to their own advantage.

SURELY the telegraph operators who served in the Union army during the civil war are deserving of success in their efforts to secure recognition from the government for the important services they performed in behalf of their country during those trying times. For several years they have been endeavoring to secure the passage of a bill by Congress providing for an official record of their connection with the army. These measures have not lacked influential supporters among the officers who gained distinction in that conflict, as they have earnestly testified to the value of the telegraph corps, but the politicians could not be induced to push the matter. In the closing hours of the last Congress, however, a bill was passed containing this provision:

> That the secretary of war is hereby authorized and directed to prepare a roll of all persons who served in the operation of military telegraph lines during the late civil war, and to issue to each, upon application, unless it appears that his service was not creditably performed, or to the representatives of those who are dead, suitable certificates of honorable service in the military telegraph corps of the army of the United States, stating the service rendered, the length of such service, and the dates, as near as may be, between which such service was performed; provided, that this law shall not be construed to entitle the persons herein mentioned to any pay or rights not herein specifically provided for.

Many other bills were passed at the same time, and owing to the limited time at the disposal of the president it was necessary that some measures should be slighted. Among those that were not considered was the military telegraphers' bill. This last disappointment has not discouraged the advocates of the measures, for they are already preparing for a spirited agitation of the subject, and it is expected that the next Congress will pass the bill early in the session. There has never been any question of the value of the telegraphers' service to the commanders of the Union forces, and it is but right and fitting that some official recognition be made of their part in the struggle. The best wishes of the entire electrical fraternity are extended to that noble band in its efforts to secure a place of honor in the official record.

FOR the second time the former employes of the Atlantic avenue trolley company of Brooklyn have been unsuccessful in their efforts to reach the company through the ten-hour law. A jury last week acquitted the president and superintendent of the company, who had been indicted on complaint of one of the strikers for alleged violation of the law of 1887, which was intended to limit the hours of labor of employes of surface and elevated railroads. The complainant testified that on January 12th he was a conductor on an Atlantic avenue car, and on that day he was eleven hours and nine minutes on his car; of this time two hours and nine minutes was passed "standing" at the terminus of the road. The complainant had been working under this arrangement for ten years, and the defense claimed that the terms of the agreement between the company and the men had provided that "stand-over" time should not be included in the time going to make up the nine hours comprising a day's work. The defense also claimed that the complainant was working under an agreement with the company, and although the term of this agreement expired on January 1st, the fact that the complainant continued to work without securing a new contract made the provisions of the old agreement binding upon him. This position was sustained by the court and it was further held that an employe could make a contract to work more than ten hours if he so desired in spite of the law of 1887. In charging the jury the judge said:

> In the first place this law does not prohibit any man's making a contract to work more than ten hours a day if he pleases. If it did I should have no hesitation in saying that such a law was beyond the power of the Legislature to pass. We have a right to make a contract, and no law can take it away. It occurs to me that the "stand time" was part of the working hours. Desmond, the complainant, did work, this time included, more than ten hours, but was there any exaction? If that working time was agreed to voluntarily by word of mouth or by long concurrence without objection, the continuance of it on January 12th would not be an exaction.
>
> It appears from the testimony that Desmond had been in the employment of the company for ten years. It had been the custom to regard the "stand time" as not a part of the working time. The defendants had a right to make that agreement. They had a right to say that the working hours should be those in which the cars were actually moving. Was there such an agreement? That you must decide from the evidence, which is that Desmond had been acting with that understanding for years. There is no evidence that he ever made any complaint. He continued to so act until the strike. It is also in evidence that this was the custom of all the employes. If that was the construction put on the agreement by employers and employes, then his working eleven hours and more on January 12th was not an exaction.

In view of this charge the acquittal of the railway officials was not surprising, but the strikers were very much disappointed with the result of the trial. They had hoped that a criminal action would hold, although their attempt to secure the forfeiture of the company's charter on the same charge had failed. No doubt they had been encouraged by the opinion of the attorney-general, who, in dismissing their application for permission to begin proceedings to annul the company's charter, said:

> It was claimed upon the hearing that the officers of the corporation have required its employes to labor more than ten hours per day, in violation of the provisions of the statutes regulating the hours of labor on street surface and elevated railroads chartered by the state, in cities of one hundred thousand inhabitants and over.
>
> The provisions of the statutes are clear and explicit in every particular. Chapter 529, of the Laws of 1887, limits the hours of labor of railroad employes in cities of more than one hundred thousand inhabitants in the operation of street surface and elevated railroads, to ten hours, to be performed within twelve consecutive hours, with a reasonable time for meals, and makes it a misdemeanor for any city officer or agent of any such corporation to exact more than ten hours' labor, in violation of this chapter.
>
> These provisions of the statute are wise and salutary, and were undoubtedly enacted for the benefit, not only of the employes of railroad corporations, but also for the purpose of protecting the traveling public.
>
> It is plain that the prohibition and the punishment refer to the officers and agents of the corporation, and not to the company acting in its corporate capacity.

In last week's proceeding it was decided that the company had not "exacted" more than ten hours' labor, although it was claimed that the rules of the company required the men's presence upon the cars more than ten hours. Judge Moore ruled that if an employe "obeyed the rules it was a voluntary act of his; it was no exaction, but only a condition under which he went to work. He was a free agent, either to follow them, and remain in the employ of the road, or not to follow them and leave the employ of the company." It is generally admitted that the law under which this proceeding was taken is defective, and the evident intention of the framers cannot be accomplished under its provisions.

The result of last week's trial will also effectually terminate the proceedings before the attorney-general to secure the removal of the president of the Atlantic avenue line on the charge of violating the ten-hour law. In the opinion previously referred to the attorney-general says:

> The papers before me allege in general terms a violation of the law, but the allegations must be proved by legal evidence, which, so far as the presidents are concerned, has not yet been presented to me. If, however, it shall appear from the investigations now or hereafter to be made, that it can be established by competent proof that the presidents of the companies have broken the law by exacting excessive hours of labor from their employes, the cases will receive further consideration.

Under the circumstances it is not to be expected that further attention will be given this application.

## American Bell Telephone Company.

The annual meeting of the American Bell Telephone company was held at Boston on March 26th, and the large attendance showed that the stockholders were taking a lively interest in the management of the corporation. It was decided to add another member to the board of directors, making the number 13 instead of 12, and the following named gentlemen were selected to serve in that capacity during the coming year: Charles W. Amory, Francis Blake, Charles P. Bowditch, George L. Bradley, Alexander Cochrane, William H. Forbes, Henry S. Howe, Charles Eustis Hubbard, Gardner G. Hubbard, John E. Hudson, Charles E. Perkins, Thomas Sanders and Moses Williams. The new names upon the board are Charles W. Amory and Moses Williams. William R. Driver was chosen treasurer and Charles E Hubbard was re-appointed clerk.

The annual report of the company was submitted, and it shows many changes during the year, including a decrease of over $1,000,000 in direct receipts from telephone rentals, which is, however, offset in part by an increase of $113,226 dividends from licensed companies. The net decrease in receipts was $932,832, and in expenses $131,132, leaving the net receipts $801,700 less than for 1893. There was an increase of $56,110 in taxes and decrease of $230,322 in commissions paid. The regular dividend payment was $185,844 larger and the extra payment $525,000 smaller than in 1893. The balance after paying dividends was $123,785, against $586,330 in 1893, a decrease of $482,545. The entire balance for 1894 was charged off to depreciation of instruments, whereas in 1893 the balance was divided, $450,000 going to general depreciation and $136,330 to depreciation of instruments. Nothing was applied to general depreciation in 1894. The total surplus on December 31, 1894, again stood at $2,151,011.

The following tabulated statement shows a comparison of the business for 1893 and 1894:

| Earnings— | 1894. | 1893. | Decrease. |
|---|---|---|---|
| Rental of telephones | $2,502,692 | $3 513,711 | $1,010,719 |
| Dividends** | 1,937,657 | 1,824,431 | *113,226 |
| Com from exterr. lines | 106,939 | 108,621 | 1,682 |
| Commission from tel. business | 29,352 | 29,192 | *160 |
| Real estate | 63,675 | 68,047 | *1,578 |
| Interest | 196,455 | 225,936 | 29,481 |
| Miscellaneous | 5,172 | 11,086 | 6.914 |
| Total | $4,848,244 | $5,781,076 | $932,832 |
| Expenses— | | | |
| Operation | $430,340 | $392,770 | *$37,570 |
| Legal | 178.342 | 114 852 | 53,490 |
| Real estate | 35,798 | 44 532 | 8,734 |
| Int. and taxes | 356,478 | 300,368 | *56 110 |
| Commission | 459,958 | 690,380 | 230,322 |
| Royalty | 5,000 | 10,000 | 5,000 |
| Concession | 231,713 | 257,829 | 26,116 |
| Miscellaneous | 26,827 | 44,857 | 18,030 |
| Total | $1,724,459 | $1,855,591 | $131,132 |
| Net earnings | $3,123,785 | $3,925,485 | $801,700 |
| Reg. dividend | $2,400,000 | $2,214,156 | *$185,844 |
| Ext. dividend | 600,000 | 1,125,000 | 525,000 |
| Total | $3,000,000 | $3,339,156 | $339,156 |
| Balance earnings | $123,785 | $586,330 | $482,545 |
| General depreciation | .... | 450,000 | 450,000 |
| Depreciation of instruments | 123,785 | 136,330 | 12,545 |
| Sur. Dec. 31 | $2,151,011 | $2,151,011 | ..... |

*Increase. **No portion of the earnings of the Metropolitan Telephone & Telegraph company were divided

BALANCE SHEET, Dec. 31.

| Dr. | 1894. | 1893. |
|---|---|---|
| Telephones | $ 1,209,788 | $ 1,266,.82 |
| Real estate | 950,927 | 950,984 |
| Stocks | 38,268,456 | 37 065,131 |
| Merchandise and machinery | 14,233 | 13,317 |
| Bills and accounts receivable | 4,355,554 | 3,573,053 |
| Cash and deposits | 760,776 | 2,843,678 |
| Totals | $45,559,734 | $45,712,341 |
| Cr. | | |
| Capital stock | $20,000,000 | $20,000,000 |
| Debenture bonds, 1885 | 2,000,000 | 2,000,000 |
| Bills and accounts payable* | 1,107,950 | 1,550,596 |
| Patent account (profit and loss) | 10.228,571 | 10,137,493 |
| Profit and loss | 5,849,444 | 5,682,227 |
| Reserve | 4,222 757 | 4,101,013 |
| Surplus | 2,151,012 | 2,151,012 |
| Totals | $45.559 734 | $45 712,341 |

*Of this amount $900,000 is for the dividends payable January 15, 1895, to stockholders of record December 31, 1894.

It will be seen that this statement shows a small reduction in the valuation of telephones, while stocks of telephone companies in the treasury were marked up no less than $1,203,325. Bills receivable rose $782,501, and cash decrease $2,082,902. There was no change in the company's own capital stock or funded debt, the $500,000 increase in stock coming after the close of the year. Bills payable were reduced $442,646 and patents were marked up $91,078, standing at no less than $10,228,571 at the end of the year. The statement brackets the patent account as "profit and loss" and follows it with another "profit and loss" item of $5,849,444. And then there is the item of "surplus," frequently termed profit and loss in balancing accounts. These combined items amount to $18,229,772, which might come under the head of profit and loss. It would be most interesting to learn at what price the various stocks of licensed companies are set down in the item of $38,268,456 in the assets

There was a gain from 13,771 to 16,015 in telephones compared with 1893, and that when the return for January and February exceeded the output by 3,472, showing a gross gain for the remaining ten months of about 20,000 instruments. President Hudson says: "Taking into consideration the facts that general business throughout the country had not recovered its usual activity, and that the growth of the telephone business must be, in great measure, dependent upon the prosperity of commercial manufacturing interests, the results have been on the whole satisfactory."

The report says that a greater mileage of toll wires has been added than in any previous year in the history of that business. Not including the cost of current repairs and renewals, the companies operating under licenses have expended, during 1894, upon extensions of lines and apparatus, $4,138,000, and for buildings to accomodate their exchanges $411,000, making with the amount reported last year a total of investment in telephone property in the United States of $77,500,000. The report continues:

The construction department reports that the total of lines, December 31, 1894, was 4,617.24 miles of pole line and cables and 75,555.72 miles of wire. Of this there were constructed during the year 633.26 miles of pole line and 9,379.71 miles of wire. The metallic circuit system has grown rapidly in favor, and at the close of the year the stations of 54,680 exchange subscribers were furnished with the equipment for this improved class of service, a gain during the year of 17,032.

The steadily increasing use which subscribers make of the exchange service continues to be a noticeable feature of the statistics furnished us by the operating companies. On the average each subscriber throughout the country now uses his telephone, upon calls made and received, 17 times per day. While this enlarged use is gratifying as an indication of the enhanced value which the subscriber derives from the service, the greater demand thus made upon the exchange system of necessity involves a corresponding increase in the cost of rendering service, and a large investment per station for central office apparatus and trunk lines.

Comparing the latest statistics with those of six years ago, we find the total number of subscribers has increased by 42 per cent. Within the same time the average daily use of the exchange service by each subscriber has increased 40 per cent., and the number of employes engaged upon exchange work 76 per cent.

The great disparity in the number of calls made by different subscribers in the same exchange, who, though paying the uniform yearly rate, require in the transaction of their business a widely varying amount of daily service, has led several of the companies, especially in the large cities, to consider the adoption of a plan for measured service, of which advantage can be taken by the smaller users. The plan has already been put in operation in New York, Brooklyn, Boston and some other exchanges.

The Long-distance company had invested up to December 31, 1894, in line construction, equipment and supplies $7,460,662.97. The company shows an increase in gross earnings in 1894 over 1893 of 13.4 per cent., the amount of 1894, gross, being $1,011,961.82. It will be remembered that the gross earnings for 1892 were $643,436.77; for 1893, $892,361.62.

The report contains much statistical matter touching mileage, exchange connections, etc. The extra territorial and toll lines included January 1, 1895, 49,324 miles of pole lines and 180,557 miles of wire. The connections for the year were about 12,000,000. The toll revenue was $2,355,488, not including the Long-distance company's income. The underground wires, January 1, 1895, were 149,592 miles, an increase of 27,662 miles. The exchange connections were about 670,000,000 in 1894 at an average cost to the subscriber ranging from 2 to 10½ cents. The number of exchanges January 1, 1895, was 867, an increase of 29. The total miles of wire was 396,674, an increase of 43,194 miles. The number of employes was 11,094, an increase of 673. The number of instruments in the hands of licensees December 20, 1894, was 582,506, an increase of 16,015 in twelve months.

The issue of the new stock under the present act is recited in the report without comment, and there is reference to the patent litigation. It is announced that the Berliner suit is expected to be argued on appeal next month. It is also announced that the Edison carbon telephone patent, No. 474,231, was overthrown by the decision in the Bate Refrigerator case. The Western Union suit has been remanded to the Circuit Court for further proceedings.

## Transformer Efficiency.

The interest taken in the Packard transformer shown running with case full of water at the Cleveland convention of the National Electric Light association will make further data on the subject acceptable to central station men and electricians in general. The water test clearly demonstrates the excellence of insulation. The efficiency test given below was made at Cornell University by Prof. Harris J. Ryan, and, of course, is absolutely disinterested, as well as of the highest authority. This test, the results of which are tabulated below, speaks for itself:

| Size. | | Voltage. | | Efficiency. | | | | Regulation from full to no load. |
|---|---|---|---|---|---|---|---|---|
| Lights. | Watts. | Primary. | Secondary. | Full load | ¾ | ½ | ¼ | |
| 30 | 1,500 | 1,000 | 50 | 94 7 | 94.2 | 92.4 | 87. | 2.1 |
| 100 | 5,000 | 1,000 | 100 | 96.5 | 95.8 | 95.4 | 90.4 | 1.7 |

## Is This a Possible Rival of Electricity for Illumination?

By C. C. Haskins.

The artifical production of all the hydro-carbons, which may be used for illumination, from one gaseous combination of carbon and hydrogen in equal proportions, is one of the most startling results of latter-day chemistry; and while the fact as stated has been known to the chemists for some considerable time, until quite recently no method has been discovered by which a commercial use could be made of the combination. Its constituents, hydrogen and carbon, place it among the hydro-carbons, a class in which we find all the gases ordinarily used in illumination. It is the simplest of them all, and most remarkable for its capability of recombining, or conversion into other substances. For instance, if this gas—acetylene—be passed through a tube heated just to a visible redness, it is at once converted into benzol; at a higher temperature naphthalene is the result, while, acted upon by nascent hydrogen, ethylene and ethane may be developed.

Now from the benzol we may produce all of the beautiful coloring matters which are obtained from coal distillation; the ethylene produced from acetylene may be converted into ethyl alcohol, and this in turn changed into a number of other organic substances. Thus acetylene may be looked upon as one of the great keystones of the organic edifice, and it is hardly possible to foresee the results which will ultimately be accomplished through it.

The chemists of the first third of the present century produced small quantities of this wonderful hydrocarbon, but not sufficient to carry it beyond the realm of laboratory experiments—barely enough to get its name and character into the books. Its production in quantity was the result of a simon-pure accident—like so many chemical discoveries—which but for the electric arc would probably never have been accomplished. Prof. Lewes says, in a paper on acetylene, that "while working with an electric furnace, and endeavoring by its aid to form an alloy of calcium from some of its compounds, T. L. Willson noticed that a mixture containing lime and powdered anthracite, under the influence of the temperature of the arc, fused down to a heavy semi-metallic mass, which, having been examined, and found not to be the substance sought, was thrown into a bucket containing water, with the result that violent effervescence of the water marked the rapid evolution of a gas, the overwhelming odor of which enforced attention to its presence, and which, on the application of a light, burned with a smoky but luminious flame."

Now having synthetically produced an organic compound, Mr. Willson set to work by the reverse process to learn what he had done and how he had accomplished the unlooked-for result. He analyzed what the phenomenon was, and determined that in a properly constructed electrical furnace pulverized chalk or lime mixed with any form of powdered carbon—charcoal, coke, anthracite, bituminous or graphite—can be fused into a compound known as calcic carbide, containing by weight five parts of calcium, the basis of lime, and three parts of carbon, and that on the addition of water a double decomposition takes place. The oxygen of the water combines with the calcium to form calcic oxide or lime and the hydrogen unites with the carbon to form acetylene. The cost of this makes it commercially possible to build up a host of other compounds of high value, for the production of which we now rely upon coal, and also an illuminant possessing many qualities which thrust it far in advance of any of its kindred hydrocarbons, and places in the hands of man the prime factor by which it is at least highly probable that nature produces those immense reservoirs of liquid fuel which the world is so largely drawing from to-day.

The point in all this to which the electrical world's attention will be directed is the capacity of acetylene for commercially competing with all present methods of gas illuminaton—possibly with electric lighting itself. Calcic carbide is of a dark gray color, weighs 2.262, and when pure one pound of it will yield 5.3 cubic feet of the gas, which is developed by dropping water upon the mass. The gas is clear, colorless, and has a very penetrating odor like that of garlic, so marked and pungent as to be a great safeguard in its use, the smallest leak being at once manifest. One volume of the gas and one of air forms a mixture which burns with a dull red flame, throws out a dense smoke and leaves behind a mass of lampblack. With more air it becomes explosive, reaching a maximum with about twelve volumes of atmospheric air, and from that point the violence rapidly decreases.

The luminosity of acetylene, as compared with sundry other hydro-carbons, is shown by the following table for a consumption of five feet per hour. The production of this amount of gas requires a stick of the calcic carbide weighing

one pound, twelve inches in length and one and one-quarter inches in diameter.

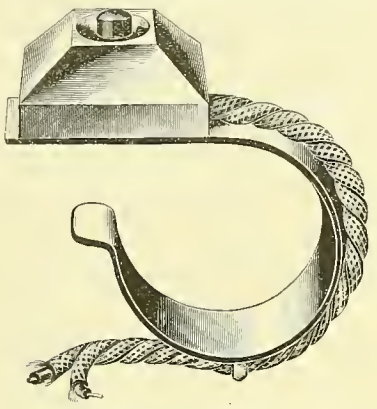
| | Candles. |
|---|---|
| Methane | 5.2 |
| Ethane | 35.7 |
| Propane | 56.7 |
| Ethylene | 70.0 |
| Butylene | 123.0 |
| Acetylene | 240.0 |
| Coal gas | 16.0 |

But there is in addition to the facts of cheapness and great additional luminosity another characteristic of this remarkable gas which commends it—the small amount of deleterious products of combustion. For an illumination of 48 candles compare the following:

| Burners. | Gas consumed. | Carbon dioxide produced. |
|---|---|---|
| Flat flame | 19.2 | 10.1 |
| Flat flame | 22.9 | 12.1 |
| Flat flame | 25.3 | 13.4 |
| Round flame | 15.0 | 7.9 |
| Acetylene | 1.0 | 2.0 |

Again, while the maximum heat in the acetylene burner is 1,000° C., coal gas shows a temperature of 1,360° C.—over 33 per cent. excess. Its cost, too, as compared with coal gas at $1.60 per 1000, when we consider the amount of illumination, would be less than 12 cents per 1,000.

A method has been proposed for isolated gas stations for small consumers, such as private families, stores, etc. A



COMBINATION CLIP AND PUSH-BUTTON.

strong steel cylinder, four inches in diameter by 16 inches in length, is fitted with an opening in the top of a size to admit a pound cartridge or stick of the calcic carbide. An opening at bottom, closed with a screw-cap, serves to clean out the residuum left after the burning. The proper proportion of water is placed in the cylinder, the stick of carbide, coated with a slowly soluble varnish, is inserted, and the top screwed on. A reducing valve regulates the gas pressure. The five feet of gas generated by dissolving the pound of carbide is compressed by its own pressure, the cylinder being placed in cold water during the decomposition. A suitable flat burner, consuming one-half a cubic foot per hour, will give a light of over 20 candles, and burn something like ten hours. After each burning the cylinder is readily cleaned, and the process can then be repeated.

The adaptability of this system of gas manufacture to all forms of wheeled conveyances, railway carriages, omnibuses nd hacks and boats of every description, will readily present itself to the minds of all. The small space required by the generator, its noiselessness in operation, its ever ready working condition and easy replenishing when burned out are advantages which are greatly in its favor, when compared with ordinary illuminants for small requirements. When the fixture—the plant proper—can be made with an attached candelabra and carried about, placed on the banquet table, afterward removed to the parlor, in a residence or room where there is no gas—when half a dozen such loaned for the occasion would as beautifully light up a ball room or a country show or concert room as the grandest opera house, why should it not be popular? The day may come when the sticks of carbide will be put up like arc light carbons, and sold at retail like sperm candles. If there is reason for nervous apprehension in the Bunsen burner, which has caused so much anxiety among electric light people this winter, there is perhaps some reason for solicitude on the possibilities of acetylene. There are certain seasonable accompaniments of the frigid term, as for instance a coal pile and a door spring, and a hot lamp is an economical and unobjectionable miniature stove. But when seal sacques and fur caps are laid away in their camphored and peppered beds by and by, the "sickly ghost with its ghastly shroud" will follow them. Whether acetylene will some time rival electricity as an illuminant is yet to be seen.

## The Selector System.

Among the many exhibits at the Cleveland convention, few, if any, attracted so much attention as the display of apparatus made by the Electric Selector & Signal company of New York. The advantages of the device were readily recognized by all thoughtful central station men, and the saving in coal its adoption would show can be easily computed.

As separate circuits need not be run for arc lights to be ignited or extinguished at different hours, a great deal of expense can be saved in construction, while every lamp or group of lamps is under control of the man at the central station.

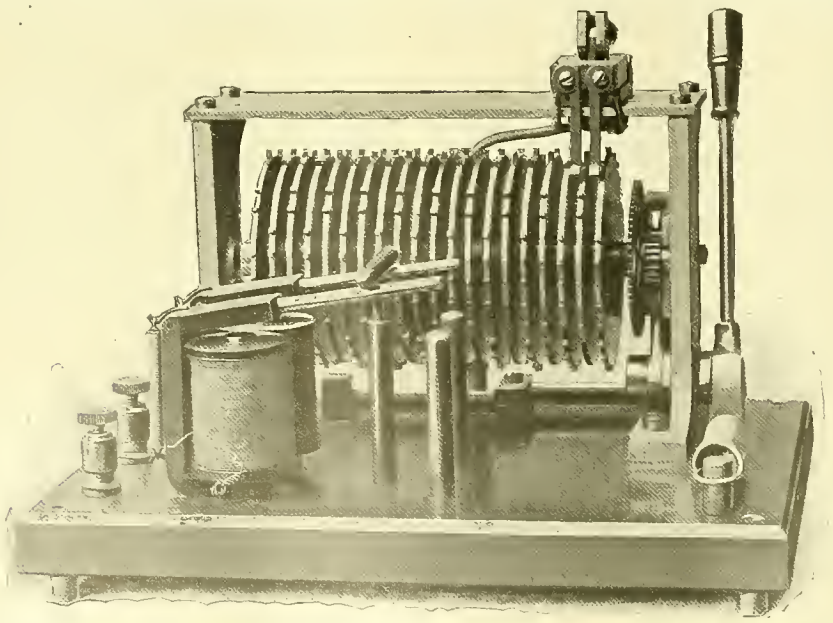


FIG. 1. THE SELECTOR SYSTEM.

Many electricians have worked hard within the last few years to reduce the leakage in the converter system, and much good has been accomplished. Yet there is a great loss at present in the system that could be overcome. There are numerous places, like churches, theaters, public halls, etc., where all the converters can be cut out at certain hours, and many more where a number of converters

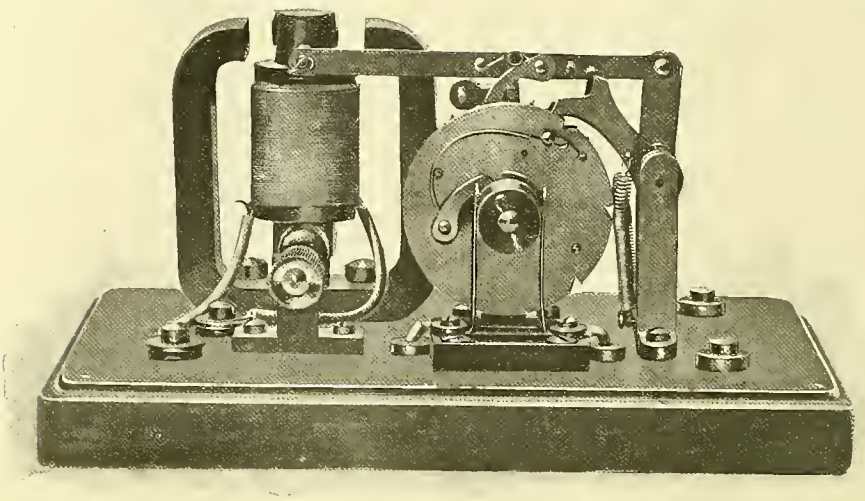
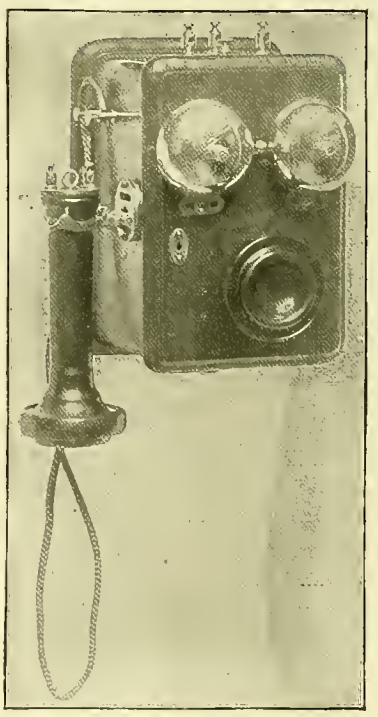


FIG. 2. THE SELECTOR SYSTEM.

can be isolated from the line. By the selector system both the primary and secondary can be cut out and cut in from the station at any time desired, and by this means a great saving is made. The simple devices by which this is accomplished are herewith illustrated.

Fig. 1 shows the transmitter (the central station instrument). It consists of a gearing operated by a lever, rotating a number of discs, each disc having upon its periphery certain contact points which, while operating, send current through metallic brushes to a selector. The amount of current used is small, and the action of the apparatus instan-



M. & B. TELEPHONE SYSTEM.

taneous. Fig. 2 represents the selector, which is the principal instrument in the combination. The cut shows the simplicity of it. It consists of a permanent magnet, in the fields of which is a movable armature. The attraction of this armature to the north or south pole of the magnet rotates a disc, the notches in which correspond to the elevations of the transmitter disc that actuates it, closing contact points through which the current passes to throw the switches. All selectors are in series, but only the one having the proper combination is operative. The switch itself is shown in Fig. 3. It is a barrel-shaped double magnet, with switch blades attached to one armature, and as this armature is attracted or repelled from its coil contact is made or broken.

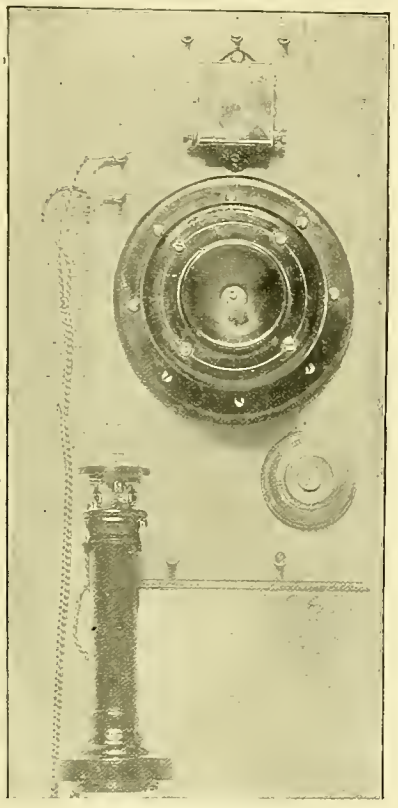
The company has the apparatus in operation at its office, 45 Broadway, New York, and at the store of its western agent, the Wallace Electric company, 307 Dearborn street, Chicago. An attractive illustrated catalogue has lately been issued.

## M. & B. Telephone System.

The accompanying illustrations represent types of instruments placed on the market by the M. & B. Telephone company, which has established headquarters in the Bullitt building, Philadelphia. This company owns a fundamental patent for the transmission of speech by the "make-and-break" method, which, in connection with numerous construction patents, gives it a complete system peculiar to itself and one which is claimed to be non-infringing, since the principle employed is diametrically opposed to that of the Bell system or any of its imitators.

The company makes various standard sizes of instruments for interior work, as well as a standard long-distance telephone, made especially for first-class exchange service. In interior work and short line service, as between house and stables or connecting a small number of houses or buildings together, the company makes a specialty of designing instruments suitable for this purpose, with switching devices protected by broad patents.

The M. & B. transmitter is claimed to be the simplest yet devised. A carbon sphere rolling on an inclined plane, with a suitable contact point attached to the diaphragm, is the principal feature of the transmitter. With every vibration of the diaphragm a complete make-and-break is made



M. & B. TELEPHONE SYSTEM.

between the point and the sphere. It has been demonstrated by actual tests that this transmitter is as well adapted for long as well as short-distance work.

The standard exchange M. & B. telephone is fitted with a receiver hook, claimed to be broadly covered by patents, which is a novel feature and of great assistance in making a complete exchange. When the subscriber rings up "Central" on this system, a few turns of the handle of the magneto automatically removes his ground, and his bell stops ringing. On taking the receiver from the hook, the hook retreats into the magneto box. When the subscriber is through talking he cannot put his receiver up until he has rung off, for the reason that the hook remains out of sight until the ringing of the magneto automatically brings it into view again. This prevents the subscriber forgetting to ring off, and goes a long way toward insuring the best possible service in an exchange.

One point of superiority claimed for this switchboard is that a board with a capacity for 1,000 subscribers occupies a space of only two feet high by six feet long. Another point claimed is that it is the quickest board to operate, as one operator can handle three times as many subscribers as on any other. It is claimed to be impossible to burn out the board either by electric light, railway or lighting currents. Perfect secrecy is another advantage claimed, owing to the fact that the "central" operator cannot cut in on a subscriber or listen to his conversation. The M. & B. switchboard can also be installed as a grounded circuit board, and can be easily changed over the metallic circuit by running another wire to the subscriber. This company is also prepared to furnish a toll line switchboard for use between cities and towns.

## Important Mexican Plant.

An interesting and important electric water power installation is now under construction for the Cia. Anonima de Transmission Electrica de Potencia, located in the state of Hidalgo, some 100 miles north of the City of Mexico.

The water is taken from the Arroyo de Regla, a mountain stream having a minimum supply of 1,500 cubic feet per minute. A natural rock dam at a point in the canyon impounds the water sufficiently to admit of its being diverted by a cut through the bluff into a canal, which follows mostly the contour of the mountain a distance of one and a half miles. This involved the cutting of seven tunnels, aggregating a total length of 1,200 feet, through solid rock.

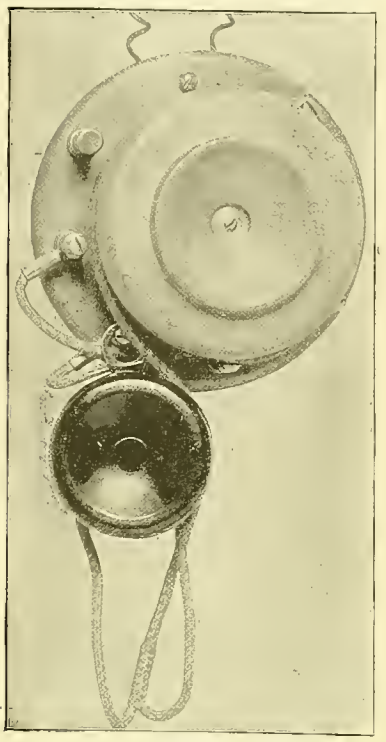
From the terminus of the canal the water is carried to the power station through 1,700 feet of 30 inch pipe, which affords a vertical head of 800 feet, and is of varying thickness to correspond to the pressure at various points on the line, the lowest portion being made of steel three-fourths of an inch thick. The pipe line discharges into a receiver 40 inches in diameter by 75 feet long, with which the wheels are connected by lateral branches. This is made of flange steel plates ¾ inch thick, tested to 700 pounds water pressure, and weighs upward of 50,000 pounds.

The power station equipment consists of five Pelton wheels, 40 inches in diameter, of capacity of 400 horse power each, direct connected to the same number of 12 pole three-phase generators running at a speed of 600 revolutions, delivering the current at a pressure of 700 volts. Two 24 inch Pelton wheels speeded at 1,700 revolutions, drive the exciters. The step-up transformers are wound for a ratio of 1 to 15, making the line potential a little over 10,000 volts at the generator end. There are three transformer sub-stations in which air blast transformers are to be used. Pelton differential governors are attached to each wheel for purpose of regulation.

This station is to supply power to the mines of the Rio del Monte company, one of the most extensive mining organizations in the world, employing upward of 8,000 men. The power is to be used for operating mining machinery, such as stamp mills, crushers, pumps, hoists, ventilators, etc. The mines of this company, said to be the richest in Mexico, are located within a radius of 20 miles, the maximum distance of power transmission being 23 miles and the mean distance about 18 miles. Various other mines in the vicinity will also be supplied with power from this station, and the city of Pachuca will be furnished with light. A market for the entire power being thus afforded at highly remunerative rates, the financial success of the enterprise is assured; in fact, it is claimed that the entire outlay, some $300,000, will be returned to the company in two years' time, from the saving effected in fuel heretofore required in carrying on its various operations. This important enterprise, involving many difficult engineering problems, originated with, and is being carried to completion under the direction of, Senor R. M. de Arozarena, an accomplished engineer, resident in the City of Mexico, who is also a director of the company.

The Pelton Water Wheel company of San Francisco and New York has the contract for the hydraulic part of the work and the Thomson-Houston International company of New York has the installation of the electrical machinery. The plant is expected to be in running order in about 90 days.

Considering the magnitude of the work, the extreme water pressure, the variety and extent of machinery to be operated, as well as the difficulties attending the transportation and erection of such massive machinery in a mountainous and



M. & B. TELEPHONE SYSTEM.

almost inaccessible region, this may be regarded as altogether one of the most remarkable electric power installations so far made in any part of the world.

## Combination Clip and Push-button.

Huebel & Manger of Brooklyn have recently placed a number of attractive electrical novelties on the market, but among them none has attracted more attention than the device illustrated by the cut on page 172. This is a combination clip and push-button, and it is claimed to be the only thing of the kind on the market. It is complete in itself and, as will be seen by a glance at the cut, can be easily and quickly attached to dining, card or chess tables or other pieces of movable furniture. The convenience and adapatability of the device are apparent.

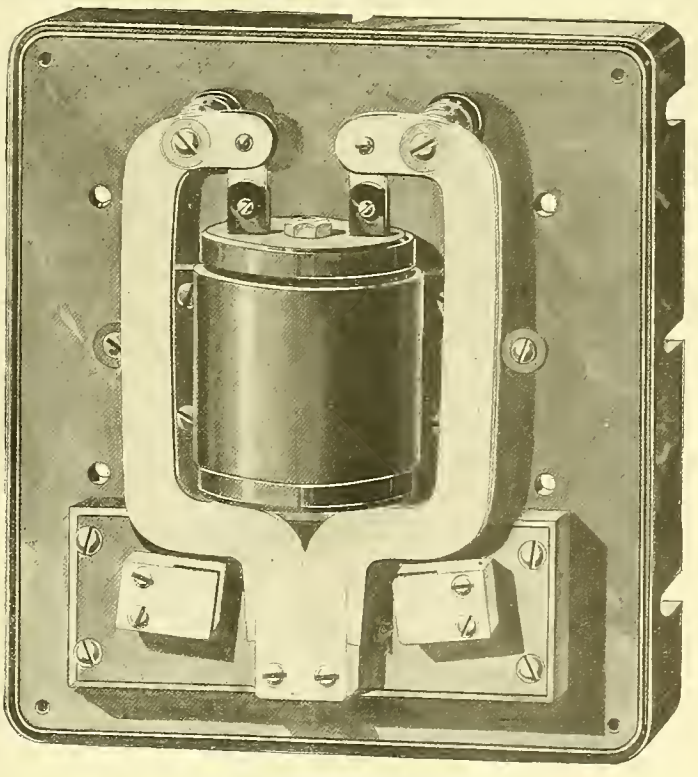


FIG. 3. THE SELECTOR SYSTEM.

## Covered Fuse Cut-outs Dangerous.

By Walter E. Harrington.

The rules of the boards of fire underwriters indicate covered fuse cut-outs. The probable reason of such a requirement is based on the natural assumption that the blowing of a fuse, if not entirely covered up, will cause fire. The reason a fuse is employed is for protection; but experience has demonstrated that fuses rarely blow in practice under the conditions which have determined their rating. That is to say, the rating of fuses is based upon the minimum current, causing fusion in the maximum time, and the usual condition in practice under which a fuse blows is such that an abnormal current flows through it before fusion occurs.

When a fuse blows under the conditions which have determined its rating, the phenomenon is one of very little manifestation, the metal simply melts quietly and drops. Consequently if a fuse be covered this latter behavior does not effect in any wise the action or result of the fusion, particularly so if the difference in potential be low, say 50 volts. There is no question that the observation of this latter method of fusion led to the adoption of the method of using covered fuse cut-outs.

The writer desires to put himself on record at this time as holding that the use of covered fuse cut-outs is radically wrong, as it is based upon practically wrong premises. The usual causes of fuses blowing are due to crosses, grounds and short-circuits. What ensues? The momentarily great flow of current which the fuse permits to flow through it during its fusion causes the fuse to blow quicker, and the more severe the condition, the higher the voltage, the quicker the fuse blows, and the consequence is that a veritable explosion follows.

In 500 volt practice it is impossible to have a fuse blow under a short-circuit in any of the commercial covered fuse blocks without their destruction. Every fuse block manufactured and placed on the market for sale was recently subjected to short-circuit tests in the power station of the Philadelphia Traction company, and in every instance the ids were shattered and the terminals burned; and, further, the circuit was opened by the switchboard magnetic circuit breakers.

The blowing of a fuse under a short-circuit in 500 volt work, when the fuse is open in the atmosphere, is accompanied by a loud rifle-like explosive report. It is manifestly incorrect then to take this explosive medium and inclose it in a small space. The writer read a paper upon "The Destructive Arcing of 500 Volt Fuses" before the American Street Railway association at Atlanta, Ga., in October, 1894, in which attention was called to the destructive and vicious character of the gases attending the blowing of fuses, and it was shown that the incidental troubles following the blowing of the fuse, due to the gas, could be worse than the damage incident to the flow of current, causing the fusion.

The sudden formation of gas in a closed fuse block under a short-circuit condition is attended with the most severe results, as the gas is an excellent conductor, and being inclosed without free vent, the gas is at its maximum density, and therefore minimum specific ohmic resistance, with the result that, while it is true the fuse is disintegrated, still a most excellent flexible, floating conductor is present carrying current, further, this gas is maintained at the expense of the terminals and is a most fruitful source for fires.

The natural remedy is to provide fuse blocks, the fuse having free unobstructed vent to the atmosphere. Copper makes the best fuse metal, as it gives the minimum cross section of metal per ampere of any metal outside of silver. Make the length of fuse as small as possible, with the fuse having protected terminals, such that when the fuse has blown the arc is killed by the protection on the terminals.

If protection outside of the fuse is desired against the vicious gases following the explosive blowing of the fuses, build a spacious box or closet for the fuse blocks to vent into, provided with proper ventilation and protected inside against fire.

Experience shows that no dependence can be placed upon fuse metals as a protection on circuits carrying over 10 amperes, and that magnetic circuit breakers are the only means available for sure protection.

## Electric Cars in Postal Service.

Officials of the Postoffice Department are considering the advisability of utilizing street cars in the large cities of the United States for the transportation of the mails from the sub-stations to the main office. This plan is now in vogue at St. Louis and Brooklyn, and it is proposed to avail the postal service of the improvement in transportation facilities at Chicago, New York and Philadelphia as speedily as possible. According to a dispatch from Washington, Second Assistant Postmaster-General Neilson has just returned from a visit to New York city, where he was in consultation with the street railway men on that subject. Mr. Neilson said that it is proposed to do away with the horse and wagon service and utilize the electric and cable car service. It is not only proposed to collect the mails by using the street cars, but also to distribute the mails either directly to the carriers along the routes or to the sub-stations. The question of compensation does not cut a very important figure in the transaction, for it is believed that the street car service will be less expensive to the government than the delivery wagon and messenger service on foot and on horseback. It will be necessary for special cars to be built for the purpose, and if they are operated exclusively on cable lines they will be constructed as trailers, but on electric lines they will be equipped with the ordinary appliances of locomotion peculiar to that system. Gen. Neilson says the subject has been carefully considered, and it is believed that its practical operation will demonstrate its advantages to the general public. It is intended to make a circuit of the city of New York and have the carriers meet the mail cars at given points, for either collection or distribution of the mails. The calculations that have been made show that the proposed system will not only facilitate the handling of the mails, but it will relieve much of the pressure upon the force in the large offices. The cars will be so constructed that the mail clerks can sort and tie the mail as they collect it along the ronte, so that a great deal of it may not have to go to the main office. In Brooklyn the delivery is made to the sub-stations, but in St. Louis it is made directly to the carrier. It is not proposed to confine this improvement in the service to the large cities, but it will be employed wherever the railways offer the desired facilities.

# COMMUNICATION.

## Cost of Central Station Storage Batteries.

*To the Editor of the* Western Electrician:

It is with considerable temerity that I offer again to the public my views upon any subject after reading in your last issue the authoritative opinion of Herbert Lloyd that my statements are "not only ridiculous, but false."

This leaves me without a leg to stand on, but while admitting my weakness, and that I am no match for Mr. Lloyd in gentlemanly controversy, acknowledging a complete knock-out, I still beg to restate my position.

In the preparation of my paper read at the Cleveland convention of the National Electric Light association, all available information was gathered as to the original cost and expense of maintenance of central station storage battery plants, both here and abroad. Most of my conclusions were based on figures given by the Electric Storage Battery company of Philadelphia, of which Mr. Lloyd is the general manager. I believed them to be essentially correct.

Among other things, Mr. Lloyd charges that my figures of original cost were too high, and that his company is willing to take contracts at much lower rates. If Mr. Lloyd will now publish this revised price-list, with discounts for plants of various capacities, and with the specific guarantees which his company will make for each, I should regard such statement as authentic and gracefully acknowledge my error if his prices proved to be lower than those given by me. It is on record that the price on one plant sold by Mr. Lloyd's company since the Cleveland meeting was higher than the price assumed by me.

Mr. Lloyd still clings to the idea that Mr. Edgar's statement in regard to the battery plant purchased by the Boston Edison company refutes my views and substantiates his position, whereas Mr. Edgar's explanation was accepted by every intelligent central station man at the Cleveland meeting as proving that the only place for a battery plant in central station service is in taking the peak off the load line. This was and is my exact position.

Nelson W. Perry

# CORRESPONDENCE.

## New York Notes.

New York, March 30.—The stockholders of the Edison Electric Illuminating company will soon be called upon to approve an extensive bond issue. The directors have decided to authorize the issue of $15,000,000 100 year 5 per cent. gold consolidated mortgage bonds for the purpose of extending the business of the company in the upper part of the city. Of the amount authorized enough will be held in reserve to provide for the $5,000,000 first mortgage 5 per cent. bonds maturing in 1910, of which $4,312,000 is outstanding. A portion of the issue will also be used to replace equal amounts of bonds and other obligations of the Manhattan and Harlem companies held by the Edison company. The bonds of the controlled companies held will then go in as additional security under the new mortgage, and it may be decided to purchase the outstanding bonds of these companies in order firmly and permanently to unite all the electric lighting and power interests of the city of New York. The new $15,000,000 consolidated mortgage will contain a provision that the total issue of bonds of the company, including the 5's now outstanding shall not at any time exceed the outstanding issue of capital stock.

A complete system of interior telephone communication has been established in the federal building. It is intended to bring all the heads of departments throughout the building into immediate and direct communication with Postmaster Dayton's office and thus to facilitate the business of the department. The main switchboard is the one which was in use at the World's Fair. Its equipment consists of fifty drops, with wires running to all the different offices in the building from the basement to the dormitories, where inspectors in the railroad mail service sleep. The postmaster's instrument rests on a base having ten jacks and a plug with which to make connections. It is the property of the American Bell Telephone company and is leased from the Metropolitan Telephone & Telegraph company.

The certificate of incorporation of the Consolidated Telegraph & News company was filed last week in the office of the county clerk. It has a capital stock of $600,000, $500,000 of which is common stock and $100,000 preferred stock. The purpose of the organization is to manufacture and supply telegraph instruments. The directors are William H. T. Hughes, James A. Davis, George W. Cummings, Joseph Thorn, Frank M. Clute, Richard H. Jaeger and Henry Herrold.

A new telephone exchange company for New York and Brooklyn—the Mutual Automatic Telephone company—has been incorporated with a capital stock of $6,000,000. It has attracted attention by the prominence of the men connected with it. Smith M. Weed is president, and among the directors are W. Seward Webb, president of the Wagner Palace Car company, New York; David A. Boody, banker and ex-mayor of Brooklyn; Henry N. Whitney, president Schermerhorn Bank, also of Kissam & Whitney, bankers, New York; Silas B. Dutcher, president Hamilton Trust company, Brooklyn; John Jacob Astor, New York; Charles F. Cox, president American Safety Deposit company. The company proposes to use the Strowger automatic system, and it is said that it has already secured thousands of contracts for five years in Brooklyn and New York.

While the Oxford-Cambridge boat race was in progress to-day a secondary race was under way that was about as exciting for the participants as was the great race on the Thames for the crowds that witnessed it. The Western Union, Direct United States and Anglo-American cable companies entered into a competition to see which company could bring the name of the winner to No. 16 Broad street, New York, first. All the little details of the race were flashed across the companies' cables, and finally the crowning bulletin, "Oxford wins," was landed in New York by the Western Union cables first, the Direct and Anglo making a dead heat for second place. W. F. O.

## St. Louis, Mo.

St. Louis, March 30.—The Magnolia Avenue Electric Railway company has filed articles of incorporation with the secretary of state at Jefferson City, and an ordinance asking the Municipal Assembly for a city franchise has been introduced in the city council. The proposed route begins at Grand and Magnolia avenues and runs directly west on Magnolia avenue along the north side of Tower Grove Park and between the park and the Missouri Botanical Gardens to King's Highway, thence north to Old Manchester road, to Weston road, and Scanlan avenue to the western city limits at Oxford avenue. The eastern terminus connects with the People's railway and the Lafayette avenue cable line, and the western terminus will probably make a connection with a county road, which will no doubt be built soon. A most desirable and well built-up suburban district extends almost continuously from the city limits to a distance of some thirteen miles west, embracing the towns of Kirkwood, Webster Groves, Oakland, Glenwood, Old Orchard, Maplewood Park and Ellendale. This has been a much coveted territory by suburban electric railway schemers for several years past. Several plans for covering this territory have been brought forward. One of the difficulties has always been the matter of a direct line or connection to the central part of the city. The new Magnolia avenue line has probably settled this question by an arrangement with the People's railway. The incorporators of the new company are: T. J. Prosser, president; W. W. Penny, vice-president, and G. W. Flannagan, T. D. Wanfried, Louis P. Spangler and other St. Louis capitalists.

The Lindell Railway company has awarded a contract to the Westinghouse company for 200 No. 28 car controllers. It has also given an order for twenty car equipments to the same company.

A bill has been introduced in the council providing for the sale to the highest bidders of all public franchises hereafter granted.

A bill has been introduced in the city council authorizing the Jefferson Avenue Railway company to change its motive power to electricity. This road is the last horse-car line in St. Louis.

The Bell Telephone company of Missouri is considering the matter of adopting the express system of telephone exchange work. In this system the magneto call bell is not

used. The subscriber puts the telephone to his ear and calls for his connection. The act of transferring the telephone from the hook to his ear sends in a signal. A clearing-out signal is sent in by hanging up the telephone.

W. C. Gotshall has been appointed chief engineer of the Union Depot Railroad company, in charge of the mechanical and electrical departments.

The St. Louis & Jefferson Barracks Railway company has filed a certificate of incorporation with the county recorder and has also petitioned the county court for a franchise.

The Senate bill authorizing the consolidation of St. Louis street railways has been defeated.

Thomas Dolan, a fireman, has been awarded $2,750 damages for injuries received from a Laclede Gaslight company wire a year ago.

The management of the Security building has decided to put in an isolated lighting plant. Two directly connected 600 light units will be installed.

Owen Ford is preparing plans for a 200 horse power municipal lighting plant at Webb City, Mo. There will be a 1,200 light alternating dynamo and an 80 arc light machine.

Wintbrop Bartlett is engaged on plans for the Jefferson Barracks extension of the Southern electric railway. This addition will connect the southern terminus at the city limits with Jefferson Barracks.

Kroell & Meysenburg, superintendents and contractors, are established in the Commercial building. Mr. Kroell was formerly associated with the Siemens & Halske Electric company of America as constructing engineer. Mr. Meysenburg has been associated with Littlefield & Meysenburg.

R. J. H.

## PERSONAL.

M. L. Stevenson, representing the National Carbon company of Cleveland, O., was in Chicago last week.

William S. Kimball, the tobacconist of Rochester, N. Y., who died last week, was financially interested in many street railway plants in this country and Canada. He was a director in the electric railway companies operating in Rochester, Buffalo, Toronto and Hamilton.

## ELECTRIC RAILWAYS.

W. W. McChesney has recently been appointed general sales agent by Huebel & Monger of Brooklyn, N. Y. He will leave for an extended trip through the central and western states in April.

The Calumet Electric Street Railway company of Chicago has filed a trust deed to the Equitable Trust company of Chicago to secure $3,000,000 gold construction bonds. The deed is to run for forty years. The bonds to be issued are of the value $1,000 each, interest payable semi-annually at the rate of 5 per cent. a year. Under a condition of the deed $500,000 is to be withheld for the extension of the line, the purchase of property or the equipment of the road. The railway company also agrees to pay all taxes and assessments that may be levied on the bonds in addition to the interest.

The electric power houses at the Chaudiere, Ottawa, Ont., had much difficulty for a few days last month in obtaining a full supply of current, owing to the sudden fall of the river to the extent of four feet. The fall was probably due to the formation of an extra amount of anchor ice in the vicinity of the falls, owing to the extremely cold weather. The trouble is causing the Electric Street Railway company to talk of establishing an auxiliary steam plant, and one is also proposed for the water works. Some prominent Ottawa citizens are agitating for the formation of a commission to investigate the water problem and suggest some means for preventing a repetition of the failure.

At East Geneva, N. Y., the scene of the trouble between the New York Central and the Geneva & Waterloo Electric Railway companies, the Central company has a large force of men guarding the crossing to prevent employes of the other company from suspending a trolley wire over the tracks, it being claimed that the Electric company only secured from the courts the privilege of laying the tracks and has no right to put up a wire. On Saturday, March 23d, the trolley wire was suspended across the tracks of the New York Central, but a rope was thrown over it and attached to an engine which quickly pulled it down. There is not the slightest doubt that the road will soon be running to Waterloo, but not without a protest from the New York Central authorities.

Congressman McGann's electric railway company—the General Street Railway company of Chicago—has brought suit in the Circuit Court to recover damages in the sum of $1,000,000 from Charles T. Yerkes and others connected with him in his street car business. The suit is for alleged conspiracy, and is a novelty in legal proceedings. The ground on which the action is based is malicious prosecution, but it avoids the long wait involved in bringing an action for malicious prosecution direct. This suit is, therefore, for conspiracy, by which, the McGann company alleges, losses were suffered to the amount of $1,468,000 by reason of certain injunction suits prosecuted in malice. The plantiff does not ask damages, however, in the full amount of the losses itemized in the declaration, but throwing off $468,000, makes a demand for an even million. The injunction suits were brought during the construction of the road, stopping the work and preventing the sale of bonds of the company and forcing it into high priced litigation. Much of this litigation is pending, and that is why the suit is brought for conspiracy instead of for malicious prosecution, the court holding that suits for malicious prosecution cannot lie until the prosecution is at an end. This style of suit is therefore a new thing to enable the plaintiff to get action in law without delay.

## MISCELLANEOUS.

William S. Pierce, manager and chief owner of the Petaluma, Cal., Electric Light & Power company and president of the Pierce Telephone company and of the California Dairymen's Union, was instantly killed by contact with a live wire on March 21st. Mr. Pierce, who had been ordered to take active exercise for his health, climbed a pole to find a broken wire. Sitting on the first crosspiece, about forty feet from the ground, he ran his right hand over several wires, when suddenly he touched one from which the insulation had been burned. A sheet of flame shot forth and Pierce dropped backward, two heavy wires keeping the body from falling. The current was cut off at the works and a hook and ladder truck was utilized in taking the body down.

The *Art Journal* for March contains an illustrated article by C. R. Ashbee on electric light fittings. Those who know the severity of the author's taste, says the London *Electrician*, will not be surprised to find suggestions for fittings which would harmonize excellently with a Norman castle or a Pompeian villa. The ordinary ironmonger would, probably, be disgusted with the outlines, and would think Mr. Ashbee's favorite material, pewter, distinctly unseemly in polite society. Mr. Ashbee prefers rest in a design, and feels disturbed when three naked bronze children come rushing over the table with 48 candle power hands full. It may suggest electricity, he says, but it does not suggest repose, and it has to be done very well if it is to be done at all. This bronze children business is, we think, getting rather tedious. The realism of the designs was novel at first, and hardly, if at all, more artistic than modern Italian sculpture; but the affectation of a green patina, done apparently in flatted oil paint, is singularly incongruous. It is a curious feature of the electric glow lamp, that it adapts itself, with the utmost facility, to a fifty-guinea gaudy ormolu vulgarity or to a sixpenny silk handkerchief with a hole in the middle of it.

## TRADE NEWS.

The Brown Electrical Construction company of New Haven, Conn., desires information and estimates in relation to establishing a gas engine and storage battery plant for about 200 lights in a customer's residence and stable.

The business of the Chicago office of the Perkins Electric Switch Manufacturing company is increasing so rapidly that larger quarters must soon be secured for a bigger stock of goods. Perkins sockets, Gibbs switches and Waterhouse arc lamps are the principal specialties.

General Manager C. E. Trump of the Novelty Electric company of Philadelphia is well pleased at the large increase shown in his company's business of late, the month of March showing a total of several times the amount of sales for any preceding month in some time. He is now preparing for a good spring and summer trade.

The Beacon Vacuum Pump & Electrical company of Boston, manufacturer of the well-known Beacon incandescent lamp, has secured Leslie W. Collins as its Chicago representative, with an office at 1105 Monadnock building. Mr. Collins has a wide acquaintance in the electrical trade of the West, and both he and the company are to be congratulated.

Edward P. Sharp, 44 Niagara street, Buffalo, N. Y., who is well known in the electric street railway business through the central part of New York, Pennsylvania, Ohio and Indiana, has been appointed representative of the R. D. Nuttall company of Allegheny, Pa. With the addition of a class of manufacture such as that of the R. D. Nuttall company, Mr. Sharp's business will grow more extensive than ever.

The Hogan Boiler company of Middletown, N. Y., has issued invitations to the trade to visit its works and inspect its boilers. The officers of the company say: "On the 9th of April we propose to throw open our works to the inspection of representatives of the trade press, mechanical engineers, representative manufacturers and steam users, and, by means of the boilers we have in operation, to demonstrate to their satisfaction the truthfulness of the remarkable statements of performance we are sending out."

Morris & MacCurdy of Indianapolis, manufacturers of the Phoenix rubber insulating paint, have added to their list of agencies the following named: Devere Electric company, 18 Plum street, Cincinnati; Standard Railway Supply company, 1115 Monadnock Block, Chicago; Partrick & Carter company, Philadelphia; John C. Dolph, 126 Liberty street, New York; Western Electrical Supply company, St. Louis, Mo.; Cuyahoga Electrical Supply company, Cleveland, Ohio, and Bergtheil & Young, London, England. The paint is meeting a flattering reception, and many testimonials are being received. The firm has just completed a large warehouse and is now prepared to make shipments up to a carload on 24 hours' notice.

In the latest issue of *Profitable Advertising* S. H. Goddard makes this deserved and appreciative reference to a well-known advertising agency: "In the special field of advertising the growing success of the Jules Viennot agency of Philadelphia for manufacturers is interesting, as it throws light on the importance of the industrial press of America. Manufacturers realize the need of advertising in their respective line of papers, but how to do it, where to do it, when to do it, are questions which the average mind, wrapped in entirely different lines of thought, does not care to grapple. For this work Mr. Jules Viennot acts in the capacity of a confidential adviser in the preparation and placing of advertising to 30 or more large manufacturers like the Brill Car company, Standard Steel Works, Trenton Iron Works, Morris, Tasker & Co., and other concerns of a like nature which use only class publications." Mr. Goddard might have included Merchat & Co. and the Baldwin Locomotive Works among the list of patrons and placed the number at 45 instead of 30.

The Campbell & Zell company of Baltimore, Md., has recently secured for general manager W. E. Gray, who was for several years in charge of the Harrison Boiler Works of Philadelphia. Although he has been but a short time with the Campbell & Zell company, Mr. Gray has made a large number of important changes, the results of which are seen in the great improvement in the business. Mr. Gray is known as one of the most progressive men in his line of trade. The concern is now preparing to add extensively to its plant by building a new machine and power house and a blacksmith shop; also by extending the boiler shop, covering an area of 40 by 275 feet. Some changes will be made in the wharf frontage, of which the company has 1,650 feet. When this work is done the Campbell & Zell company will have one of the most complete plants of its kind in the country.

## BUSINESS.

The Metropolitan Electric company of Chicago is finding very ready sales for the new carbon open-circuit battery which it recently put on the market.

The Goubert Manufacturing company, New York, maker of the Goubert feed water heater and Stratton steam separator, has lately removed its Pittsburg office from 403 Lewis building to 1012 Carnegie building.

The Bryant Electric company's make of sockets has been increased by the addition of a new weatherproof socket. This company claims to make the greatest variety of devices in the way of sockets, and there is never a demand for some new device that it is not ready to meet and with good goods.

The Mather Electric company of Manchester, Conn., reports the sale through H. B. Coho & Co., its New York contractors, of one 30 kilowatt and two 50 kilowatt direct-connected generators of the new type for Grace Chapel, Seventeenth street, New York city. Armington & Sims engines will be used.

The Electric Appliance company has just issued a descriptive circular of the improved Hunnings telephone and the American telephone switchboard, which presents the merits of these goods to advantage. The switchboard is a very neat and artistic device, and certain advantages are claimed for this battery telephone over any other on the market.

General Sales Agent H. F. Kellogg of the Whitney Instrument company, with office at Boston, Mass., reports that various agencies located through the country are sending in orders much in excess of last year. Mr. Kellogg made an extensive trip through the South and West to the Pacific Coast last fall. He is well known to the electrical trade, which will be pleased to hear of his success in pushing the Whitney instrument.

The Lukens Iron & Steel company, Coatesville, Pa., which makes a specialty of the Huston patent boiler brace, announces that it has recently received an order for 6,000 tons of open hearth steel plates, to be used in the construction of the cantilever bridge across the East river at Blackwell's Island, New York. The company has also received large orders for boiler steel from Cramp & Sons, the Philadelphia ship builders, for the new Clyde line steamship, and from the Pennsylvania Railroad company, the Lehigh Valley Railroad company, the Schenectady Locomotive Works and others for boiler and fire box steel.

General Manager Frank S. Marr of the Helios Electric company of Philadelphia reports a great improvement in business since March 1st. The company has added largely to its force of men in the factory to meet the increase in business. A large proportion of this business is in the West; a carload of Helios lamps for San Francisco and also one for Salt Lake City were among the recent shipments. The foreign trade of this concern is also very good. A portion of a recent shipment to Japan was an additional order for Kioto, Japan, where a large number of Helios lamps are in operation.

The Walker Manufacturing company of Cleveland, O., is building up a good business in the sale of electrical machinery. It closed the following contracts between March 1 and March 22, 1895: Burhorn & Granger, 136 Liberty street, New York city, two 25 kilowatt direct-coupled lighting generators; Union Depot Railroad company, St. Louis, Mo., forty-one double car equipments (eighty-two 30 horse power steel motors); Pittsburg Traction company, Pittsburg, Pa., one double car equipment (two 30 horse power steel motors); Pittsburg, Crafton & Mansfield Passenger Railway company, Pittsburg, Pa., one double car equipment (two 50 horse power steel motors); Federal Street & Pleasant Valley Passenger Railway company, Pittsburg, Pa., two double car equipments (four 30 horse power steel motors); Suburban Rapid Transit Street Railway company, Pittsburg, Pa., one double car equipment (two 25 horse power steel motors); Schuylkill Electric Railway company, Pottsville, Pa., four double car equipments (eight 25 horse power steel motors); Chicago City Railway company, Chicago, Ill., forty-nine double car equipments (ninety-eight 25 horse power steel motors); F. E. Snow, receiver, Adrian City Electric Belt Railway company, Adrian, Mich., one 60 kilowatt belted generator, three single car equipments (25 horse power steel motors.

Without doubt there are many young men and women engaged in the electrical and allied businesses that have thought more or less of the study of short-hand. To be a good short-hand writer is an aid to anyone, no matter what branch of the business he may be engaged in. For this reason a large number will find of interest the following statement of President Clarence H. E. Zeigler of the Chicago

Short-hand Institute, southeast corner of Thirty-fifth street and Wabash avenue, Chicago: "It is the object of the Chicago Short-hand Institute to impart a complete knowledge of phonography, or phonetic short-hand, fitting its graduates to act efficiently as business amanuenses, private secretaries, law and general reporters, and teachers of phonography. The institute is open during the summer months, so that the teachers of English branches may profitably and pleasantly spend their vacations in preparing themselves to fill a wider field of usefulness, and to earn increased salaries." The Chicago Short-hand Institute commands, in the fullest measure, the necessary facilities for accomplishing the objects proposed. The president, under whose general supervision the institute is conducted, needs no introduction, as he has been known for years as a teacher of the leading system of short-hand practiced in America—the system written by the reporters of Congress, and pronounced by the National Bureau of Education to be the American system of short-hand. His short-hand education and experience is of the widest and most varied character as teacher, lecturer, and law and general reporter. An illustrated circular giving fuller information will be furnished on application. Prospective students will find food for reflection in the institute's published statement that 98 per cent. of its students up to date are holding good paying positions.

The Cutter Electrical & Manufacturing company of Philadelphia has recently moved to 1110 and 1112 Sansom street, that city, having been obliged to seek larger quarters owing to the rapid growth of its business during the last year. This concern has now facilities that are first-class in all respects. The first floor of the factory is devoted to a general business office, with estimating department for construction work, and to the stockrooms and shipping department. On the sixth floor is the manufacturing department, occupying the full width of building, where the light is of the best, as is necessary for this class of manufacture. This large floor space is divided into several departments. In front is located the plating and grinding rooms, while near by are the model, testing and drafting departments. The assembling and machinery departments occupy a large space with a stock-room from which is issued the material for manufacture. A new case hardening furnace of improved pattern operated by gas was recently placed in the factory, which, with the large amount of new machinery purchased recently, all of the most improved pattern, places this concern in a position to meet the large increase in business. President H. B. Cutter located a modest little shop on Chestnut street, Philadelphia, in 1889. Remaining there a year, he was then compelled to find larger quarters because of increase in trade. He removed to No. 27 South Eleventh street, at which place the company was organized under the name of the Cutter Electrical & Manufacturing company. The next move was as stated to 1012 Sansom street, where about fifteen thousand square feet of floor space is taken. Mr. Cutter is known East and West among the electrical fraternity, and especially for the high grade of goods manufactured, and his many friends will be pleased to hear of the success of his company, which is largely owing to the push and business record of its president.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

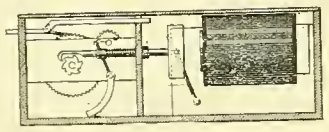
*Issued March 26, 1895.*

536,184. Method of Applying Insulation. Frank E. Case, Schenectady, N Y. Application filed June 21, 1894.

This method consists in applying when cold to the part to which it is to be united an insulating compressed material adapted to expand under heat and retain its expanded form when cold, and then heating the insulation while the compressed material and the part to which it is to be united are held firmly together.

536,210. Electrical Signaling Apparatus. William E. M. Jackson, San Francisco, Cal. Application filed June 8, 1893

In this arrangement the combination is claimed of the double relay device, with two electro-magnets and two armatures, a trigger, a back contact and one or more retractile springs, a revoluble type wheel, a stop device, impression device and successive contact-making device, in operative relation with the type wheel.



NO. 536,256.

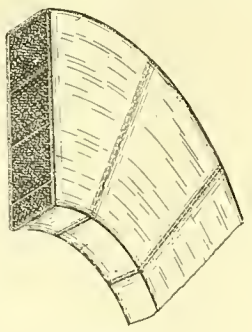
536,221. Electric Switch. Charles J. Miller, Philadelphia, Pa. Application filed January 19, 1895.

The combination of the terminals, the pivoted knife having yielding side plates, a tapered spring adapted to pass between the side plates and to force them out against the contacts, and a pivoted handle acting to withdraw the spring from between the side plates of the knife, and place it under tension, whereby the movement of the knife is accelerated as it is withdrawn from the contacts.

536,226. Magnetic Separator. James D. McKinnon, Portland, Ore. Application filed August 7, 1894.

In a magnetic separator, an endless magnetized belt, magnets, and an agitator arranged in the magnetic field, are claimed.

536,233. Telephone System. John I. Sabin and William Hampton, San Francisco, Cal. Application filed November 9, 1894.



NO. 536,319.

Telephone lines extending in groups to divided boards of an exchange, each group to a separate board, a local trunk line plug provided at one of boards and adapted to be inserted in the switch of a called subscriber, switches, one at each of the boards connected in circuit with the local trunk line plug, and means for connecting the line of a calling subscriber at any one of the boards with the switch thereat to complete circuit between a calling and a called subscriber.

536,256. Electric Railway Switch. Roilin A. Baldwin, South Norwalk, Conn. Application filed October 24, 1893.

The principal features of the device illustrated are a single electro-magnet, a vibrating switch point, a reciprocating rod attached to the switch point, a thrust rod moved in one direction by the magnet and connections whereby the movement imparted to the thrust rod by the magnet will cause the reciprocation of the rod in either direction.

536,266. Electric Switch. Cummings C. Chesney, Pittsfield, Mass. Application filed January 17, 1895.

A jaw and a lever bar bearing a contact blade both mounted upon an insulating base, with a casing inclosing the jaw and having a slide normally covering jaw, lever bar having a projection controlling the position of the slide when the bar is depressed.

536,271. Electrical Signal and Switch Operating Apparatus. Justin Dutrey, New Orleans, La. Application filed July 19, 1894.

There are included in this arrangement a railway track, a conductor electrically connected with one of the track rails and arranged adjacent to and in a plane slightly above the rail, a locomotive or car provided with a contact device adapted to engage the track rail with which the conductor is connected and a vertically adjustable contact device adapted to engage the conductor, and a battery or other generator and an electrical signal carried by the locomotive and electrically connected with each other and with the contact devices.

536,275. Supply System for Electric Railways. Charles E. Emery, Brooklyn, N Y. Application filed March 15, 1894.

A non-insulated electric railway conduit, a series of insulated live supports and a series of insulated intermediate supports arranged therein and adapted to support a flexible conductor arranged to convey electric current from such live supports to apparatus on a car.

536,319. Method of Insulating High Tension Coils of Transformers. August Schneller, Aarlanderveen-Alfeo, and Willem J. Wisse, Haarlem, Amsterdam, Netherlands. Application filed December 27, 1894.

The manufacture of secondary transformer coils as shown in the cut, for use in the production of high tension electric currents is described. The process consists of boiling coils of insulated wire in wax or a waxy substance, then pressing them, and putting them into preliminary use for the purpose of evaporating moisture therefrom and of filling up the interstices therein, additional wax or waxy substance being supplied to the coils as long as heating thereof is produced by the passage of an electric current therethrough.

536,374. Conduit Electric Railway. Frederick S. Davenport, Jerseyville, Ill. Application filed January 28, 1895.

In connection with the underground conduit of an electric railway the inventor claims the combination as shown in the accompanying illustration of an insulated feed-wire, a casing secured to the wall of the conduit, and adapted to inclose and support the feed-wire, openings in the insulating covering of the feed-wire, and elastic bands or diaphragms of insulating material adapted to hermetically close the openings, metallic contact studs passing through and made air-tight in the elastic covers or diaphragms, and rigidly secured in metallic sprigg arms insulated from the feed-wire, a collecting contact bar supported by, but insulated from, arms depending from the car truck, the collecting bar adapted to come in contact with, and depress, the free ends of the spring arms so as to press the contact studs upon the feed-wire as it travels over them, and an insulated wire for electrically connecting the collecting bar with the motor.

536,382. Telephone Exchange System. Silas W. Holman, Boston, Mass. Application filed March 24, 1894.

The metallic circuit telephone exchange system described by the inventor and illustrated in the accompanying drawing, consists of telephonic apparatus at each subscriber's station, and a pair of wires extending therefrom to the central office switchboard and there ending in pairs of open branch terminals, one of each pair of line wires being normally open at the subscriber's station and grounded at the central office through a high impedance annunciator and battery, the other wire being normally open at the central office and grounded through a bell at the subscriber's station; switching mechanism at each subscriber's station by means of which its two wires may be joined through the subscriber's telephone and, at the central office, a double conductor connecting cord provided with a condenser in each conductor and a double-contact terminal at each end, each of which contact terminals is adapted to make connection with any pair of the branch terminals on the switchboard; an operator's switchboard commutator comprising a transmitting and receiving telephone conveniently adjusted upon the person of the operator and having each terminal connected by a flexible conductor with a metallic thimble placed upon a finger of each hand, and signaling apparatus consisting of a conductor adapted to be connected to an electric generator and connected by flexible conductors with other metallic thimbles placed one upon a finger of each hand, whereby the operator may, by touching the proper combination of metallically tipped fingers to the appropriate switchboard terminals, send signals to and put himself in telephonic communication with any desired subscriber or pair of subscribers.

536,420. Telegraphy. Patrick B. Delany, South Orange, N. J. Application filed November 19, 1894.

In an automatic perforated tape transmitter, elastic or yielding contact brushes are utilized, each consisting of a bunch of wires arranged on opposite sides of the tape with their contact making ends opposite each other, the organization being such that the brushes press into contact with each other through the perforations as the tape passes between them.

536,438. Electric Mining Machine. Edmund C. Morgan, Chicago, Ill. Application filed July 18, 1894.

An electric motor, a mining tool, gearing interposed between the motor and mining tool, included in which gearing is a wheel having openings in the web thereof and a shaft having wings carrying holders for rubber buffers adapted to engage the walls of the openings in the gear, and a cam secured to the same shaft, and the wings and cam both being formed integrally with the shaft.

536,467. Electric Signal System. Webster Gillette, New York, and Alexander S. Williams, Long Island City, N. Y. Application filed October 30, 1894.

The combination with the telephone switch for controlling the line and local circuits of a single plug having a single contact surface switch for throwing one pole of the connections of the battery and one pole of the secondary of the induction coil into electrical connection with the line is claimed.

536,478. Combination Electrical Meter. Herschel C. Parker, Brooklyn, N. Y. Application filed January 9, 1895.

An electrical meter is described, comprising a pair of coils wound respectively for low and high resistance and turning on a common axis between the poles of a magnet, means for connecting a current to the coils, and an indicating hand moved by the coils.

536,481. Telephone. Jonathan D. Price, Chicago, Ill. Application filed July 30, 1894.

NO. 536,374.

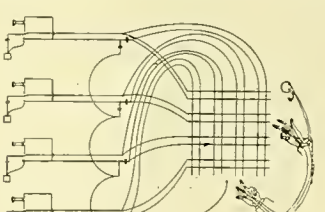
The first claim is as follows: In combination with a telephone having a transmitter box hinged or pivoted to its support, contact making and breaking device placed between the transmitter box and its support and operating to break the circuit through the signaling device, and close circuit through the transmitter and receiver and battery when in one position, and close the circuit through the signaling device and open the circuits through the transmitter and receiver and battery in another.

536,530. Electric Current Regulator. Charles M. Jordan, Washington, D. C. Application filed February 13, 1895.

This method of controlling electric currents consists in driving a motor subject to the fluctuations of the controlled current, driving a motor not subject to these fluctuations and in causing the motors to act upon a current controlling device in angularly displaced relation, whereby the movement of the controller is conformed to the resultant action of the motors

536,535. Electric Brake. Edward D. Lewis, Savona, N. Y. Application filed November 12, 1894.

A fixed electro magnet, a movable electro-magnet in the same circuit, a break-beam, a lever connected to the break-beam and the movable magnet, and means for regulating the throw of the lever.



NO. 536,382.

536,547. System of Electrical Signaling for Railways. Charles Selden, Baltimore, Md. Application filed December 26, 1894.

In a system of electrical signaling for railways there are electro-magnets whose armatures are adapted to interlock and thereby control a signal circuit, another electro-magnet controlling the circuit of one of the interlocking magnets, means for retarding the back stroke of the armature, and track operating circuits for the magnets.

536,559. Relay. Cyprien R. J. Willot, Paris, France. Application filed November 24, 1893.

This device comprises two movable armatures fixed on the same axis, and an electro-magnetic system in a magnetic circuit closed by means of two breech pieces and a combined magnetic field with two magnets acting simultaneously upon the mass of the soft iron of the electro-magnet and upon the armatures.

REISSUE.

11,481. Closed Conduit Electric Railway. William Lawrence, New York, N. Y. Application filed March 26, 1894.

The first claim follows: In a system of electric distribution, a main conductor, a contact, a connection from the main conductor to the fixed part of said contact, a weighted lever carrying the movable part of the contact, a sectional working conductor, a rod connecting the moving conductor with the weighted lever, and a watertight casing inclosing the contacts and lever.

# Western Electrician.

EVERY SATURDAY.

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## Chicago City Railway Company Wrecks a Rival Company's Car.

The unusual spectacle of the employes of one street railway company deliberately tearing to pieces the car of a rival company, on the ground that the latter was trespassing on its property, was witnessed on Twenty-second street, Chicago, on April 4th. The two companies at war are the Chicago City Railway company, which operates the extensive network of cable, electric and horse car lines on the South Side, and the General Street Railway company—Congressman McGann's company—a young but enterprising corporation which has, at present, an exclusively electric system on the West Side. Mr. McGann and his associates are anxious to extend their lines and they have raised the novel point that they have the right to run their cars over the existing tracks of other companies on payment of a proper rental. In other words, they claim that there is no more exclusive proprietorship in the iron of the street car tracks than in the stone of the pavement adjoining the rails. In pursuance of this view the General company attempted to drive one of its cars over the bridge at Twenty-second street and thus on the South Side and on the tracks of the Chicago City company. The latter company considered this a trespass, and its men, under the personal direction of Superintendent Bowen, pulled the adventurous car from the tracks and demolished it. The story in detail is full of interest. The following account is taken from a daily newspaper:

When the electric train came up there was an open car attached to it. This was switched around to the front and a magnificent big span of bay horses was brought up and hitched to it. It was car No. 306, the first car ever owned by Mr. McGann and the one with which he inaugurated his roads. This was the car selected to make the perilous journey to Twenty-second street and Wabash avenue.

Over the bridge on the east side of the river the South Side company was laying its blockade and gathering its forces. A horse car stood on the tracks over which Mr. McGann's car was scheduled to run. There were no horses to it, but there was the biggest conductor ever seen on the South Side standing by the step.

"What is this car doing here?" was asked.

"What d'ye tink it's doin'?" the big man with a conductor's cap on replied.

On Grove street, just off Twenty-second street, there was a heavy truck wagon loaded with big iron castings that weighed about two tons each. A young man was loosening the tap on the right front wheel. Twenty-second street was filled between Grove and Canal streets with the South Side company's wrecking wagons. Each wagon carried an unusual number of able-bodied men. Superintendent Bowen with two big bodyguards was on the bridge. The sidewalks on both sides of the bridge approach were filled with people murmuring against the threatening preparations of the South Side company. Special officers in the employ of the South Side company were mingling in the crowds.

At nearly 10:30 a young man came running over the bridge waving his hand.

"They're coming," he yelled as he reached the corner of Grove street. The big truck with its abnormal load of castings was driven on the track. The young man who had loosened the tap ran up and unscrewed it and took it off. Two men with crowbars quickly pried the wheel off the axle and down came the ponderous weight on the tracks. The wreckers sprang to their wagons. The car that was destined to cause so much trouble reached the draw of the bridge. Superintendent Bowen stepped out in front of it.

"Stop!" he cried. "Don't drive on this track."

"Go on," said McGann, who was in the car.

CHICAGO CITY RAILWAY COMPANY WRECKS A RIVAL COMPANY'S CAR.—SNAP-SHOT VIEWS OF THE ENCOUNTER.

The driver slackened the lines and the car started slowly down the inclined approach, which is about 200 feet long. When about half way down Superintendent Bowen ran out in front of the horses. A dozen of his men sprang to his assistance and the car was stopped.

"Off the track with it!" cried Superintendent Bowen.

"Let go of those horses," said Superintendent Brennan of the McGann company.

"Get away," said Superintendent Bowen, giving him a contemptuous push.

"I'll teach you a little good behavior," said Superintendent Brennan, white with rage, as he reached for the other superintendent's collar.

Mr. McGann stepped in between them, telling his superintendent to offer no violence.

"We will leave that to them," he said.

A score of men at Bowen's orders sprang to his assistance. Crowds of people swarmed around. At the same moment wreck wagon No. 1 A came galloping into the crowd. Po-

liceman Martin Nolan, who is on duty at the bridge, sprang in front of the wreck wagon and stopped it. As he did so he was seized by the arm by one of Superintendent Bowen's men.

"I am a policeman, too," he cried, "and I will see that this wagon is not stopped."

Officer Nolan turned on the man, a stout fellow with a brown mustache and wearing glasses, who was tugging at his vest to display a badge.

Mr. McGann stepped in between them and told Officer Nolan to let them alone.

"But they must not obstruct the street," the officer protested.

"Use no violence on my account," said Mr. McGann. "If a public outrage is to be committed the perpetrators must answer at the proper tribunal."

"Come on," cried Bowen, and the wreck wagon drove up to the rear of the car. A big rope about 10 feet long with a hook on the end of it, the other end of which was fastened to the wagon, was attached to the drawhead of the car. A mighty pull at a tangent brought the rear end of the car around with a lurch. Mr. McGann's little conductor in his new uniform of black broadcloth went off the platform of the car with another lurch. The car was pulled from the track and off to the curb on the north side of the street. By this time three score of men were standing around it with axes, sledges and crowbars.

"Tip it over," yelled Bowen.

The men got on the north side of it and tipped it over. It fell on its side with a crash and jingling of glass. Officer Nolan had gone to send in a riot call to the Twenty-second street station.

When the car was down Superintendent Bowen cried:

"Knock h—l out of it."

Men sprang at it from all sides, smashing and hacking it. The wreck wagon that pulled it off the track was put to work tearing it to pieces. The hook was fastened in the overhanging end of the roof and the horses tore it off. Again and again the hook was fastened in the roof, which was torn off in pieces until it was all gone. The sides were then battered off and the floor broken in a hundred places. The wheels were broken off and the rods wrenched and twisted and broken.

Then the wreck wagon was hooked to the battered remains and they were pulled crossways on the approach, blockading the street. It was still a big piece of obstruction, which would permit no vehicle to pass. At this juncture a patrol wagon from the Twenty-second street station dashed up with six policemen and Detective Creed, who was in citizen's clothes. When Superintendent Bowen saw them coming he signaled his men to get away and started away himself. The men who had been smashing the car scattered. The wreck wagon that played such a prominent part was started away. Officer Nolan stopped the driver.

"You must not leave here until this street is cleared," he said.

Then he stopped Superintendent Bowen and led him back to where the debris lay.

"You must clean this away before you leave," he said.

"Well, if my men are under arrest they can't work," Bowen said.

Assistant Bridge Superintendent Hart said he would notify Superintendent O'Brien immediately that the South Side company had obstructed a bridge approach.

"You know very well," said officer Nolan, "that you and your men are not under arrest, and I tell you again to clear this street, and to do it in a hurry."

Superintendent Bowen set his men to work getting the wreck over against the north curb, where they left it.

In an interview, Superintendent M. K. Bowen—who is one of the best known street railway men in the country, by the way—gave the following explanation of his conduct:

I learned through the newspapers a few days ago that an attempt was to be made to run a car over our tracks. I made up my mind that it should not be done. I know nothing of legal technicalities. I had no opinion from a lawyer. I simply knew that what I considered an act of trespass was to be committed, and I acted within what I thought, and still think, were my rights. I ordered the men whom I needed to come along; in number they were 400 or 500. The horses drew the car over the bridge, and as soon as their feet were planted on our track I went to their heads, held up my hand and ordered the driver to stop. He stopped, and the superintendent of the road came up to me and asked me if I had an injunction. I said "No." Then he turned to the man on the platform and said "Drive on." The car struck our tracks and started down the incline. I turned to my men and ordered them to hitch the wrecking wagons to the car. This was done, the car was pulled from the tracks, turned over and broken up.

The officials of Mr. McGann's company think that their position is greatly strengthened by the display of force and violence made by the Chicago City company. They will pursue the matter vigorously in the courts. They claim, also, that while their car was on tracks laid by the older company, they had a right to operate cars as far east as Grove street by the terms of their city ordinance, and that the Chicago City company will have to settle with the city, as the car was demolished west of Grove street. The point raised by the General company is of the greatest importance to all street railway companies, and the further progress of the case will be watched with much interest.

The interesting group of pictures presented on the preceding page is a reproduction of a series of snap-shot photographs made by Mrs. C. L. Bonney during the exciting scenes at the demolition of the car. Mrs. Bonney's husband is actively interested in the McGann company, and when the attempt was made to drive the car over the tracks of the South Side company she was on the spot with a hand camera and coolly made several exposures of the stirring picture presented. The conditions were hardly favorable to the production of ideal negatives, but the pictures nevertheless graphically portray the very effective work accomplished in wrecking the car. Mrs. Bonney is entitled to credit for the pluck and thoughtfulness which resulted in a pictorial record of this interesting event.

At the last account the ruin of the car was still lying on Twenty-second street. Neither company will have anything to do with it.

## English Motor-alternator.

In designing the internal arrangements of the new electrical engineering laboratories at University College, London, Dr. Fleming wished to make provision in the dynamo room for generating alternating currents for experimental purposes by some means which should provide in the most simple manner possible for producing alternating currents of various frequencies, and also for generating two-phase currents from the same plant. With this object he designed the machine shown in Fig. 1, and Mr. Kapp worked out the full details and calculations. The arrangement consists of four separate machines bolted on the same bed-plate, two Kapp alternators and two continuous current motors. Each alternator is coupled directly to its own motor, the commutators of the continuous current machines being on the outside end of the shaft. The shaft is cut in the middle and the inside ends carry a flange pulley. These pulleys can be coupled together through the flange by bolts so as to drive the whole as one machine, or they can be separated for use as two machines. By coupling them together with the armatures in the proper relative position, two-phase currents can be got out of the united machine.

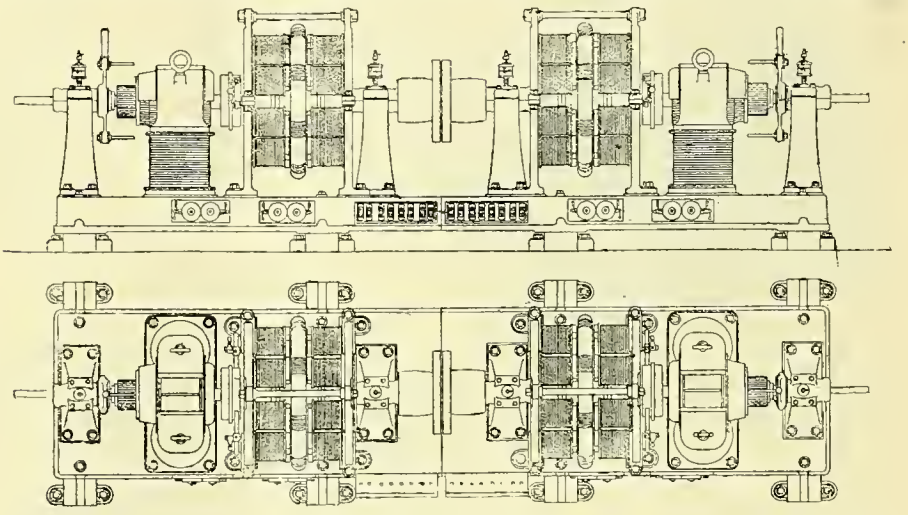

FIG. 1. ENGLISH MOTOR—ALTERNATOR.

Each of the continuous current motors is of 5 horse power, designed to work at 100 volts. The armature is ring-wound, and there are 216 turns of wire on it, connected to a 72 part commutator. The magnets of the motors are of cast-steel 6⅜ inches in diameter. Each armature can carry 35 or 40 amperes.

The alternator armatures contain an iron core, and are each wound over with eight coils having 16 turns of wire. The field magnets have eight poles, and corresponding poles are opposite one another. The alternators when driven at a speed of 1,250 revolutions give an electromotive force of 100 volts.

The four machines are carried on a cast-iron bed-plate nine feet long and two feet wide, which is carried on slide rails in the usual manner. The ends of all the armature and field magnet circuits are brought to terminals fixed in a box on the front of the machine. In the field magnet circuit of each machine is an appropriate resistance and in the armature circuits of the motors there are also resistances for starting the motors. Since the machine was delivered at the University College two very useful additions have been made to it by students working in the laboratory. One of these is a curve tracer for tracing the form of alternating current curves which is fixed to one outside end of the right-hand machine, and the other a hydraulic speed indicator which is fixed to the outside end of the shaft of the left-hand machine. A small centrifugal pump is driven by the shaft, and it pumps colored water from a small reservoir placed over the pump through a pipe into two vertical glass tube pressure gauges, one of which is placed on the wall of the dynamo room, and the other of which is placed on the wall of the electrical laboratory thirty feet away. When the motor-alternator is running, the centrifugal pump forces the water up these tubes until the hydrostatic pressure of the column of liquid supported in the tube balances the pressure due to the pump. The height of the column of liquid, therefore, can be made a measure of the speed of the machine, and these gauges have been carefully calibrated. The hydraulic speed indicator is exceedingly responsive to changes in speed, while the accuracy of the indication is independent of the density of the liquid used. The speed of the motor can, therefore, be regulated from the laboratory and kept constant.

It will be seen that such a double motor-alternator plant can be put to a great many uses. The alternators can be driven separately or together. The electromotive forces and currents of the alternators can be added together as required, or a two-phase alternating current can be obtained from the machines.

As usually used, the motors are driven off the St. Pancras electric lighting circuits, the speed being regulated by field resistances and the electromotive force of the alternator regulated by resistances in the alternator field magnet circuits. The machine is exceedingly useful in investigations on alternating currents. It will be seen that the construction lends itself to many forms of experimental testing useful in a teaching laboratory. Fig. 2 gives a general view of the plant and of part of the dynamo room in which it stands. The cuts are reproduced from the London *Electrician*.

## Strong Competition for the Bell Company Promised.

The most interesting development in electrical circles last week was the semi-official announcement of the formation of a powerful combination to enter the telephone field and engage in active competition with the American Bell Telephone company in every part of this country, Mexico and Canada. The plan of organization proposed is similar in many respects to that of the Bell interests. The parent company will be known as the Standard Telephone company, with headquarters at New York. It is capitalized at $10,000,000 and its board of directors is composed of influential capitalists in every part of the country. The promoters of the enterprise have succeeded in interesting not only capitalists but also public men of eminent standing, whose names will be recognized throughout the country, and will, it is thought, add considerable strength to the organization in securing franchises and preventing the enactment of hostile legislation. It is believed, too, that this combination of capitalists and influential public men in this enterprise will invite confidence in the project and serve to assure the public that it is neither a stock-selling nor sand-bagging scheme. Among those mentioned as being identified with the company are the following named gentlemen: Thurlow Weed Barnes, president of the company, a capitalist; John A. Brill, president of the J. G. Brill company, car builders, Philadelphia; Carl F. Baker of the hardware, steel and iron house of H. Baker & Co., New York; John W. Candler, ex-congressman, railroad president and merchant, Boston; George Crocker, San Francisco; Senator John P. Jones of Nevada; Henry Merz, president of the Heller-Merz company, manufacturers of colors, New York; Allen T. Nye, the promoter of the company; Manning C. Palmer, president of the Syracuse National Bank and Electric Light company, Syracuse, N. Y.; Felix Rakeman of Bulch & Rakeman, Boston; John E. Searles, secretary and treasurer of the American Sugar Refining company, New York; Charles T. Strauss of Charles T. Strauss & Brother, importers of lace, New York and St. Gall, Switzerland, and Louis Windmueller, of Windmueller & Roelker, New York.

No less eminent are the names mentioned in connection with the companies formed to operate in the several territories into which the country has been divided. The promo-

ters of the enterprise have been careful not to admit anyone interested in the old company. The work of organization has been going on for two years, and the degree of success that has marked the promoters' efforts is shown by the following list of companies already organized to operate as licensees of the parent company:

New York Standard Telephone company; capital, $6,000,000; to operate in the state of New York; John E. Searles, New York; Winthrop Murray Tuttle, New York; Charles T. Armstrong, New York; Lowell M. Palmer, Brooklyn; William Dick, Brooklyn; John Dunn, Jr., Syracuse; Alva W. Palmer, Syracuse; Gustavus E. Strauss, New York; George Hutchins, New York; Anthony N. Brady, Albany, N. Y.; Henry Siebert, New York; Gustavus E. Jahn, New York; Henry D. McCord, New York.

Eastern Standard Telephone company, Boston; capital, $6,000,000; to operate throughout New England; John W. Candler, Boston, Mass.; William Green Roelker, Providence, R. I.; George P. Wescott, Portland, Me.; George W. Hunt, Portland, Me.; J. M. W. Hall, Cambridge, Mass.; Franklin Fairbanks, St. Johnsburg, Vt.; H. E. Wellman, Providence, R. I.; R. R. Armstrong, New Haven, Conn.; J. A. Stursburg, Boston; F. C. Hewitt, New York; Stillman F. Kelly, Boston; Joseph B. Bartram, New Haven, Conn.; Thurlow Weed Barnes, New York.

New Jersey Standard Telephone company, Jersey City; capital, $3,000,000; to operate in New Jersey and Delaware; Nathan Tooker, Orange; F. D. Mollinhauer, New York; August Lueder, New York; Elisha B. Gaddis, Newark; Frank A. Magowan, Trenton, N. J.; James A. Silvey, New York; Samuel Klotz, Newark; A. Q. Garrettson, Jersey City; Howard S. Titus, Trenton, N. J.; George Pfeiffer, Jr., Camden.

Pennsylvania Standard Telephone company, Philadelphia; capital, $5,000,000; to operate in Pennsylvania; Richard W. Clay, Philadelphia; William P. Armstrong, New York; R. Dale Benson, Philadelphia; Henry A. Berwind, Philadelphia; John Storey Jenks, Philadelphia; Nicholas Lennig, Philadelphia; Craige Lippincott, Philadelphia; R. Sellers McKee, Pittsburg; George Moore, Braddock, Pa; Henry P. Nesmith, Jr., New York; Charles Platt, Philadelphia; Winthrop Smith, Philadelphia; Francis Ralston Welsh, Philadelphia; C. W. Bergner, Philadelphia.

Columbian Standard Telephone company, Washington, D. C., Baltimore and Richmond; capital, $4,000,000; to operate in Maryland, District of Columbia, Virginia and West Virginia; Lemon G. Hine, Washington, D. C.; Judge Poindexter, Washington, D. C.; Dr. W. W. Fierce, Washington, D. C.; Theodore J. Meyer, Washington, D. C.; Frank Hume, Washington, D. C.; W. O. Denison, Washington, D. C.; Christian Henrich, Washington, D. C.; John A. Hamilton, Washington, D. C.; Nicholas H. Shea, Washington, D. C.; Edward Graves, Washington, D. C.; E. S. Johnson, Washington, D. C.; J. W. Woodlands, Baltimore, Md.; General Felix Agnus, Baltimore, Md.

Ohio & Indiana Standard Telephone company, Cleveland, Cincinnati and Indianapolis; to operate in Ohio and Indiana; Colonel A. L. Conger, Akron, O; Alexander Montgomery, Cincinnati; James McConville, Cincinnati; John G. Bauer, Lawrenceburg, Ind.; J. M. Kirtley, Cincinnati; W. E. Brackman, Cincinnati; Frank M. Morton, Cincinnati; A. Acton Hall, Cincinnati; Gottlieb Hartweg, Cincinnati; W. H. O'Brien, Lawrenceburg, Ind.; Jared Dunbar, Steubenville, O.; Henry Maley, Cincinnati; Nicholas Koss, Cincinnati; E. H. Bourne, Cleveland.

Michigan Standard Telephone company, Detroit; capital, $4,000,000; to operate in Michigan; O. W. Shipman, W. C. Coleburn, J. D. Standish, W. E. Quinby, George H. Scripps, F. G. Smith, E. W. Meddaugh, C. J. Whitney, F. G. Smith, Jr., W. R. Cole, George W. Moore, Detroit, Mich.; J. H. McFarland, Flint, Mich.; Thurlow Weed Barnes, New York.

Northern Standard Telephone company, St. Paul, Minneapolis and Pierre; capital, $4,000,000; to operate in in Minnesota, North and South Dakota; John De Laittre, Minneapolis, Minn.; Charles A. Pillsbury, Minneapolis, Minn.; F. A. Chamberlain, Minneapolis, Minn.; William B. Dean, St. Paul, Minn.; A. H. Linton, Minneapolis, Minn.; J. F. R. Foss, Minneapolis, Minn.; T. B. Janney, Minneapolis, Minn.; R. R. Rand, Minneapolis, Minn.; Thomas B. Scott, St. Paul, Minn.; Cavour S. Langdon, Minneapolis, Minn.; Maurice Auerbach, St. Paul, Minn.; William Hamm, St. Paul, Minn.; Charles J. Tryon, Minneapolis, Minn.; E. W. Winter, St. Paul, Minn.; Dr. Charles A. Wheaton, St. Paul, Minn.

In several districts the organization of local companies has not yet been completed, although the promoters of the enterprise assert that the preliminary arrangements have been perfected and assurances have been received of the support and financial backing of the men that they desire to become interested in the project. The most important of these is the Northwestern Standard Telephone company, Chicago, Davenport and Milwaukee—capital, $6,000,000—to operate in Illinois, Iowa and Wisconsin. Several meetings of business men have been held in Chicago to consider the plans of the proposed company, and these meetings have been attended by capitalists from other points in the territory allotted to the Northwestern company. Among those who have been invited to serve as directors of this company are the following: J. S. Clarkson, N. B. Holbrook and G. H. Higbee of Iowa; N. S. Murphy, H. D. Smith, G. G. Pabst and E. H. Bottum of Wisconsin, and John S. Runnels, W. J. Campbell, R. W. Hunt, W. P. Ketcham, T. A. Griffin, L. H. Hole, A. M. Day, Montgomery Ward and John S. Hannah of Chicago, and W. W. Tracy of Springfield, Ill.

The Central Standard Telephone company, St. Louis, Kansas City and Lincoln—capital, $5,000,000—to operate in Missouri, Kansas, Nebraska and Arkansas, is in process of organization, the promoter being Griffith Colt, president of the Union Trust company, St. Louis.

The organization of the Mountain Standard Telephone company, Denver, Albuquerque and Salt Lake City—capital, $4,000,000—to operate in Colorado, New Mexico, Utah and Arizona, is in the hands of George Q. Cannon, the head of the Mormon church.

The local operating companies whose organization is not yet completed are the following:

Southern Standard Telephone company, Nashville Louisville and Charleston; capital, $4,000,000; to operate in Tennessee, Kentucky, North and South Carolina.

Gulf States Standard Telephone company, New Orleans, Atlanta and St. Augustine; capital, $5,000,000; to operate in Georgia Florida, Alabama, Louisiana and Mississippi.

Texas Standard Telephone company, Austin, Galveston and Guthrie; capital, $4,000,000; to operate in Texas, Indian Territory and Oklahoma.

Pacific Standard Telephone company, Portland, Tacoma and Helena; capital, $5,000,000; to operate in Washington, Oregon, Montana, Idaho, Wyoming and Alaska.

California Standard Telephone company, San Francisco; capital, $4,000,000; to operate in California and Nevada.

Intercolonial Standard Telephone company, Quebec, St. Johns and Halifax; capital, $2,000,000; to operate in all British territory east of the province of Ontario.

Canadian Standard Telephone company, Montreal and Ottawa; capital, $2,000,000; to operate in the provinces of Ontario and Quebec.

British Columbian Standard Telephone company, Winnipeg, Vancouver and Victoria; capital, $2,000,000; to operate in the British provinces west of Ontario.

Mexican Standard Telephone company, City of Mexico; capital, $2,000,000; to operate in the Republic of Mexico.

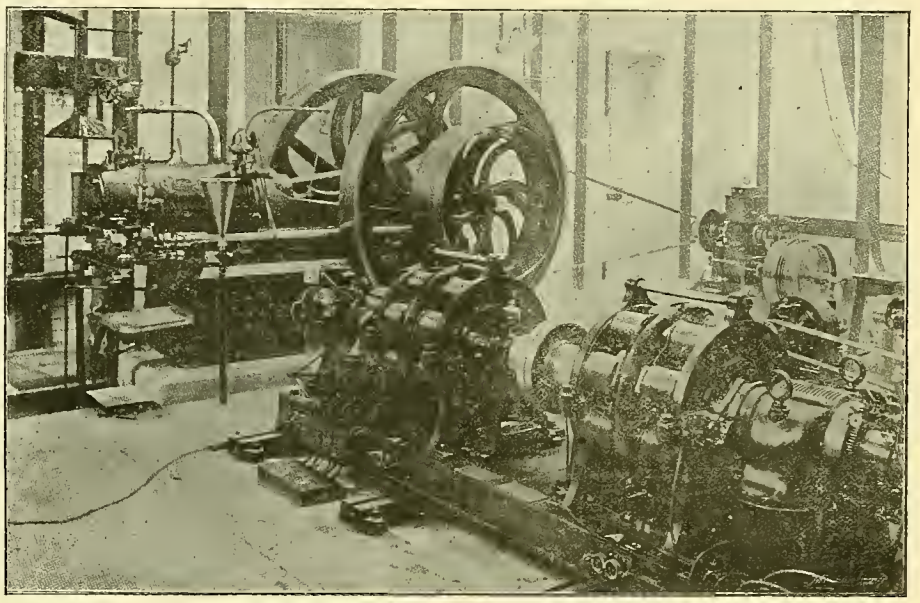

FIG. 2. AN ENGLISH MOTOR-ALTERNATOR.

The parent company announces that it has been engaged two years in developing its plans and that it has acquired patents covering a complete system for exchange service. It has enlisted the services of competent engineers and experts and has gathered sufficient data to warrant the announcement that it can furnish first-class service at less than half the rate now charged by the Bell interests and return a fair profit to its stockholders. The men who have signified their intention of engaging in this enterprise say that they consider it an excellent investment. It is probable that an effort will be made to effect a combination with the Western Union or Postal Telegraph, and if this is accomplished it will, no doubt, greatly strengthen the new company. As yet nothing has been done in the way of securing franchises in the large cities, but with the influence of the individual members interested it is not expected that any difficulty will be experienced. The popular interest already manifested in the project indicates that considerable assistance will be offered the proposed scheme.

The *Chicago Record* of Monday printed the following special dispatch from New York:

Men who are familiar with the methods of the Standard Oil people say that none of them are financially interested in the much-talked-of Standard telephone company. The widely published announcement that the Standard Oil clique was back of the telephone company of which Thurlow Weed Barnes is the president, has some foundation in fact, for certain of the Standard Oil officials are interested to the extent of several hundreds of thousands of dollars in a magneto telephone, and within ten days they will have control of the patents, good will, factory and all. This telephone is described as a successful long-distance instrument, novel in construction, cheap to manufacture and up to all requirements.

This is the report made to the ten men who gathered in a Wall street office yesterday. This telephone is the invention of an electrician who is classed with Edison, Tesla, Gray and Bell. It is no experimental device, but has been on the market for several months, and is made in a modern, well equipped factory in Michigan. It is the purpose of the Western Union and Standard Oil people to place this telephone in country exchanges, leaving the large cities to the Bell company. The full development of their plans, however, will see a complete system of copper wires reaching all parts of the United States for the long-distance telephone system which is to compete with the Bell.

## Unlimited Capital and Boundless Energy Required.

[From the *Rochester Herald.*]

The general public will be deeply interested in the report, seemingly well substantiated, that "the finest combination of capital and political influence ever gotten together has been organized to enter the telephone field and rout the Bell monopoly by giving cheaper and, as it is claimed, better telephones." If the details as printed in a Chicago paper be correct, the opposition company will, indeed, be no wild-cat concern. Among the interests back of it are said to be the Standard Oil company, the Pullman company and the Crocker interests of California. The board of directors of the new company, the stock of which is capitalized at $10,000,000, includes several men of national reputation, capitalists and politicians. The announcement that will chiefly interest the public, however, is that the company proposes to put in telephones all over the country at a uniform price of $25 a year. What this would mean to the users of telephones can be better comprehended when it is stated that the annual cost of this convenience now varies from $40 a year in the smaller cities of the country to $100 in cities like St. Louis and Cincinnati, $125 in Chicago and from $175 to $240 in New York city. Efforts to enact legislation reducing the charges of the Bell telephone company have almost invariably failed.

When several of the most important of the Bell patents expired, competition was expected to spring up at once; but the magnitude of the undertaking has heretofore discouraged even the boldest of investors. The establishment and ownership of a magnificent plant gave a tremendous advantage to the Bell people, and this seemed to make their position secure. It will require practically unlimited capital and boundless energy to fight them even now. If the new company means business, it will be able to render the public an incalculable service; but we must not place too much faith in its plans until it has demonstrated beyond doubt that it does not intend to be bought off or to work for ultimate consolidation.

## Immense Advantages Enjoyed by the Bell Company.

[From the *Boston Herald.*]

The *New York Times* thinks it foresees in the expiration of the fundamental Bell patents, the decision of the Circuit Court in the Berliner case, and the more recent decision of the Supreme Court in the Bate case, the overthrow of monopoly in the telephone business of this country. And yet it is a fact that the output of telephones by the Bell company for the last month was almost unprecedentedly large, and the price of Bell stock is now quoted at a higher price than before any of these decisions were rendered. In anticipating the future of the telephone business the immense advantage enjoyed by a company already occupying the field will have to be taken into account and reckoned with.

## Competition Desirable but Difficult.

[From the *Rochester Post-Express.*]

There is much talk just now about competition in telephone service. A new company, we are told, has been organized with an enormous capital, and it proposes to supply the best of service at half the present rates, or less. We hope it may. The present rates are high and the service might be better, and all those who have been the patrons of the old company for years, and conscious all the time that an unjust tribute was being levied upon their revenues, will welcome a new company. But there are great difficulties

in the way of establishing competing lines. Where the lines of the old company are underground the new company may be forced to build conduits of its own; where the wires are strung overhead the new company may find that these furnish all in the way of danger and unsightliness that the community will tolerate, and even where new lines may be established the old company may retain its subscribers by liberal reductions in rates. We shall believe in competition when we see it.

## Telephone War in Kingston.

Telephone users in Kingston are now reaping a benefit, owing to the controversy between the Hudson River Telephone company and the West Shore Telephone company. The latter is a new corporation which started out to get away the business of the former by giving the use of telephones to customers for $30 a year, while its older rival charged $5 a month. Now the Hudson River Telephone company has cut the rate to $25 a year, and says that the new rates will not be changed after the cut-rate war is over. It is said that the West Shore Telephone company will go its rival one better and cut the rate lower, while the users smile and hope the war will continue until a premium is paid to everyone who will allow a telephone to be kept in his place of business. All the villages in the vicinity will share the benefit, as will the cities in the Hudson valley where the Hudson River Telephone company has exchanges.

## Telephone Case Dismissed.

Judge Lacombe, in the United States Circuit Court, New York, last week, in the action of the American Bell Telephone company and others against Thomas Godwin, Edward Byrnes and Patrick Prendergrast for an accounting before a master to compute damages and costs, granted an order, on motion of the complainants, terminating all proceedings and releasing the defendants from all claims of the complainants for damages and profits on account of an alleged infringement of complainants' patents.

## Cheap Telephones in Canada.

A correspondent of the *New York Herald*, writing from Sherbrooke, Que., asks: "Why do you pay so much more for telephones in the United States than we do in Canada?" and he adds that "in some places where there is competition $15 pays for one in office and one in residence." He says, moreover, that "$25 per annum secures good service in most Canadian exchanges."

## Street Railway Situation in Washington.

It is alleged that the Columbia Street Railway company of Washington, D. C., is opposing the Suburban company (which proposes to make use of an underground trolley system for a portion of its route) with the idea of erecting an extensive overhead trolley system. A gentleman who has opportunity to obtain inside facts makes the following statement:

The great trolley syndicate of Philadelphia have recently acquired one-third of the total number of miles of street railways in the District of Columbia, and is now asking for further extensions, and it has been a matter of surprise to see with what facility the syndicate gets bills reported allowing them to cover the streets of the city of Washington with the extension of horse car lines, when other roads are compelled at great expense to change their motive power. It is the evident purpose of this syndicate to keep other roads from being built, while they acquire the control of the streets of this city with the extension of their horse car lines. And with the ultimate intention, no doubt, of * * * forcing the trolley system upon the city. * * *

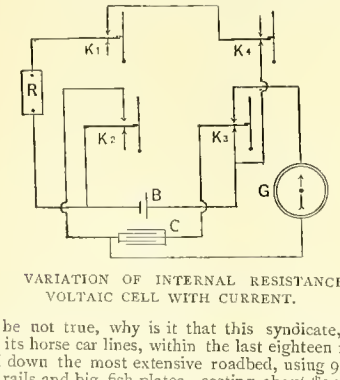


FIG. 1. VARIATION OF INTERNAL RESISTANCE OF A VOLTAIC CELL WITH CURRENT.

If this be not true, why is it that this syndicate, in extending its horse car lines, within the last eighteen months, has laid down the most extensive roadbed, using 93-pound bonded rails and big fish-plates, costing about $25,000 per mile, and known to contractors as a trolley roadbed? I doubt if there is a street car line in America, except a trolley line, that uses such a heavy rail. The average horse car line rail is only 45 pounds to the yard. Rails used for cable roads are only 65 pounds to the yard. The Eckington road, which is on C street, and which belongs to the Philadelphia syndicate, used 93-pound rails for its horse car extension, and constructed a stable for its horses which cost $40,000, which has a big chimney, is without stalls, and is evidently intended for a trolley power house.

## Variation of Internal Resistance of a Voltaic Cell with Current.[1]

By Henry S. Carhart.

It has long been known that the internal resistance of a voltaic cell, when at a constant temperature, has not a fixed and finite value, but that it is a function of the current flowing through it. The methods commonly employed to measure this resistance are not sufficiently exact to exhibit the relationship in question with satisfactory accuracy. But if the condenser method be employed,[2] together with certain auxiliary appliances to secure very brief and uniform closing of the circuit through different external resistances, while the potential difference between the battery terminals is measured within this short interval, then results can be obtained which plot as a smooth curve.

The resistance measured is a quantity satisfying the equation

$$r = R\frac{E-E'}{E'}, \text{ or } \frac{E}{R+r} = \frac{E'}{R} = I,$$

where $r$ is the internal resistance, $E$ the electromotive force of the cell and $E'$ the potential difference between the terminals when closed through an external resistance $R$. To determine the relation between $r$ and $I$, the potential difference $E'$ must be measured with different external resistances in succession. For this purpose, the operations of closing the circuit, charging the condenser, discharging through a ballistic galvanometer, and finally opening the circuit, must be done by some mechanical device, by which all of them can be repeated in precisely the same interval of time. The disturbing influences due to absorption of the condenser and polarization of the cell are then as nearly eliminated as possible.

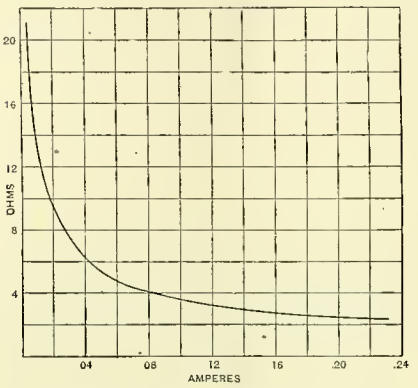


FIG. 2. VARIATION OF INTERNAL RESISTANCE OF A VOLTAIC CELL WITH CURRENT.

For this reason I have made use of a pendulum consisting of a long narrow frame pivoted at the top, and carrying a heavy bob at the bottom. The bob swings between two curved rails, concentric with the axis of suspension of the pendulum, and each rail supports two keys, which can be clamped on it in any desired position. A vertical lever on each key holds it closed on the lower contact, but when the pendulum sweeps over the rails it throws these levers over and allows the spring keys to make contact on the upper point. The contacts are all platinum, and the base and pillars of the keys are hard rubber. When care is taken to adjust the contacts properly and to keep them free from dust their performance is in every way satisfactory.

Fig. 1 shows the connections for the measurements in hand. Keys $K_1$ and $K_4$ are one rail, while $K_2$ and $K_3$ are on the other. When the lever of $K_1$ is thrown forward while that of $K_4$ is up, the battery circuit is closed through the resistance $R$. When the lever of $K_3$ is thrown over while that of $K_3$ is up, the battery is charging the condenser $C$, but as soon as the lever $K_3$ is thrown over the cell is disconnected from the condenser, and the latter is instantly discharged through the galvanometer $G$. The pendulum swings from left to right on removing a detent. If all the levers are up it closes the battery circuit on reaching $K_1$, charges the condenser by throwing over lever $K_2$, discharges it through the galvanometer by means of $K_3$ and finally opens the battery circuit on passing $K_4$. The key levers remain forward out of the way of the pendulum bar as it swings back again to the detent. The keys can be set as close together as desired. The length of the pendulum is such that its period is a second. Hence the time during which the battery circuit remains closed can be calculated. To get the deflection proportional to the total electromotive of the cell, the levers of $K_1$ and $K_4$ are both left down. The pendulum then charges and discharges the condenser, the circuit through $R$ remaining open.

The change of resistance with the current is exhibited in a marked degree by "dry cells." The table contains the data of a series of measurements on a Gassner cell, whose electromotive force was 1.213 volts. The first column contains the deflections due to charging the condenser with the whole electromotive force of the cell, and it will be seen that the polarization was inappreciable. The second column contains the deflections due to charging the condenser with the potential difference at the extremities of the cell when closed through the resistances in the third column. The fourth column contains the resulting internal resistances, and the last column the currents.

| $d_1$ | $d_2$ | $R$ | $r$ | $I$ |
|---|---|---|---|---|
| 271 | 258 | 400 | 21.1 | 0.0028 |
| | 249 | 200 | 17.7 | 0.0056 |
| | 238 | 100 | 13.9 | 0.0106 |
| | 227 | 50 | 9.7 | 0.1203 |
| 271 | 223 | 40 | 8.6 | 0.0249 |
| | 218 | 30 | 7.3 | 0.0324 |
| | 212 | 20 | 5.56 | 0.0473 |
| | 204 | 15 | 4.93 | 0.0607 |
| | 194 | 10 | 3.96 | 0.0868 |
| 271 | 172 | 5 | 2.87 | 0.1538 |
| | 164 | 4 | 2.59 | 0.1838 |
| 270 | 153 | 3 | 2.29 | 0.2289 |

In Fig. 2 these internal resistances and the corresponding currents are plotted as co-ordinates. It cannot be objected that the relatively low resistances with the larger currents are due to polarization; for, while it was demonstrated that polarization did occur within the small time interval required for the pendulum to swing from $K_1$ to $K_4$, yet the effect of such polarization is to diminish the potential difference between the terminals of the cell when on closed circuit, and this effect increases the computed internal resistance.

The Gessner cell was an old one, and its internal resistance was above the average, but other dry cells show the same characteristic curve, differing only in the relative values of $r$.

A Daniell cell shows a similar decrease in $r$, with increase in current, but the decrease is much smaller, and the curve is more nearly a straight line.

1. From the *Physical Review* for March.
2. Carhart's "Primary Batteries," p. 116.

## An Apparatus for Measuring Difference of Phase Between Alternating Currents.[1]

By Louis Derr, M. A., S. B.

Most of the methods hitherto employed for the measurement of difference of phase between alternating currents (*vide La Lumière Electrique*, March 10 and 17, 1894) assume that the currents measured are truly sinusoidal in character, or demand exceptional conditions of steadiness. The method here described is applicable to the measurement of periodic currents of any form whatever, and can be used under ordinary conditions.

The apparatus is a modification of that employed by Dr. J. Puluj for a similar purpose, and described at length in the *Elektrotechnische Zeitschrift* for December 1, 1893. Dr. Puluj's apparatus consists in brief of a pair of electromagnets, each carrying a flat steel spring at the free end of its core, a small mirror being mounted on the spring. A beam of light is reflected from one mirror upon the other, and thence to a screen. If alternating currents are sent through the magnet coils, the springs will be set vibrating, and the spot of light on the screen will be lengthened into a line if the springs are parallel; and if the springs be turned so that the vibrations are perpendicalar to each other, the line becomes an ellipse whose dimensions afford a measure of the difference of phase between the currents in the coils.

It is evident that to maintain an ellipse sufficiently stable to permit measurements of precision requires great steadiness in the currents, a condition not always obtainable. The springs give best results when their period of free vibration is that of the current or its octave, and slight changes of the current period will throw them out of tune, instantly affecting the amplitude of vibration, as the inertia of the moving parts is very small. Belt slip at the generator, irregular load or changes of steam pressure, make precise measurements very difficult.

To obtain results without the steadiness demanded by this method, the following modification was devised by the writer and successfully used by L. R. Nash and J. C. Nowell, of the class of 1894 (Massachusetts Institute of Technology), in their thesis. The two electro-magnets were placed side by side, and the beams reflected from their mirrors received upon a prismatic mirror and thence sent to the screen. This is shown in plan in Fig. 1. In this case the spots of light which appear on the screen when the mirrors are at rest are elongated into two vertical lines when currents are sent through the magnets, and these lines are drawn out into curves which flash across the screen when the prismatic mirror is rotated. As the motion of the springs is harmonic, these curves are sine curves, and thus bear no necessary resemblance to the original wave form. Figs. 2 and 3 show some of these curves, whose wave length is, however, much less than that employed in measurements.

The theory of measurements is as follows: If the spots of light on the screen are in the same vertical line when the prismatic mirror is at rest, the curves produced by revolving it will have the same time origin, and will be parallel if they are in the same phase. Any time lag of one behind the other will be shown by a lateral shifting of the lagging curve ahead of the other, and if a variable inductance is inserted in the circuit of $B$, the $B$ curve will be seen to move farther and farther ahead of the $A$ curve as the inductance is increased. The difference of phase is thus evident to the eye, and to obtain a direct measure of it requires only a knowledge of the angle through which one curve must be shifted to bring it into parallelism with the other. This is readily expressible in degrees by finding the angle through which $B$ must be turned to bring $E$ and $F$, Fig. 4, into the same vertical, and then finding the angle through which $B$ must be further turned to bring $G$ and $E$ into the same vertical, the first adjustment giving the portion of a wave length by which

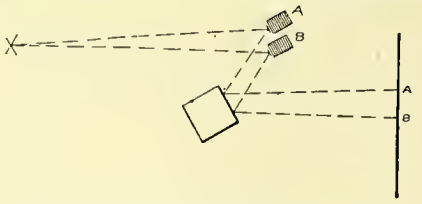


FIG. 1. AN APPARATUS FOR MEASURING DIFFERENCE OF PHASE BETWEEN ALTERNATING CURRENTS.

1. From the *Technology Quarterly*.

the two curves are separated, and the second the value of the whole wave length. Calling these quantities $c$ and $d$, respectively, the phase difference of the curves on the screen is, in degrees, $360° \frac{c}{d}$.

One consideration is to be noted here, that as the vibrating springs execute a complete vibration for every reversal of the current, their vibration frequency is just twice that of the current, and hence the phase difference of the curves on the screen is twice that of the currents measured. The desired value is thus $180° \frac{c}{d}$.

As $c$ and $d$ are too small to be directly measured with precision, a multiplying device is necessary. Mirror $B$ is turned by a gear wheel meshing with a small pinion which carries a long pointer moving over a divided scale. With this device a wave length on the screen is covered by a displacement of 13 centimeters of the end of the pointer.

The procedure is as follows: With the prismatic mirror

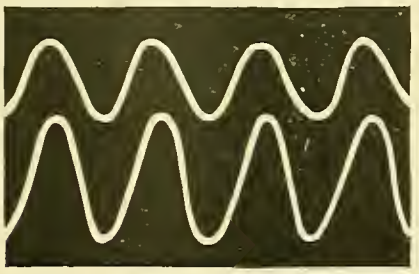

FIG. 2. AN APPARATUS FOR MEASURING DIFFERENCE OF PHASE BETWEEN ALTERNATING CURRENTS.

at rest, send the currents to be studied through $A$ and $B$ respectively. Turn $B$ until the lines on the screen are in the same vertical, and take the pointer reading $m$. Start the revolving mirror, and when the curves are sufficiently elongated to permit convenient comparison turn the pointer until the curves are parallel, and take the reading $n$ of the pointer. Turn the pointer still further until the $B$ curve has moved through an entire wave length and is again parallel to the $A$ curve, and record the new reading $p$ of the pointer. Then the phase difference in degrees between the currents is

$$180 \frac{m - n}{n - p}.$$

The results of these measurements plainly depend on the accuracy of bringing the curves into parallelism. The adjustment can be satisfactorily made by moving $A$ vertically until the curves are brought close together. As used in the following transformer measurements the mirrors were of silvered glass and the outlines of the curves consequently indistinct from multiple reflection. This makes the adjustment less precise than might be expected if metallic mirrors were used and partially accounts for the relatively large deviations attached to the results below.

| Small Experimental Transformers. | Lag in Degrees. | Average Deviation. |
|---|---|---|
| Transformer with four secondaries, idle circuits open | 173.75 | ±0.38 |
| Transformer with four secondaries, idle circuits closed | 177 0 | ..... |
| Ring transformer, overwound with iron wire. | 172.29 | ±0.82 |
| Ring transformer, closed secondary | 176.50 | ±0.52 |
| Two telephone induction coils in series | 332 11 | ±0.84 |
| Giving for each coil. | 166.06 | ±0.42 |

The following measurement affords a comparison of calculated with known values. The apparatus was applied to the measurement of the lag between the branches of a three-phase circuit. Perfect symmetry in the dynamo windings would give 120° in each branch and in any case the sum of the three lags should be 360°. The values actually obtained are 119.22, 120.44 and 119.44. The sum of these is 359.00, the average deviation (0.92) in this case being not far from the real error.

Among the advantages of the method described above are: (*a*) Since the wave form does not enter the calculation any source of periodic current may be employed, whether sinusoidal or not; (*b*) slight changes in the electromotive force do not impair the measurements, for their effect is only to vary the amplitude of the curves, a quantity of small consequence; (*c*) constancy in the speed of the revolving mirror is unnecessary, since irregularity affects both curves alike and does not alter their parallelism; (*d*) the approximate value of the lag can be seen at once, as well as the quadrant in which it lies; (*e*) the curves need not fall successively in the same positions on the screen, as no measurements are made there, hence the speed of the revolving mirror need bear no definite ratio to that of the springs; (*f*) the apparatus is simple and easily constructed.

Fig. 3 shows the form of the curves produced when the free vibration of the springs is the octave of the current frequency. These curves were obtained from the three-phase circuit before mentioned.

## Arc Light Carbons.

The disintegration of arc light carbons and the wasteful combustion of these through the action of air currents has been made a study by Hardmuth & Co. of Vienna, says the *Electricien*, and as a result of their investigations they have suggested a protection of the positive carbon in the form of an insulating sleeve sufficiently large to permit the passage of the rod while the lower carbon point is surrounded by a ring having three claws which rest on the carbon and descend as the latter burns away. Experiments at the Musee Techologique de Vienne show that while no material loss of light results, there is an economy shown of 70 per cent. for the positive and 33 per cent. for the negative, where hard carbons were used, having diameters of 11 millimeters and 16 millimeters. The consumer will look upon these figures as much too high and wait further developments, probably.

## Proposed Board of Electrical Examiners for Chicago.

There is pending in the city council of Chicago an ordinance to create a Board of Electrical Examiners and to license and control electrical contractors, interior electrical wiremen and operators of electrical machinery. The ordinance now awaiting passage is a substitute for the one originally introduced and was prepared by the judiciary committee, of which Alderman Mann is chairman. It is now fairly satisfactory to the 1,400 or 1,500 wiremen of the city, who are anxious to elevate the standard of their calling, and will probably pass.

The ordinance provides that the Board of Electrical Examiners shall consist of three members at a salary of $500 each, to be appointed by the mayor on the recommendation of the city electrician. The term of office is two years, and provision is made for a secretary, to be similarly appointed, at a salary of $1,500. The entire expense of the board, however, must be met by the fees, as it is expressly declared that the city must not be charged with its maintenance. The board must meet monthly or oftener if necessary, and a monthly report must be made through the secretary. The provisions of the ordinance relating to examinations and licenses are as follows:

Any person, firm or corporation desiring to engage in the business of construction work for electric lighting, heat or power within the limits of the city of Chicago, or desiring to make contracts to install electrical machinery or electrical apparatus of any kind for the purposes aforesaid, shall, before entering upon such business, make application to said Board of Electrical Examiners, on proper forms to be provided by the board, for the license granting authority to engage in said business. Said application for license shall state whether the applicant desires to do business as an individual or as a member of a firm or corporation, together with his previous experience in work of this character; he shall also give such other information concerning his qualifications and

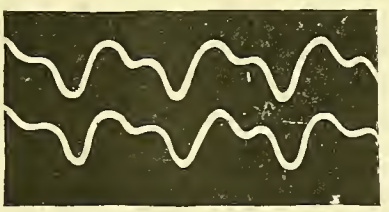

FIG. 3. AN APPARATUS FOR MEASURING DIFFERENCE OF PHASE BETWEEN ALTERNATING CURRENTS.

responsibility as may be required by said board, provided that whenever a firm or corporation desires said license, it shall be issued in the name of the firm or corporation after proper examination of one of the members of said firm or corporation, and where said member of a firm or corporation ceases his connection with the same, then and in that case the license so granted shall stand forfeited until some other member of the same firm or corporation appears and qualifies in like manner provided for in the original granting of said license.

Before the board shall have the power to examine any person for himself or as representing a firm or corporation, said application shall show an endorsement that the applicant has paid the sum of $10 to the city collector, which $10 shall be regarded as an examination fee, and shall be retained by the city whether the applicant pass his examination or not.

If said applicant shall pass said examination satisfactorily to the Board of Electrical Examiners, it shall then be their duty to make a requisition in proper form upon the superintendent of city telegraph for a license, which requisition must be signed by a majority of the members of the board. Before the superintendent of city telegraph shall have the power to grant a license, the applicant must present to said official with the requisition from the Board of Electrical Examiners a receipt from the city collector showing that said applicant has paid the sum of $50, which $50 shall be regarded as an annual license fee. When said applicant shall have complied with the requirements as herein provided, it shall be the duty of the said superintendent of city telegraph to issue to said applicant a license in proper form, which license shall be denominated "Electrical Contractors' License."

Each applicant shall also at the same time file with the superintendent of city telegraph a bond signed by two or more sureties, to be approved by said superintendent of city telegraph, in the sum of $1,000, conditioned that he or the firm or corporation for which he applies will indemnify and save harmless the city of Chicago, from all expense and damage caused by any negligence or defective work, or for inadequate work of any kind done under and by virtue of his license, together with all cost and expense which said city shall incur in making safe or secure any work of such licensee, or in curing any defect therein; and conditioned further, that said licensee as such will conform to all the conditions and requirements of the city of Chicago for government of said licensee, or in force governing electrical construction work of the character mentioned herein; and in the event that any work done by said licensee, or his firm or corporation, shall be deemed defective by the superintendent of city telegraph, and in the event that said licensee shall fail to revise such work to the satisfaction of said superintendent of city telegraph, within thirty days after notice so to do has been served upon him in writing, by said superintendent of city telegraph, then and in that case the superintendent of city telegraph shall revise, correct and make safe and secure such work, and charge the cost and expense thereof to such licensee.

Any person desiring to do electrical construction work, either original work, repairs, additions or alterations in any building containing electric light, heat or power conductors within the corporate limits of the city of Chicago, as an employe, shall make application therefor to said Board of Electrical Examiners.

Said application shall be made in writing in the proper form to be provided by the board, and shall state the qualifications of said applicant, together with his experience in such work, and shall supply such other information concerning his qualifications and responsibility to do electrical construction work as may be required by the Board of Electrical Examiners. Before the board shall have the power to examine such person, said application shall show an endorsement that the applicant has paid the sum of $5 to the city collector, which $5 shall be regarded as an examination fee, and shall be retained by the city, whether the applicant pass his examination or not. If said applicant shall pass said examination satisfactorily to the Board of Electrical Examiners, it shall be their duty to make a requisition in proper form upon the superintendent of city telegraph for a license, which requisition must be signed by a majority of the members of the board. Before the superintendent of city telegraph shall have the power to grant a license, the applicant must present to said official, with the requisition from the Board of Electrical Examiners, a receipt from the city collector, showing that said applicant has paid the sum of $5, which $5 shall be regarded as an annual license fee. When said applicant shall have complied with the requirements as herein provided, it shall be the duty of the superintendent of city telegraph to issue to said applicant a license in proper form, which license shall be denominated "License for an Interior Electrical Wireman."

It is herein provided that any person who shall have duly qualified and obtained a license as an interior wireman, and who shall be employed permanently in an operative isolated plant furnishing light, heat or power for one building or group of buildings under one ownership or management, shall be authorized by virtue of his license to make such additions or repairs as may be required by his employer in the building wherein he is permanently employed; provided, that he shall make written application to the superintendent of city telegraph, stating the nature of the required additions or repairs, and receive from said superintendent of city telegraph a written permit to do said work.

Any person desiring to operate an electric light, heat or power plant of whatever character within the corporate limits of the city of Chicago shall make application therefor to said Board of Electrical Examiners. Said application shall be made in writing in proper form to be supplied by the board and shall state the qualifications of said applicant, together with his experience in such work, and shall supply such other information concerning his qualifications and responsibility to operate electrical machinery as may be required by the Board of Electrical Examiners. Before the board shall have the power to examine such person, said applicant shall show an endorsement that the applicant has paid the sum of $5 to the city collector, which $5 shall be regarded as an examination fee and shall be retained by the city whether the applicant pass his examination or not. If said applicant shall pass said examination satisfactorily to the Board of Electrical Examiners it shall be their duty to make a requisition in proper form upon the superintendent of city telegraph for a license, which requisition must be signed by a majority of the members of the board. Before the superintendent of city telegraph shall have the power to grant a license, the applicant must present to said official, with the requisition from the Board of Electrical Examiners, a receipt from the city collector that said applicant has paid the sum of $5, which $5 shall be regarded as an annual license fee.

When said applicant shall have complied with the requirements as herein provided, it shall be the duty of the superintendent of city telegraph to issue to said applicant a

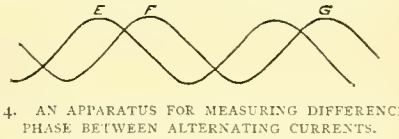


FIG. 4. AN APPARATUS FOR MEASURING DIFFERENCE OF PHASE BETWEEN ALTERNATING CURRENTS.

license in proper form, which license will be denominated "License for Operating Electrical Machinery."

The penalty named in the ordinance for operating without a license is, for either original work or repairs, in construction work or the operation of electrical machinery, a fine of not less than $25 or more than $100, and an equal penalty is to be imposed upon anyone, whether licensed or not, who shall do electrical construction work of any kind without giving due notice in writing to the superintendent of city telegraph.

The ordinance is to take effect immediately on its passage.

The Hobart Electric Railway company is the name of an organization formed at a meeting held recently at Hobart, Ind., to make the preliminary arrangements for the construction of an electric railway from that town to Chicago. A. Morrison was chosen president and A. J. Smith secretary. Committees were appointed to secure articles of corporation, select a route and complete arrangements. Several thousand dollars have been subscribed locally.

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ON the occasion of the recent celebration in honor of Prince Bismarck, the ex-chancellor received 8,390 congratulatory telegrams, containing 277,697 words, in addition to 50,000 letters and 115,000 postal cards. These messages came from all parts of the world, a large proportion of the telegrams to the illustrious German statesman being sent by his admirers in this country.

IT is a significant and interesting fact that in the recent award of the Bowdoin prizes at Harvard University one, for $100, was apportioned to a member of the senior class for a dissertation entitled "A Historical Sketch of Theories as to the Nature of Electricity, with Especial Attention to Changes of Theory Within Recent Years." This is a rather large subject for an undergraduate to grapple; but the fact that this student did so, and that his essay possessed sufficient merit to secure a prize, well shows the increased attention now paid to electrical phenomena in American academic and collegiate institutions.

IT is interesting to note that there is a possibility of the government suit against the American Bell Telephone company and Alexander Graham Bell at last being closed. This assertion is based on no less authority than the annual report of the Bell company, which remarks that this suit "still remains pending, notwithstanding that the two Bell patents, No. 174,465 of March 7, 1876, and No. 186,787 of January 30, 1877, which it was brought to annul, have both expired." The report adds: "The deposition of Franklin L. Pope was concluded May 15, 1894, and on June 15, 1894, the court extended until January 1, 1895, the time within which the defendants might take further evidence. Owing to unavoidable interferences and to the illness of counsel for complainant, the time for taking defendants' evidence has again been extended to June 12, 1895. By that date, if no accident prevents, the defendants expect to have closed their testimony." The policy of delay which was followed in this case is similar to that adopted by the company in preventing the issuance of the Berliner patent, which created such a scandal. It is to be hoped that there will be no further delay in this case.

WE present elsewhere in this issue a long abstract of an ordinance now pending in the city council of Chicago to provide for the licensing of all electrical contractors, wiremen and dynamo tenders within the corporate limits of the city. This is an important measure and one that should receive the careful attention of all local electrical men in the classes named. The ordinance has not yet passed the council, but it seems likely that it will become a law. The general purpose of the ordinance—to insure competent construction and operation of electrical plants—is excellent, but it is possible that the objection may be raised that the ordinance is too sweeping and indefinite in its terms. For instance, it is imaginable that every man in charge of a little factory motor, whose electrical knowledge need only ascend to the level of a switch and rheostat, may be required to take out a license under a forced construction of the section requiring paid permits for operators of electrical power plants. However, a wide discretion and much authority are vested in the superintendent of city telegraphs, otherwise the city electrician, and we may expect a fair and rational interpretation of the ordinance if passed. But in any event now is the time for all construction men and wiremen to carefully examine the text of the ordinance and file their protests, if they have any, with the aldermen.

A BROOKLYN street railway official was interviewed by a New York reporter recently on the subject of fenders and accidents on cable and trolley roads. He said his street railway company was making an honest effort to secure an efficient and reliable fender, and that it had tested several that had been highly recommended and seemed most promising, but they did not answer the purpose. "I cannot understand," he said, "why it is that we run into so many persons. If our cars chased them up side streets and into their houses it does not seem to me that we could catch more of them. I can see no other reason for it than that the public generally are more careless in this city than elsewhere, for the cars do not run any faster, and the men we have to run them come from cities like Boston, Rochester and Philadelphia, where accidents are fewer in number." There is no doubt that inventors are giving much attention to the fender problem. A glance at the list of patents issued every week discloses the fact that there are very many devices of this class passed through the Patent Office, but it must be confessed that a vast majority of those described in patent specifications possess no novel features that a layman can discover. It is to be expected, though, that where so much work is being done, something really meritorious will be developed, and with this in view every effort in this direction should be encouraged.

THE question raised by the General Street Railway company and combatted so forcibly by the Chicago City Railway company, as detailed on another page—the contention that a street railway corporation, operating under a municipal franchise, does not possess exclusive ownership of the tracks laid by it in the public streets—is one that all street railway men will recognize as of great importance. The General company takes the position that the Chicago City company, operating in the public streets, cannot exclude another street car company from using its tracks if it receives a proper rental for the use of the rails. The General company asserts that the authority of the municipality over the streets is supreme, and that the Chicago City company can no more claim the exclusive use of the rails than of the stones of the pavement. On the other hand, the Chicago City company holds that its tracks are its private property, and that any other street railway company attempting to use them is simply a trespasser. Acting on this view, Superintendent Bowen caused the forcible overthrow and destruction of a car of the General company which was driven on the Twenty-second street tracks of the older company to test the matter. This resort to physical force and the destruction of property seems to be unwise in any view of the case. Admitting that the General company was trespassing, the South Side people had their remedy without resorting to violence. In adopting the course it did, the Chicago City company has only prejudiced its case. The main question presents several puzzling features, and a plausible argument may be made on either side. It will be well for the general public to suspend judgment until the matter is settled by the wisdom of the law courts. If the existing practice is overturned, the decision will certainly have great influence on the street railway industry.

WIDESPREAD interest is manifested in the plans of the Standard Telephone company, which are outlined elsewhere in this issue. The company is one of the strongest combinations that has ever been formed in this country. Enormous capital and political influence are combined in the new company, which announces its intention of entering into active competition with the Bell company throughout this country, Canada and Mexico. The plan of organization is similar to that of the Bell company. There will be a parent company with headquarters in New York, which will include among its stockholders many wealthy men in all parts of the country, and public men of vast influence, whose assistance in securing franchises and protecting the company from unfavorable legislation will be very valuable. The entire country has been divided and the several districts placed in the hands of local companies, each of which is organized along these double lines of capital and influence. The aggregate capital involved is estimated at $360,000,000, while the political influence commanded is enough to make any desired friendly legislation a great deal easier to obtain than it otherwise would be, and to make hostile legislation a great deal harder. The principal object of the company is to establish telephone exchanges in all the large cities of the country, and also build up a system of intercommunication between cities after the manner of the Long-distance company. It is claimed that first-class service can be furnished for less than half the present rates of the Bell company, and the new company will at once apply for franchises in all the leading cities of the country. The Bell company persistently reiterates its claim that it cannot furnish first-class service at a lower rate than is at present charged, and it will be interesting to note its attitude toward the new company. In capital and influence the new company bids fair to surpass any competitor that the Bell company has thus far met, and a great fight may be expected if the promises of the promoters of the enterprise are fulfilled. The public will await the contest with no little interest.

THE wave of reform that swept over Chicago last week resulted in the retirement from the city council of several aldermen who were instrumental in securing the passage of the Cosmopolitan ordinance, a measure generally condemned by the people and denounced by the newspapers as a boodle ordinance. The men chosen to replace the retiring statesmen are not in every instance selected from the most desirable class of citizens, but they all contend that they are eager in the cause of municipal reform. Most of the newcomers have been interviewed and in several instances they have discussed the policy of the city toward trolley, cable and other companies operating under franchises. Ald. Milne thinks that "electric cars have been the salvation of certain districts of the Northwest Side." "I cannot speak positively about this plan of charging the street car companies rent for the streets they occupy," he said, "as the circumstances vary so much in different localities. In some districts the company may be doing the people a favor in constructing the line, and I favor the building of car lines wherever the people want them." On the other hand, Ald. Judah, who prides himself upon his "advanced ideas on the streets," says, "I do not believe any of them should be given up to corporations without full and complete compensation therefor." Ald. Foster is more explicity in his demands. He says: "I shall oppose every ordinance which would give away any franchise except on condition of the payment into the city treasury of five or more per cent. of the gross receipts of the benefiting corporation during the term of the franchise. Every street used for street railway tracks should be improved with good pavement and kept clean from curb to curb at the expense of the street railway." Ald. Gleason, fresh from his victory over "Hinky Dink," proclaims his position as "against the trolley system tooth and nail." Ald. Hoyer announces that "if the property owners along the proposed line want electric cars I am in favor of having them." The city should receive some monetary return for the use of its streets by various corporations, he thinks, as the "franchises are among the most valuable possessions of a street car company and it should be willing to pay for them." It will always be a matter of considerable difficulty to determine the value of franchises for street railways and other privileges of this class, but it is evident that companies desiring future grants of this character will find the city far more exacting in its demands than heretofore. The example of other cities has helped strengthen the position of those who have been advocating this course in Chicago. It has proved eminently satisfactory in several instances and aside from the greatly increased revenue of the city one of the best features is that it places the company in a much more independent and dignified position. This of itself is no little advantage.

## First Electrically Lighted Carriage in Chicago.

To one of Chicago's most progressive citizens belongs the credit of having been the first to lead the way in the utilization of electricity in the western metropolis for carriage illumination and heating. It is said that electric harness lights for carriage use were probably first employed in connection with one of the carriages of the German emperor, and were designed for the convenience of the coachman in driving along dark thoroughfares. But wherever else the application may have been made, it is safe to say that no neater or more complete carriage lighting equipment than that illustrated by the accompanying pictures has been heretofore described.

The carriage, or brougham more properly, shown in the pictures is that of President Geo. A. McKinlock of the Central Electric company, Chicago. The picture in the center shows the brougham and its pair of cobs, a gray and a roan, as they appear in front of Mr. McKinlock's residence on Prairie avenue. The cut to the right gives an excellent idea of the arrangement of the battery under the coachman's seat and the switches; and it also shows the side lights. The box or drawer is of oak 13½ inches by 12 inches by 9 inches high, containing the battery of five Pumpelly-Sorley 40 ampere hour cells, giving about 10 volts pressure. It is represented as partially pulled out from its place under the seat in order to better show the battery's position. At the top edge of the seat, just over the battery box, are the two outside switches for the coachman's use. One of these switches controls the light in the two side lanterns, while the other sends current to the group of main ceiling lamps in the carriage. The left-hand picture in the illustration shows the tasteful manner in which this group of ceiling lamps is set in the roof of the brougham and enclosed in an exquisitely cut glass ceiling hemi-globe, so as to shed, when lighted, a soft glow throughout the interior and make the closed carriage a veritable little parlor.

A third switch hidden inside behind the upholstered arm strap on the right-hand side enables the occupants of the carriage to light the ceiling lamps independently of the coachman.

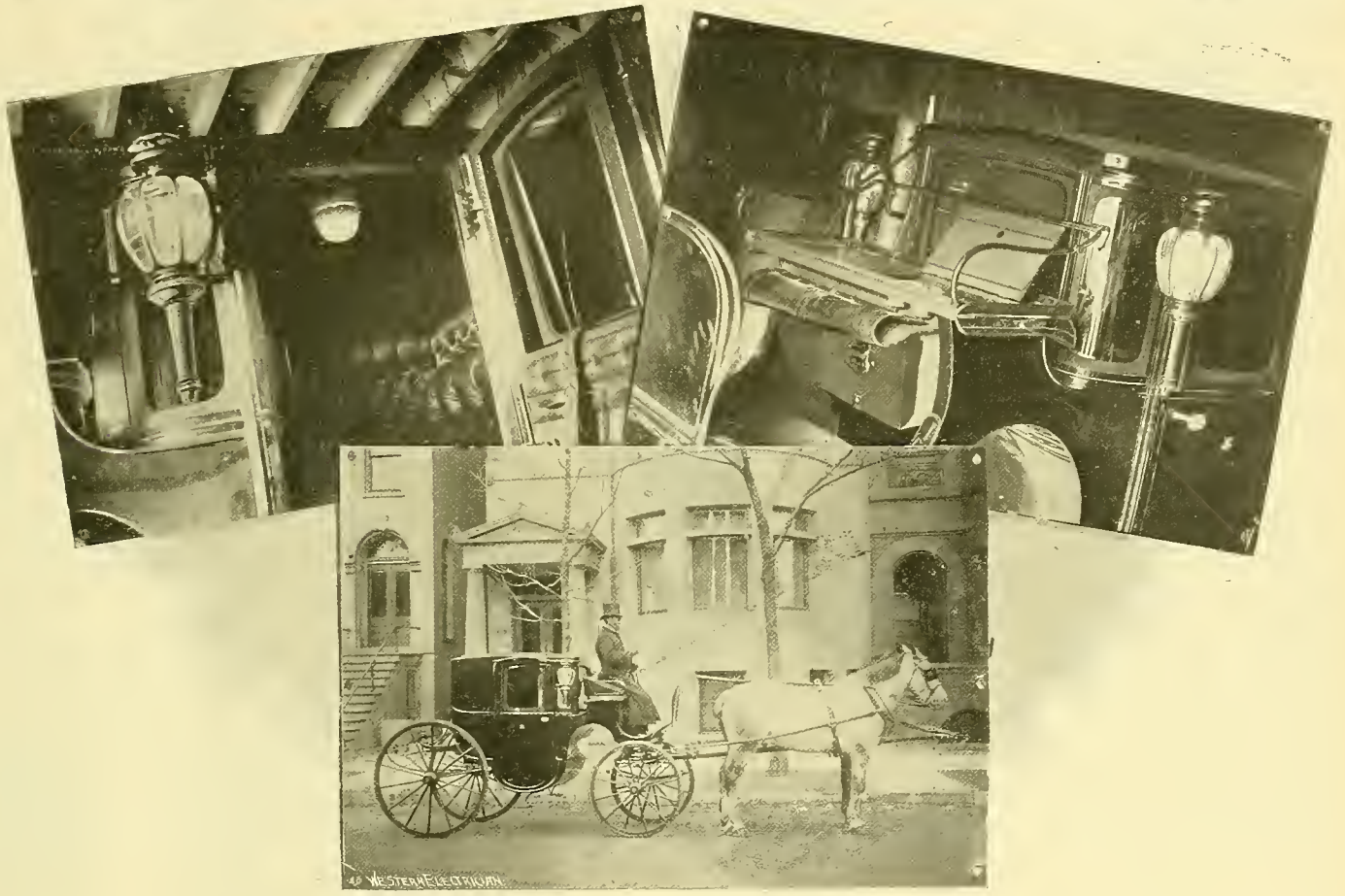
The ceiling hemi-globe covers three ten volt six candle power lamps, the lanterns outside being fitted up also each with a six candle power lamp of the same voltage.

It is perhaps needless to say that the connections from battery to lamps are of Okonite wire, which is concealed beneath the upholstering of the carriage. Fuses located at the battery box protect the equipment in case of a short-circuit.

Next winter it is not at all improbable that Mr. McKinlock will utilize attachments, already provided, for installing electric plate footwarmers. In London and Paris vehicles, it is said, are supplied with hot water heaters similar to the can heaters in foreign railway carriages. The application of the simple electrical plate heaters in connection with the lighting equipment will be an improvement, through its convenience, over this crude method of heating.

Provision has been made, of course, in the McKinlock carriage so that the battery may be easily recharged from a house or other lighting circuit.

It is estimated that the battery will light continuously all five lamps about 10 hours. The installation of this lighting equipment was made under the direction of C. G. Burton of the Central Electric company, who is entitled to credit for the very thorough manner in which the work was carried out.



FIRST ELECTRICALLY LIGHTED CARRIAGE IN CHICAGO.

## Liability of Electric Railway Companies for Telephone Wire Accidents.

In an action brought to recover damages from an electric railway company for personal injuries which it was claimed were received by accidental contact with a telephone wire which had fallen upon the railway company's trolley wire and so become heavily charged with electricity, the negligence imputed to the company was its omission to place guard wires over its trolley wires in such a way as to prevent the telephone wires, in case of their falling from any cause, from coming in contact with the trolley wires. It was contended that the electric railway company owed the duty to the public to guard it from the effect of accidents which might happen to the telephone wire, which it neither owned nor controlled. The responsibility of the railway company was plainly defined by the Supreme Court of Wisconsin, which called attention to the fact that the employment of electricity to propel cars along railway tracks in cities was of recent institution. The court also calls attention to the fact that the dangers attending its use in that function, and the best modes of guarding against accident in its use, may not be fully known and understood. Many of the phenomena and the possibilities of danger attendant upon such use are still subjects of question and experiment. But, notwithstanding this condition of imperfect knowledge, the law permits this mysterious and dangerous power to be used for locomotion in the streets of cities. It is lawfully there. No doubt it is the duty to use such customary and approved appliances as are known and used in the business of operating electric railways. So far as reasonable knowledge in the present state of the science and the practical use of electricity as a motive power for street railways, and reasonable foresight can go, it is bound to guard the public against the perils attendant upon this use of electricity. But it is liable only for what is known as "reasonable care." The present state of the science and the present practical knowledge of the most practical and effectual means and methods of guarding against such perils as are incident to its use are a most important element in the question of what is reasonable care. In the present condition of the science and of the practical knowledge on this subject it cannot be said, as matter of law, what method of guarding the wires shall be required, nor whether any guards shall be required, for it is not known to the law that any method now known will prove effective. But it is a question for the jury, under all the facts of the case, to determine whether the method actually used was negligent. There would, in such a case as this one, be no claim against the railway company unless it could be shown that the telephone wire was alive with electricity communicated to it by the trolley wires. The railway company might be liable for the result if its omission to guard its wires was negligence, and if that negligence was the proximate cause of the plaintiff's damages. The real test of its liability for the accident was whether the omission to guard its wire, that being found by the jury to be negligence, was the proximate cause of the accident. The negligence was not the proximate cause of the accident unless, under all the circumstances, the accident might have been reasonably foreseen by a man of ordinary intelligence and prudence. It was not enough to prove that the accident was the natural consequence of the negligence. It must also have been the probable consequence. This, too, must always be a question for the jury where the evidence is not clear, or the proper inference from undisputed evidence may be in doubt. This opinion was given in the case of Block against the Milwaukee Street Railway company.

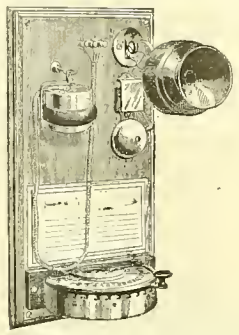
## New Cable Code.

The new cable code, as prepared by the International Telegraph convention, has just been published. Owing to difficulties and inconveniences heretofore experienced in modes of transmission, it was decided to prepare and publish a vocabulary of authorized code words, which should come into use three years after the date of publication, and be the sole authority on the legitimacy of code words. It contains 250,000 words of not more than ten letters. Two classes of telegraphic correspondence are recognized—that which passes between states within the limits of Europe, and is called European, and that which passes between Europe, Asia, America, Africa and Australia, direct or by the way of Europe, which is called extra European. After January 1, 1898, European telegrams containing code words which cannot be found in the vocabulary will not be accepted for transmission. This will include all messages transmitted by the Atlantic cables. It is urged, in behalf of the new

code, that every word in it differs in at least two letters from every other word in the collection, and that, therefore, errors in deciphering are not likely to occur. Code books now in use will have to be revised.

## Auto-telephone System.

The Tucker Electrical Construction company of New York is introducing a new automatic system of interior telephonic communication. The accompanying cut shows a wall set for three or more stations. The system is simple and is easily operated by inexperienced persons. But one hand is needed in operating, leaving the other free for writing or other work. In the auto-telephone system the receiver may be hung up or placed on its own base as de-

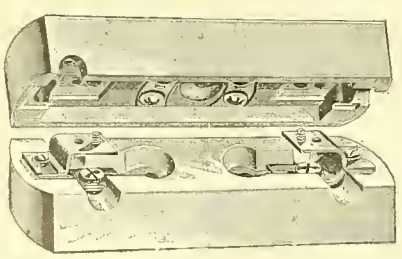


AUTO-TELEPHONE SYSTEM.

sired. In either case each station is always in touch with all others. It is impossible to leave circuits closed through forgetfulness, for the reason that warning signals will ring continuously when the receiver is laid aside, unless the circuit is opened by releasing the signal key. The system is very flexible. When desired it may be arranged so that certain stations only can call a given station, although the latter is in such relation to the system as to permit calling each of the others. The auto-telephone system uses but one battery source. Two or more pairs may converse at the same time without interference. It employs but a single key to place any one station in speaking relation with any other. The apparatus is sold outright and will doubtless be in demand from establishments where there are several departments desiring inter-communication.

## Rating Feed Water Heaters.

The Feed Water Heater Manufacturers' association has sent out resolutions declaring that a better understanding among the members and also between each of them and their customers in the matter of rating of feed water heaters is much to be desired, and that they believe that the only proper rating for feed water heaters is one which is based upon the square feet of heating surface contained in the heater. For the purpose of giving practical shape to this belief, they agree that for the future they will in each and every case in which they are called upon to make prices upon heaters state the exact number of square feet of surface which they are offering; that they will in each and every case state without reservation both in their printed catalogues and specifications the diameter of the tubes, the number of lineal feet thereof and the total square feet of heating surface in each heater offered. These resolutions are signed by the following named concerns: Taunton Locomotive Manufacturing company, maker of the Wainwright feed water heater; Benj. F. Kelley & Son, makers of the Berry-



BRYANT COMBINATION CLEAT AND ROSETTE.

man feed water heater; Wm. Baragwanath & Son, makers of the Baragwanath feed water heater; Goubert Manufacturing company, maker of the Goubert feed water heater; National Pipe Bending company, maker of the National feed water heater; Robt. Wetherill & Co., makers of the Wetherill feed water heater; Keystone Engine & Machine Works, makers of the Kensington feed water heater.

## Getting Back at Them.

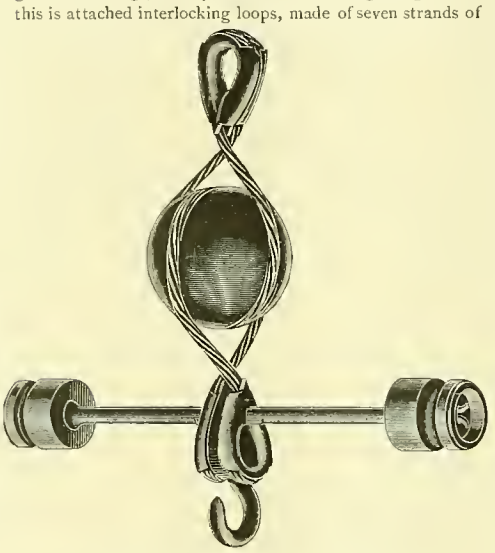
One of the Parisian electrical journals retaliates on the "deadly current" cranks by collating and publishing the lists of both gas and electric accidents. In the last exhibit there were 14 gas accidents and not one of an electric origin.

## Plush Protector.

A new device recently placed on the market by the Electric Protection company of Philadelphia is illustrated by the accompanying cuts. The protection through this protector does not depend upon melting wire with an intense heat or in grounding the circuit for the excess current to accumulate in the telephone or other instrument; but it is operated by magnetism, which automatically opens the "Plush" protector, and breaks the circuit. These protectors are adapted for use on telephone and telegraph lines, to open the lines or circuits when they become charged with an excessive or dangerous electric current, the break being large enough to prevent the possibility of currents of great strength flowing across the break and injuring the operator or causing fire to the property upon which the wires or instruments are attached. No danger from electric light or trolley wire crosses need be apprehended by using these protectors. The claims made for this protector are: Simplicity; sure action; ready adjustment and interchange of parts; the quickest way of closing the circuit after the protector has been opened by a dangerous current; it will prevent an arc forming between the lines as attached to the protector. The protector is shown in both open and closed conditions in the cuts.

## Insulating Hanger for Arc Lamps.

The hanger shown in the accompanying illustration is designed for insulating arc lamps, when suspended outdoors, exposed to the elements, where high insulation, strength and durability are required, and fully covers the rules of all boards of fire underwriters. The ball is make of the toughest green glass, three inches in diameter, with two grooves running part way round the ball at right angles. To this is attached interlocking loops, made of seven strands of



INSULATING HANGER FOR ARC LAMPS.

galvanized steel wire, dipped in P. & B. insulating compound, thereby insuring high insulation.

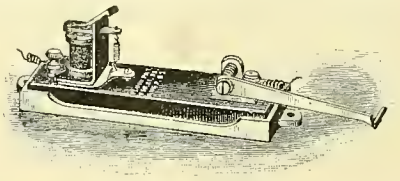
To either end of the steel wire loops are fastened malleable iron castings, provided with eyes, on one of which is hung a switch hook, on which the arc lamp is suspended, thereby insuring ease of suspending and disengaging the lamp. Above the hook is a cross arm, also of malleable iron, one foot wide, on the ends of which are glass insulators for the suspension of the conductor wires to the lamps, thereby doubly insulating the lines before entering the lamp. The insulator will stand a strain of 6,000 pounds and will withstand extreme changes of weather without deterioration. For strength and fine appearance the hanger is not excelled. The device is exploited by the Metropolitan Electric company of Chicago.

## Bryant Combination Cleat and Rosette.

A device which is both novel and useful has been placed on the market by the Bryant Electric company. It is a cleat and rosette in one, or the combination cleat and rosette, as it is called, and is designed with the view of obtaining uniformity and at the same time complying with the requirements of the underwriters. It is in two pieces. In the one which comes next to the ceiling are the arrangements for making connections to the wire; in the other, or what would be termed the top, the fuse and the drop cord are connected. The accompanying illustration shows the connecting pieces, which are of the K. W. pattern, removed from the top porcelain, and left in the lower or ceiling piece to better illustrate the method by which the two halves of the cleat are fastened together when in use. When taking the cleat apart only the screws nearest the ends are loosened and the projecting brass clips remain fastened to the top porcelain. No brass parts show on the cleat when in place, and it looks, when in position, very similar to any other porcelain cleat which keeps the wires from the ceiling. The western office of the Bryant Electric company, Grier Bros., managers, carries these cleats in stock in Chicago.

## Russell Harrison's Work in Terre Haute.

According to the New York *Sun*, Russell Harrison, who went to Terre Haute a year ago to be president of the electric street railway company, and who has since organized a lighting company, and secured a five years' contract for lighting the streets, is now figuring in the courts as a result of complications with the owners of the old lighting company, who are among the best known citizens of the city. The son of the ex-president had things all his own way for a long time and became very popular with the public, who believed he was introducing progressive methods in the city. He improved the street car service. He won a decided

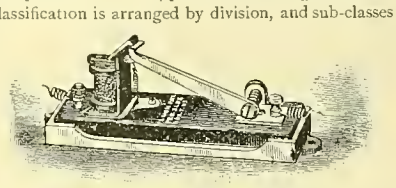


PLUSH PROTECTOR.—OPEN.

victory in a contest with the city park board, which wanted to keep a public park closed on Sunday and in the evenings. Harrison appealed to the public and won. He provided amusements at the park, and the people went there by the thousands, and they rode on his street railway. No one knew who was behind him in the company. He had secured an option on the property a year before he came, and at that time it was understood that S. B. Elkins, R. C. Kerens and others, with whom young Harrison became acquainted when his father was president, were behind him. When Harrison asked the council for a change in the franchise, by which he could issue more stock and bonds, there was some opposition, but he won. All the time he was saying that the opposition to his projects arose from the opposition of Andrew Crawford, the millionaire iron founder, who is a member of the council, and leader of the republican majority. The newspapers were on Harrison's side, and he was lauded as the typical progressive citizen, whose presence in Terre Haute was most desirable. There was nothing of a public nature in which he did not have a part, and it got to be a joking remark that he owned the town. Two months ago the city advertised for bids for lighting the streets. The old company bid at the same price it had received during the last three years. Russell Harrison, as president of a new company, sent in a bid at a much lower figure, and the contract was awarded to him for five years. He insisted, however, on a franchise for the use of the streets and alleys for thirty years for the transmission of power and heat as well as light, and, after a short struggle in the council with an incidental personal controversy with the mayor, he signed a contract to begin lighting the city on February 1st. He had no plant, but soon began constructing one. In the prosecution of this work he ran afoul of the old company, whose employes cut down some of his poles because they were erected in too close proximity to the old ones. Harrison went before Judge Taylor for an injunction, and got one of sweeping terms. Then the old company went before another court for an injunction against him on the ground that he was tresspassing on its right of way. Russell laid off his force of workmen and appeared before the public as a martyr to a judicial outrage. He was interviewed and is alleged to have made remarks about the judge, which afterward he disclaimed. The temporary injunction was dissolved, and, pending the hearing on the motion for a permanent injunction, he resumed work. Meantime the old company continued lighting the city on a temporary contract.

## Classification of Patents.

The official classification of patents and inventions, revised under the direction of the commissioner of patents, has been published as a supplement to the *Official Gazette*. The classification is arranged by division, and sub-classes are



PLUSH PROTECTOR.—CLOSED.

arranged alphabetically. The report was completed January 1st and is accompanied by the following announcement by the commissioner:

The following is the official classification of patents and inventions in the Patent Office. No changes will be made therein except by order of the commissioner.

Should occasion arise for any modification of this classification, either by the discontinuance of any title or by the addition of a new one, the matter will be presented to the commissioner for his action.

Examiners will not transfer patented drawings from one class or sub-class to another except on the commissioner's approval.

Changes in classes and sub-classes will be published in the *Official Gazette*.

This document is of great value to all patent attorneys and is an excellent work of reference to all who are interested in any way in the Patent Office.

## New Gustafson Telephone.

An instrument especially adapted for the telephone construction man's trade is what W. A. Gustafson claims for his telephone outfit, illustrated in the accompanying cut. At Mr. Gustafson's factory in Joliet, Ill., there are now being turned out the three styles of instrument shown in the cuts.

Outfit "No. 1," shown in Fig. 1, is the Gustafson long-distance telephone, which works equally well on long or short lines, and is, its maker claims, superior in construction and operation to any instrument now on the market. This telephone can be put up in series up to ten on one line and be operated successfully without switchboard.

Outfit "No. 2," Fig. 2, is a magneto telephone with all the latest improvements. This instrument will do good and

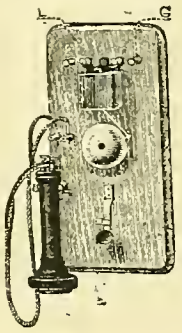


FIG. 3 NEW GUSTAFSON TELEPHONE.

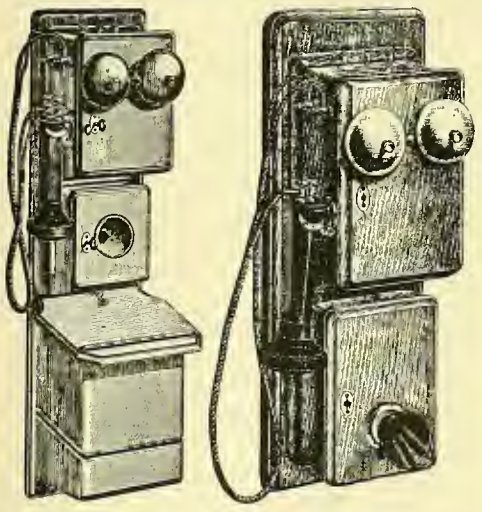
satisfactory work on lines not to exceed ten miles and is fully warranted in every respect.

The low-priced Gustafson telephone "No. 3" is represented by Fig. 3. It consists of a back-board, electric bell and magneto receiver, which is also used as a transmitter, strap key and an automatic switch, thus making it a good and reliable outfit for short distances. This equipment can be used over a three-mile line by adding more battery.

## Setback for the London Trolley Scheme.

The WESTERN ELECTRICIAN, in its issue of December 15th last, noted with some satisfaction the serious proposal of the London United Tramways company to establish an electric railway with overhead conductors in Hammersmith, London. It is to be regretted that the scheme met defeat in the London County Council. The English *Railway World* says:

Regarding the proposal of the London United Tramways company to equip a part of its lines for electric traction on the overhead system, the highways committee, we regret to state, has reported adversely on the proposal, and the council has accordingly refused its sanction. The discussion on the report was chiefly remarkable for the ignorance of the



FIGS. 1 AND 2 NEW GUSTAFSON TELEPHONE.

details of the proposal evinced by certain labor members of the council. Both J. W. Benn, M. P., and John Burns, M. P., indulged in observations no doubt designed to be facetious, but which were, in fact, simply ridiculous. It is doubtful if a little learning ever proved more dangerous than in this case. The members who talked with so much assurance had seen the rather antiquated electric tramway at Leeds, and applying the maxim, "from one know all," had apparently made up their minds that electric traction in any form would be intolerable to Londoners. It is certainly surprising to find men whose chief qualification for government is supposed to be a practical acquaintance with the needs of the people, opposing in this manner plans designed to improve local facilities for communication and to afford the poorer classes cheap transportation.

## Crocker-Wheeler Factory Burned.

On Sunday afternoon the extensive plant of the Crocker-Wheeler Electric company at Ampere, N. J., was almost entirely destroyed by fire. The property destroyed is estimated to be worth $250,000, but the buildings and machinery were fully insured. Over $100,000 worth of motors and dynamos, which were stored in the main building, were destroyed, together with about $50,000 worth of machinery. This building, a brick structure, 300 feet by 40 feet, was burned to the ground. The works extended over an area of seven acres of ground, a large part of which was covered by the buildings. The fire broke out in some unexplained manner in the shipping building, near the center of the plant. It being Sunday, the works were shut down, and no one was in them but the watchman, John Nick. He saw the flames, and attempted to fight them with a patent fire extinguisher. He was overcome by the smoke and nearly lost his life, being rescued in an unconscious condition by the firemen. By this means valuable time was lost. An alarm was given by a passerby on the track of the Delaware, Lackawanna & Western Railroad, who ran nearly a quarter of a mile to the nearest alarm box. When the East Orange department arrived the buildings were wrapped in flames, and it was evident that nothing could save them. A second alarm was at once sent out, bringing out the entire force of the department. The office building, with all books, patterns and drawings, was saved. The company will rebuild at once, and as arrangements were at once made for temporary quarters, there will be little delay in delivering apparatus.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, April 6.—It is still difficult to obtain exact information in relation to the negotiations in progress between the General Electric and Westinghouse companies. One of yesterday morning's papers, however, contained the statement that the executive committees of the two companies have approved a plan for the pooling of patents. The plan is now said to await the signature of one member of the committee, T. Jefferson Coolidge, Jr., who has been detained in Boston. By the terms of the plan each company will contribute an equal percentage to the pool to defend the patents of the two concerns against outside litigation and competition, and, as it has cost these two companies about $300,000 a year apiece in legal battles against each other, there will be, by the new arrangement, a big saving to the concerns and better dividend prospects. The arrangement between the companies is not in any way a consolidation of interests, as has been published from time to time, but merely a mutual effort to protect each other. The pooling of the patents is considered as an excellent arrangement by the security holders of the two concerns. Another newspaper oracle says: "The companies will both use all patents at pleasure, subject to royalties to be paid each other on a basis to be determined by a board of experts to be appointed by themselves, the rates and amounts due to be determined quarterly. This plan, it is said, will result in a saving in law expenses sufficient to pay a dividend of 2 or 3 per cent. on the common stock of the respective companies. This arrangement will affect not only the companies' rights under existing patents but future patents. This combine has nothing to do with the corporate rights and powers of the two companies. They will remain separate and independent as heretofore. There will be no trust or consolidation of the two companies and no division of territory."

The agitation over the operation of the electric street railway companies in Brooklyn appears to be interminable. The Kings county grand jury has made a presentment stating that safety fenders are needed on the cars and recommending the passage of an act by the Legislature making their use mandatory. The Brooklyn aldermen have adopted some new resolutions on the subject. Alderman Carey introduced a resolution providing for the appointment of a committee of nine, three to be appointed by the mayor, three to be members of the board of aldermen, and three to be named by the railroad corporations, to consider the question of trolley speed, fenders, etc. After a lively discussion the resolution was defeated by a vote of 8 to 7. Alderman Clark then moved that seven day trolley inspectors and seven night inspectors and one chief inspector, the former to receive $3 a day and the latter $1,000 a year, be chosen to act as special policemen and to supervise the running of the cars. He said that the conduct of some of the aldermen in the matter was disgraceful, and that it was their duty to resign. The people were beginning to move away from Brooklyn under the terror of the "murderous trolley," and some decisive action should be taken. After Mr. Carey had made a protest the resolution was adopted by a vote of 9 to 2. The day and night inspectors are to be named by the aldermen and the chief inspector by the mayor. Alderman Cohn then offered a new trolley ordinance providing that the rate of speed should not exceed six miles an hour within a radius of one and a half miles from the city hall or two miles from the Broadway ferries, and that in any other part of the first twenty-eight wards the rate of speed should not exceed eight miles an hour. The ordinance also provided that the cars should stop at each street crossing, except where the block is 300 feet or more in length, and that in the center of such blocks a sign bearing the words, "trolley station" should be put up. The ordinance was adopted by a vote of 11 to 1, Mr. Carey voting in the negative. Alderman Cohn also introduced another resolution, compelling the railroad companies to have indicators in the cars showing the exact rate of speed, and also checks whereby it will be impossible to exceed a ten-mile rate of speed on grade. This resolution also provides for the placing of the most approved safety fenders on the cars and prohibits the carrying of more than 50 per cent. more passengers than there are seats. This was also adopted by a vote of 9 to 1. At the Mayflower Mission in Brooklyn on Sunday night Rev. Horace Porter, Rev. Dr. Abbott's assistant, denounced the "trolley slaughter", and resolutions were adopted calling for a reduction in the speed of the cars and the adoption of a proper life-saving fender. Rev. Mr. Porter headed a delegation which waited upon President Lewis of the Heights company and submitted the resolutions. President Lewis assured the delegation that he was using every possible effort to check the accidents.

In the meantime a plaintive wail comes up from the Brooklyn Elevated Railroad company in relation to the inroads made in its business by trolley-car competition. In fact the company has begun a suit against the city authorities to restrain them from selling its property for the arrears of taxes for 1893 and 1894 amounting respectively to $83,119 37 and $87,339.62. The company contends that the taxes levied on it are grossly in excess of what they should be. The complaint sets forth that in 1892 a franchise was granted to the surface roads to use electricity and increase the speed of their cars from six to ten miles an hour, thus giving them the same rights as to speed as the elevated roads. In spite of this, however, the latter are not taxed on their real estate, while the elevated company is so taxed. The property of the company, it is said, has diminished in value by reason of the privileges granted to the trolley lines, inflicting great injury on the company. It was through the competition of the trolley companies that the surplus of $236,345.84 which the company had on June 30, 1893, was wiped out altogether, leaving a debt of $362,000 on Jan. 1, 1895. The actual decrease in the value of the property is given at from $200,000 per mile to less than $100,000. W. F. O.

## Northwestern Notations.

MINNEAPOLIS, April 5.—The Northwestern Telephone company has announced a 25 per cent. reduction in rates in Grand Forks, N. D.

Street car traffic was stopped and factories using electric motors inconvenienced in St. Cloud, Minn., for a couple of days recently, owing to the perpendicular shaft of the large turbine water wheel breaking near the wheel.

C. J. Willow, representing the Wizard Telephone company, was in Council Bluffs, Ia., recently, inspecting the place as a possible location for a manufacturing plant. He says that his company is prospecting for the erection of a transcontinental line from New York to San Francisco, and intends to establish a factory and headquarters somewhere between the termini of the system. Kansas City and Omaha had both been inspected for the location. He has been in conference with the Union Pacific officials, he said, to secure the use of their poles for stringing the wires. The company is incorporated for $100,000 for inspecting purposes, but this amount will undoubtedly be greatly increased as the work progresses. It claims to own patents which are vastly superior to those on the telephones now in use. The proposed plant would employ about 500 men. Wire, cables and telephone supplies generally would be manufactured.

The Northwestern Telephone Exchange has announced a reduction in rates in Winona, Minn., from $48 for business and $36 for residence telephones to $20 and $15 respectively. The Winona Telephone company is a recently organized local company and has secured three-year contracts with 250 subscribers for $30 for business and $18 for residence telephones. The Northwestern also announced that it would meet all competition either in rates or service. The Northwestern Telephone Exchange in St. Cloud reduced rates from $4 for business and $3 for residences to $3 and $2. Mankato, Minn., is also in the swim with a 25 per cent. reduction in telephone rates by the Northwestern Telephone Exchange. The city will be redistricted and

charges based on the length of wire each subscriber has. Distances will be made in quarters, halves, three-quarters, etc.

The city council of Minneapolis has released the telephone company from the operations of the subway ordinance on Cedar avenue, from Fourth to Seventh streets, in order to accommodate the company in its long-distance service. The council is considering a new electrical ordinance. This will require extensive changes by all companies using the three-wire system of wiring. It will also prevent companies from grounding wires on water and gas pipes, which is alleged to be the cause of many fires. The ordinance will be opposed by the electrical companies.

The telephone line between Sioux City, Ia., and Dakota City, Neb., is completed, and was formally opened by a speech by the Sioux City mayor, which the *Journal* says "caused the wires to sing with eloquence."

Michael Kaminski has sued the Ashland Lighting & Street Railway company for $25,000 damages for running over and crippling his five-year-old son.

Manager Hoopes of the Bell Telephone company in Dubuque, Ia., says his company will give telephones for nothing for five years to its present subscribers. The Dubuque Telephone company will begin operations in a few days.

J. K. Tillotson of the Wisconsin Interurban Railway company says that contracts have been let for 26 miles of track to be laid from Oshkosh to Kaukauna, and 15 miles to be built in Oshkosh, Wis. Twenty street cars have been ordered of the St. Louis Car company for Oshkosh and 10 large double truck cars for the interurban line.

Mankato, Minn., democrats have declared in favor of a municipal electric light plant.

One of the papers of Burlington, Ia., says it costs more in that town to rent a telephone than to rent a good house, owing to the telephone monopoly having the town in its grasp, and suggests that the council force a 50 or 75 per cent. reduction in tolls by revoking the permit to use the streets and alleys, pending the reduction.

S. B. Livermore, receiver for the General Electric company of Winona, Minn., has filed a statement of the condition of the company, showing $147,607 assets, and liabilities amounting to $504,610, including $27,000 bonds.

The Edison Electric Light company of Oskaloosa, Ia., has made a proposition to the council to change the arc lights in the residence portion of the town to incandescent and increase those in the business portion from 1,200 to 2,000 candle power at an increased cost of $20 per month.

Wisconsin Telephone company officials are looking over the ground preparatory to building a metallic circuit to Chicago from Watertown via Elkhorn, Williams Bay, Lake Geneva and Genoa Junction.

The Sauk County Improvement company has asked a franchise of the council of Baraboo, Wis., for an electric railway system. The promoters are E. N. Marsh, J. B. Donavon, G. S. Cramer of Baraboo, Henry L. Des Anges of Hoboken, N. J., and D. Harvey, Jr., of New York.

Three cars of rails for the Tillotson electric line in Oshkosh have arrived and five more are on the way. It is expected that in 60 days eight miles of the road will be built and in operation. The franchise, expires April 2d, but with materials arriving and work beginning it is thought there will be no difficulty in securing an extension.

Wm. L. Porter, who has put in telephone systems in Ontonagon and other places, has applied for a franchise in Ironwood, Mich., and offers to have the exchange in operation in thirty days from the time the ordinance takes effect. The Bell company operating there has no franchise.

F. F. Fargo of St. Paul will put a telephone system in at Litchfield, Minn., providing he can secure fifteen persons to take telephones at $72 each, this cost to include wiring, poles and everything, and the system to be turned over to them. He will use an automatic switch which does away with a central station.

Des Moines, Ia., has acquired the police and fire alarm system and the office of city electrician will be created.

Aitkin, Minn., has voted bonds for electric lights.

A petition has been circulated in Medford, Wis., asking the council to call an election to vote on bonding for $5,000 for an electric light plant.

The Wolf River Telephone company has been incorporated to build and operate a line from Orihula to Weyauwega, Wis., via Fremont, and to maintain a local exchange in Weyauwega. The capital stock is $3,000. Work will be begun as soon as possible. The headquarters will be in Orihula.

The Winona, Minn., council has accepted the offer of the receiver of the General Electric company to furnish light at $7 per light per month. The police are instructed to report all lamps not burning. An opinion has been asked of the city attorney on the legal liability of the General Electric company for reducing the candle power in the street lamps.

C. K. Mead has applied for a franchise for a telephone system in Des Moines, Ia., and offers to put in on metallic circuit 'phones at $36 for business houses and $24 for residences, as against $67.50 and $45 as charged by the old company. He estimates a system will cost about $75,000 for 1,000 subscribers.

There is an electric rate war on in Green Bay, Wis. The Green Bay Electric Street Railway company is canvassing for electric light subscribers with a view to putting in a plant. This has aroused the Green Bay & Fort Howard Electric Light & Gas company, which is already in the field, and there is a promise of a rate war which will greatly reduce gas and electric light in price.

W. E. Owens, superintendent of the Des Moines, Ia., lines, has invented an adjustable spring truck to lessen the friction on a curve. The wheels of the truck adjust themselves to the parabola of both rails with this truck and materially reduces the power necessary to go around a curve. It is estimated the increase in power necessary under the present conditions is about one-third.

J. F. W. McFarlane, manager of the British Columbia Iron Works of Victoria, B. C., has been arrested on a charge of attempting to bribe Alderman McCraney. Tenders were recently called for by the city for constructing an electric light plant, and the contract was awarded to the British Columbia Iron Works, although their bid was not the lowest, on the ground of their being a home institution. Now it is charged that boodling existed.

The city council of Mankato, Minn., has renewed the contract for electric lights at $75 per light per annum for five years, for a 1,200 candle power light, with the rate for the succeeding five years to be fixed by arbitration, which is claimed to be a reduction of 17 per cent. from the old figures. The citizens do not see it that way, inasmuch as the old contract called for 2,000 candle power, and as the contract does not go into effect until six months after the council has retired some are unkind enough to suggest a "job."

Clarion, Ia., is in trouble over the electric light plant There is a judgment against the town for $1,800, and two more warrants are outstanding amounting to $1,000 more, making the plant cost $2,800 more than was expected. The council is being severely criticized for its extravagance in plunging the town into debt, and it is thought it has exceeded its authority in issuing bonds to make up the difference between the bonds issued and the cost of the plant. In the meantime the taxpayers see no way out but to pay the extra $2,800.

Arthur Perry and Winthrop Coffin of Boston, Mass., representing the Old Colony Trust company, have petitioned for a receiver for the Winona General Electric company and the Winona City Railway company and to foreclose on $270,000 of first mortgage bonds outstanding on the plants. The respondents are the Northwestern General Electric company and the St. Paul Title Insurance company of St. Paul and Andrew H. Hill, John I. Wilson and George F. Crise of Winona. The case will be heard in St. Louis before Judge Sanborn. It is understood that a plan of reorganization will be considered in St. Paul next week.

There is an electric light rate war on at Appleton, Wis. The Appleton Edison Electric company, which has been in existence since 1881, had the field exclusively until last fall, when the Citizens' Electric Light & Power company was organized by local capitalists. It built an excellent plant and began business a few weeks ago with 1,500 lights on the circuit. The light has been favorably received, and the new company has already ordered machinery to double the capacity of the plant. The Edison company recently announced a 50 per cent. reduction, taking effect March 1st, which the new company promptly met, and the prospects for a considerable extension of the electric light service are good.

The grand jury will return no indictment against the men charged with making way with certain property of the Great Western Manufacturing company. Receiver Moore has brought suit to restrain the Great Western directors from ratifying the $100,000 mortgage and bonds given to the American Loan & Trust company of Boston, by the vice-president and secretary some months ago, to restrain the Maine Electric company from selling $80,000 of the bonds to innocent purchasers, to restrain the Trust company from delivering the remaining $20,000 of bonds to the Great Western and to declare the mortgage and bonds null and void in order that all creditors of the company may stand on an equal footing. He charges that the mortgage and bonds were issued to make the receiving company a preferred creditor.

Judge Webber has granted a new trial in the case of S. D. Peterson against the Western Union Telegraph company for transmitting a libellous message in New Ulm, Minn. Peterson secured judgment for the full amount sued for—$10,000—and the judge says the amount is excessive and not based on evidence, but rather upon prejudice and passion.

There has been a reduction in telephone tolls for residences at Chippewa Falls, Wis., of $1 per month and a similar reduction for business houses.

The Dubuque Telephone company will begin operations in a few days in Dubuque, Ia., and will give rates about one-half cheaper than the recent prices made by the Bell company.

The Marquette County Telephone company has been incorporated in Ishpeming and Negaunee to put in a system in both cities, and A. B. Miner, secretary and treasurer, has gone to Chicago to look up various kinds of instruments and report. Work will be begun in May. The headquarters will be in Ishpeming.

The Wisconsin Telephone company has announced a 25 per cent. reduction in telephone tolls beginning April 1st. The reduction is heralded the strongest, however, where there are franchises pending for competitive companies. Ashland will have 'phones at $3 and $2.25 respectively for business firms and homes, but a new company offers them at $2 and $1.25 per month.

The Michigan Telegraph & Telephone company has announced a reduction from $60 to $42 for business houses, and from $50 to $30 for residences in Michigan. Long-distance wires will be put in for $60 per annum. New companies offer similar service for $30 and $24 per annum, and declare they are in the business to stay, which indicates a lively war in rates here as elsewhere.

The Central Union Telephone company has announced a reduction on April 1st, from $58 per annum for business houses to $48, and from $36 for residences to $30 in Davenport, Ia., and also a reduction at Des Moines, though the figures are not given.

A move is on foot at Pierre, S. D., to establish a telephone exchange to connect with East Pierre and Fort Pierre.

Two applications for a telephone franchise have been made to the Rock Rapids, Ia., council. The plan is to cover all the towns in the county and then make connections with lines running into Sioux City.

The long pending dispute between Tracy, Minn., and the General Electric company has been settled. The company claimed $15,545, but settled for $10,882 when the city sued to recover its warrants.

Superintendent Deserens of the Street Railway company in Cedar Rapids, Ia., has had a route for an electric street car line surveyed to the state rifle range on Indian creek.

Bayfield, Wis., is considering plans for an electric light plant by Arthur M. Morgan of Chicago.

Poles are being set and wire stretched for a telephone line from Sioux City, Ia., to Dakota City, Neb., via Ponca and Homer.

The People's Light company of Davenport, Ia., has reorganized, and J. Charles Young is manager. The company contemplates erecting a building of its own soon.

The Burlington Improvement company has been incorporated in Burlington, Ia., to extend the street railway to West Burlington and also to the new park. A new telephone system is also in contemplation.

The Aberdeen Telephone company of Aberdeen, S. D., is experimenting with various instruments to secure an improved telephone.

The city council of Lancaster, Wis., has granted an exclusive franchise to Edward Pollock for electric lights conditional on the plant being in operation in six months.

An electric line is in contemplation in Oskaloosa, Ia., to take in Beacon, Carbonado, probably Evans and possibly Givin and Muchicbinock.

Contracts for 26 miles of rails have been let on the Wisconsin Interurban Railway company running from Oshkosh to Kaukauna, beside 15 miles in Oshkosh. Contracts for 20 street cars and 10 large double truck cars for the interurban line have been let to the St. Louis Car company.

M.

## St. Louis, Mo.

ST. LOUIS, April 6.—Only one bill was passed at the recent session of the State Legislature that relates in any way to electrical interests, and that is a bill authorizing municipalities to sell to the highest bidder all franchises for waterworks, gas works, electric lighting plants, railroads and other similar works. No franchise is to be sold for less than 2 per cent. of the gross earnings.

An important bill is now pending before the Municipal Assembly providing for the settlement of a long standing contention between the city and the lighting companies. In brief the bill provides that the city shall relinquish its right to collect the 5 per cent. tax on the gross receipts of the lighting companies up to January, 1900. In consideration of this release the lighting companies agree to pay the city $25,000 cash on passage of the ordinance and $9,000 per annum after January 1, 1896, to January 1, 1900, and to relieve the city from any cost in putting their wires underground; also to furnish free of charge to the city conduit

space for police and fire department wires. The bill has passed the council.

In the Municipal Assembly only one bill of any electrical interest has passed—the street-car fender bill.

The Clayton & Forest Park electric railroad, a county road, will probably be sold at auction. The line was partly built some two years ago. The permanent way was built, but no electrical plant has been supplied, and the line has never been in operation. The construction company holds a mortgage on the property, which can be foreclosed after April 1st, and it will most likely be compelled to do so, as the County Court has ordered the tracks removed if not put in use. R. J. H.

## PERSONAL.

A. P. Trotter, editor of the London *Electrician*, has retired to engage in engineering and laboratory work.

John Knight, for many years arc light expert and inventor with the Electric Construction Supply company of New York, left on the 6th instant for an extended trip abroad. He will be gone about two months and visit the principal cities of Europe. A large delegation of his friends were at the pier when the La Bourgogne sailed, to wish him bon voyage.

## ELECTRIC LIGHTING.

At the annual election of the Patchogue, N. Y., Electric Light company the following named officers were elected: John S. Havens, president; Jesse C. Mills, vice-president; Geo. D. Gerard, secretary; J. Henry Mills, treasurer; J. C. Mills, purchasing agent; executive committee, J. C. Mills, G. D. Gerard and H. J. Bishop. The annual dividend of 6 per cent. on the capital stock was voted payable April 1st.

The plant and business of the Neptune Electric company of Asbury Park, N. J., was sold at auction on March 30th by ex-Judge J. H. Gaskill of Mount Holly, who was appointed receiver of the company several weeks ago. George A. Smock of Asbury Park and F. H. Kearney of Newark were the principal bidders. Mr. Kearney represented a Newark syndicate and Mr. Smock's bidding was in the interest of the Asbury Park Electric Light company, a stock company newly organized. The property was sold on Mr. Smock's bid of $60,000. The Neptune Electric company was organized in 1884. It furnished electric light to the towns of Asbury Park, Belmar, Avon and Spring Lake. In 1892 the plant was greatly enlarged, and the failure to sell the bonds thus created was the cause of insolvency. Mortgages to the amount of $41,000 are upon the property. About $60,000 worth of stock was paid in, which is practically wiped out by the receivership. Many of the old stockholders are owners of stock in the new company.

## ELECTRIC RAILWAYS.

The right of way for the new trolley railroad from Port Jefferson to Patchogue, N. Y., has been secured. The company will be incorporated in a few days with a capital of $150,000. O. T. Fanning, Dr. W. I. Chalbers of Port Jefferson, and John Roe Smith and J. C. Mills of the Patchogue Electric Light company are the promoters.

A number of men interested in the proposed electric road between Red Bank and Long Branch, N. J., recently inspected the route of the road. Among those from New York were M. H. Hazzard, S. B. Dutcher, James Mercer and Benjamin Frick. The probable cost of the road is $300,000, and it will be completed about July 1st. The commissioners will be asked to grant a franchise.

The North Chicago Street Railway company will start up some of its electric lines soon. There has been some delay in completing the power houses, but it is expected that most of the lines will be started in a few days. The company has now 22 miles of electric lines in operation, and there will be 73 miles of electric road in operation as soon as the power houses are completed. It is expected that all the lines will be completed and started during May, and if those yet to be equipped with electricity show anything like the increase in earnings shown by those already started, the traffic record this year will be remarkable.

An ordinance has been passed by the Evanston, Ill., city council granting to the North Shore Electric company the right to extend its road on Sherman avenue from Emerson street, the present terminus, to Central avenue in North Evanston, a distance of one mile. The ordinance has been pending for some time. It received the votes of the entire council, with the exception of Alderman Prentiss, who held that the extension of the road would disfigure the street and that it was mainly desired by real estate speculators. It is claimed by supporters of the ordinance, however, that the property owners on the street desire the extension.

On October 15, 1894, the Chicago Suburban Rapid Transit company asked the Cook County Board for permission to erect poles and operate an electric railroad, one branch to run to Jefferson by the way of Grand avenue, Seventy-second street, Tanner road, Dee road, Center street, River street, Jefferson road and Lee road; the other to connect the city limits with the town of Maine, was to be operated on Higgins road. The ordinance was accompanied by a petition signed by twenty of the citizens along the route, requesting that the permission be granted to the company. Last fall the ordinance was referred to the judiciary committee, which reported favorably upon the passage of the ordinance to the public service committee at its meeting. Commissioner Struckman, after the reading of the approval of the committee, asked if the highway commissioners of the towns through which the road was to run had been consulted. Commissioner Munn, the chairman of the judiciary committee, said he had considered the petitions of the citizens sufficient, and as the county attorney had given an opinion that the petition and ordinance were in due form, his committee had recommended the passage of the ordinance. Upon the request of Commissioner Struckman, the ordinance was sent back to the committee which recommended its passage, and the clerk of the board was instructed to notify the highway commissioners of Leyden, Maine and Norwood Park, if they so desired, to appear and give their views of the ordinance.

## TELEGRAPH.

The Central & South American Telegraph company has declared a quarterly dividend of 1¾ per cent., payable April 9th to stock of record April 2d. The surplus after the dividend is $55,770.

The Mexican Telegraph company has declared a quarterly dividend of 2½ per cent. out of net earnings to March 31st, payable April 16th to shareholders of record April 9th. The surplus after the dividend is $20,926 increase.

D. K. Persons has obtained permission from Itasca County, Minn., to build a telegraph line from Grand Rapids to Koochiching, 100 miles distant, on the Rainy river. This will open direct communication with the center of the gold region.

The stockholders of the Postal Telegraph-cable company have authorized an increase of its capital stock from $10,000,000 to $15,000,000. The additional $5,000,000 of stock is to be used in extending the service and in payment for extensions that have been made, principally the line from Chicago to St. Louis and to San Francisco.

Arnold Morley, British postmaster-general, spoke in the House of Commons on April 4th concerning the business relations of the government telegraph lines and the newspapers. He reiterated the statement made by him last month before the Congress of the Chambers of Commerce, that the government's annual loss upon press telegrams was £300,000. He was willing to institute an impartial inquiry, he said, if he could get the assurance that the press would abide by the result and assent to a legislative revision of the tariff.

## TRADE NEWS.

The Electric Appliance company, Chicago, is meeting with considerable success in the introduction of the improved Hunning transmitter and American telephone switchboard and has already sold a number of equipments.

The Mather Electric company of Manchester, Conn., has just closed a contract with the Berlin Iron Bridge company of East Berlin, Conn., for equipping its new forge shop with electric power. A 40 kilowatt generator and a 50 horse power motor will be used.

The Hogan Boiler company of Middletown, N. Y., has issued a very attractive series of views of some of its recent installations, including a 400 horse power Hogan boiler of the manifold type at the State Homeopathic Asylum for the Insane at Middletown, N. Y.

C. E. Newton, treasurer of the Jewell Belting company of Hartford, Conn., was a visitor to the New York office of the WESTERN ELECTRICIAN last week. He reports unusual business increase for the past few weeks, indicating a large trade in the belting business.

The catalogue of the Partrick & Carter company, Philadelphia, for 1895, like everything else turned out by this corporation, is a model of its class. It is admirably arranged, and presents in a practical manner the special features of the company's specialties. The catalogue shows that the company, since its establishment in 1867, has been advancing steadily in public favor, and its present prosperity is the natural outgrowth of the business policy which it has always followed. The company is certainly to be congratulated upon its excellent showing.

The Brodie Electric company of Manchester, N. H., has brought out a new automatic motor switch for which many points of superiority are claimed. This device combines a double-pole switch, adjustable limit-switch and automatic cut-off in one piece of apparatus, and it would seem that it must prove valuable in all motor installations, protecting the motors from burning out under all conditions. The company reports an active demand for its other specialties, notably the Brodie tree insulator. It would be pleased to hear from responsible supply houses in the West in regard to handling these goods.

The Wallace Electric company of Chicago has recently taken the general western agency of the Boston incandescent lamp, and is very successfully spreading the news that "the best is the Boston." In connection with this lamp the Wallace company is introducing a comparatively new business—that of renewing burned-out lamps. It claims that the renewal of lamps has proven to be entirely practical, and that central station managers can make a considerable saving by having their old lamps repaired. The process is simple. The lamp is opened at the top, the blackening removed from the bulb, and the regular Boston filament inserted. The air is then exhausted, and any lamp thus renewed becomes practically as good as new, while the globe and base are saved.

## BUSINESS.

The Royal Electric company of Peoria, Ill., has completed arrangements with H. B. Coho & Co., 203 Broadway, New York city, to handle its alternating current apparatus in the East. The latter firm has secured the services of George C. Hoffman, formerly of the Westinghouse company, who will have charge of its alternating current department.

Pattison Brothers, electrical engineers of 136 Liberty street, New York, report that they have a large amount of work on hand, the volume of business showing a great increase during the last two months. This concern has the contract for the electrical equipment of the Buckingham building, New York, and the Scoville mansion at Chapinville, Conn. It is also completing work upon the electric railways at Rahway and Woodbridge, N. J.

The general manager of the Nashold Cleat company of the Monadnock building, Chicago, reports an excellent business in Nashold cleats. This concern has met with such remarkable success in the introduction of its specialty that it is now developing other novelties fully as meritorious as the cleat. The letters received in relation to this cleat are of a most flattering character, and the best evidence of the trade's appreciation lies in the fact that sample orders are almost invariably followed by large ones.

W. F. Parish, general sales manager of the Racine Hardware company, builder of the Racine automatic vertical and horizontal engine, whose sales offices have been in the Home Insurance building, has moved to the new Marquette building, corner of Adams and Dearborn streets, Chicago. The new catalogue of the company fully describes its improved automatic vertical and horizontal engines, porcupine boilers and marine outfits. It is nicely gotten up, contains much information about these engines and will be sent to interested parties upon application.

The Hogan Boiler company of Middletown, N. Y., is giving every opportunity to experts to investigate the claims made for its vertical water tube boilers in practical work. A programme was prepared for the public exhibition at the works on April 9th, which will be of interest to the trade, and is herewith reproduced: Examination of quality of steam through ½ inch valve, pressure 125 pounds; opening of 4 inch steam valve suddenly to atmosphere to illustrate the steadiness of the water line and the dryness of the steam under unusual conditions; use of forced draft for one hour or so, to show the quantity of water evaporated and coal used; use of induced draft for one hour or so, to show the quantity of water evaporated and coal used; use of natural draft for one hour or so, to show the quantity of water evaporated and coal used; use of side dampers by which the areas of flue openings are varied; examination with four thermometers of the temperature of water entering the boiler from external inductors with feed water (at from 40° to 50° Fahr.) passing through external inductors, and without feed water passing through external inductor, the same steam pressure to be maintained on steam gauge during both examinations (these experiments are intended to show that the Hogan boiler is superior to the need of feed water heaters); use of internal inductor with blow-through valve from internal inductor to muddrum, in and out of operation; blowing off from and blowing through internal inductor while boiler is running with muddrum shut off and muddrum cover removed. The testing apparatus was so arranged that the quantity of water used and the amount of fuel burned were at all times clearly apparent to the spectator.

There appears to be every prospect of a boom in electric elevators. The Sprague Electric Elevator company of New York reports recent installations as follows: Parrott building, San Francisco, 15 elevators; Minneapolis city hall and court house, four elevators now under construction and eight others ordered; Guaranty building, Buffalo, four; Fred Gerkin building, New York, two; New York Custom House, two; *Boston Globe*, two. In a recent interview in the New York *Evening Sun*, Frank J. Sprague, vice-president of the company, said: "There is a great field for electric elevators that is now almost unoccupied. That is for small passenger elevators in private houses. They are now looked upon as a luxury, but they are bound to become a necessity. This elevator must be absolutely automatic, though, and will have a controlled circuit. It must be capable of being run from any point to any other point by the pressing of a button at the landing, as one would call a servant, and it must respond positively if the conditions are proper, and stay where it is if they are not. For instance, it must not operate if any landing door is open. If it did, the result might easily be fatal. Again, if the car is in use by one person when wanted by another, the latter's call must not interfere with its operation. All of these things will be done and many have already been done." The Sprague company is rejoicing at the termination of the controversy in Minneapolis. The hydraulic elevator companies made a desperate effort to secure the contract for the city hall and court house, but after a four months' contest and various injunctions and threats of injunctions, the electric elevator was victorious, the contract being finally given to the Sprague company.

The Electric Protection company of 1026 and 1028 Filbert street, Philadelphia, has recently located at this address and will manufacture "Plush" electric protectors, the Stevens flush switch and other electrical appliances, also do a general experimental work and make models of all descriptions. Several thousand dollars has been spent in the purchase of special tools and the most improved machinery for this class of work, making one of the best equipped shops of its kind in the country, having all the facilities for shipment and quick handling of work. Charles M. Swain, the president, is well known in the business circles of Philadelphia. W. H. Dresher is the treasurer and business manager. The manufactory is under the personal charge of Frank Stevens as superintendent. Mr. Stevens is a gentleman well known to the electrical trade, his first start in this line being with the Weston Electric Light company of Newark, N. J., and after the purchase of this company by the United States Electric company he was with the latter for some time, when he went with Edward Weston, in connection with the latter's laboratory work in Newark, N. J. After this he accepted the position of superintendent for the Cleverly Electrical Works of Philadelphia, where he was located eight years until he came with the Electric Protection company. Mr. Stevens has invented a number of novelties which are used extensively in the electrical trade, his fifteen years of experience in this line of work fitting him especially for the position he now occupies. With its superior equipment the company is able to fill the largest orders promptly and satisfactorily. It has taken up an exceptionally strong position in its particular field of usefulness, and the steady growth of its business at a rapidly accelerating rate may be very confidently counted upon.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued April 2, 1895.*

536,608. Electrical Transformer. Malcolm Dickerson, Fort Wayne, Ind. Application filed November 26, 1894.

In an electric transformer for alternating or pulsating currents, there is claimed the combination of the primary and secondary coils with a continuous surrounding envelope of laminated iron, each lamination having a cross plate entering within the coils, so arranged that by the abutting edges of the plates being out of coincidence withthose of each reversed adjacent or alternate lamination, they will break joints.

536,689. Electric Battery. Hosea W. Libbey, Boston, Mass. Application filed February 23, 1894.

The cell consists of two outer disks or plates having inwardly projecting rims or flanges of insulating material, a central ring of insulating material, two perforated disks or plates forming the negative elements and a central divided positive element. There is absorbent material on each side of the elements as well as means for supplying the exciting fluid to the absorbent material.

536,705. Telephoning Apparatus. William B. Robeson, Philadelphia, Pa. Application filed September 7, 1894.

An alarm or indicator and a receiver, combined with means for operating the alarm, or indicator, and a controlling device thrown into operation by the weight of the receiver when unsupported for putting the alarm or indicator into action.

536,730. Electrical Controlling System for Elevators. Cyprien O. Mailloux, New York, N. Y. Application filed December 20, 1894.

The last claim is given: In an electric controlling system for elevators, the combination with a dynamo circuit closed through a series of resistances, controlling switches for the elevator, motive power controlling mechanism, and a controlling circuit starting from the dynamo circuit and extending through the switches and having one branch returning to the dynamo circuit at a point such as to shunt a portion of the resistances and another branch extending through the motive power controlling mechanism and returning to the dynamo circuit at a point such as to shunt a greater portion of the resistances.

536,748. Dynamo Driven from Axles of Railway Cars. William Biddle, Brooklyn, N. Y. Application filed May 31, 1894.

The combination illustrated shows the car axle and a dynamo, a dynamo frame extending up over the axle and having a bearer or journal box, an oil-box below the axle and bolts for connecting the parts, a bearer upon which the distant end of the dynamo frame rests and upon which it is free to move in any direction.

536,763. Telephone. John Serdinko, San Antonio, Tex. Application filed December 4, 1894.

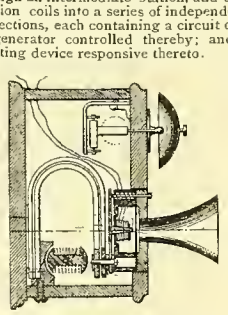
The claim made for the instrument illustrated comprises the combination with the magnets of a magneto call, the bobbin, the diaphragm fixed in front of the latter, the iron disk and core in proximity to the magnets, the core extending through the bobbin, into close proximity to the diaphragm, the magnets of a magneto call having the iron extension piece on one side only and the magneto call armature.

536,764. Electric Block Signal. Fred P. Snow, Lynn, Mass. Application filed April 27, 1894.

This comprises: A section of electric railway track between two stations, a trolley wire, accompanying such track, an electric signal, a two-point switch, an electro-magnet, actuating such switch, and a normally open local circuit from the track, through such signal and switch magnet, the movable member of such switch, and one of the points of the switch to the trolley wire, at one of the stations, in combination with a normally open circuit, extending from the other of the points of the switch to the trolley wire, at the other of the stations, and means for opening and closing the circuit.

536,787. Telephone Exchange System and Apparatus. Hammond V. Hayes and Theodore Spencer, Cambridge, Mass. Application filed September 10, 1894.

A speaking telephone circuit extending between two terminal stations through an intermediate station, and divided by interposed induction coils into a series of independent conductively continuous sections, each containing a circuit controller; a signal current generator controlled thereby; and an automatic signal indicating device responsive thereto.



NO. 536,787.

536,792. Socket for Incandescent Lamps. Francis H. Soden, Chicago, Ill. Application filed February 12, 1890.

The socket illustrated consists of a shell of porcelain or like material provided with grooves about its inner periphery, a partition of insulating material fitted removably in the grooves and dividing the socket transversely, lamp contacts mounted in the partition to which the conductors are connected at one side of the partition, cement filled in about the conductors, thus sealing one end of the socket, and means for sealing the lamp in the other end of the socket.

536,794. Electric Controller. Gustaf Valley, Cleveland, Ohio. Application filed December 3, 1894.

An electric controller drum composed of similar sections each provided with the necessary contact strips and having on their sides lugs and cavities by which the sections engage each other, and a central shaft carrying top and bottom clamping plates between which the sections are secured together and form a rigid drum.

536,809. Electrical Switchboard. Francis W. Jones, New York, N. Y. Application filed January 22, 1895.

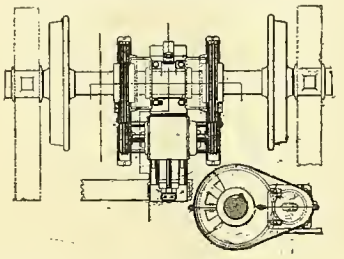
In a switchboard the combination of parallel metallic strips, a series of disks or buttons arranged in parallel rows between the strips, arc shaped notches in the adjacent surfaces of the strips and buttons, to receive a metal pin or plug, a foundation or frame of fireproof insulating material, mica disks between the buttons and the foundation frame, and air spaces between the strips and the foundation frame, whereby insulation is increased and arcing is prevented.

536,816. Combined Dynamo-electric Generator and Current Director. James F. McElroy, Albany, N. Y. Application filed January 2, 1892.

In a dynamo-electric generator the combination is claimed of a circular range of fixed electro-magnets alternately included in the field and generating circuits of the generator, with the field magnets alternately of opposite polarity, an outer cylindrical casing to which the magnets are secured and forming a magnetic circuit therefor, a revolving armature shaft, a series of unwound armatures, one for each pair of magnets, a hollow supporting body upon the armature shaft to which the armatures are peripherally secured, and centrifugal governor weights inclosed within the hollow body.

536,828. Supply System for Electric Railways. Albert C. Crehore, Ithaca, N. Y. Application filed July 22, 1893.

The last claim follows: In an electric railway system, an insulated main conductor, a series of exposed insulated contact plates arranged along one rail of the track, a similar series of contact plates arranged along the other rail of the track, both series normally disconnected from the main conductor, electromagnetic switching devices connected with each member of one side of the series, and normally open contacts operated thereby, and connected with each member of the other series.



NO. 536,748.

536,848. Electrolysis. Henry Blumenberg, Jr., Mount Vernon, N. Y. Application filed October 9, 1893.

The process consists in placing an electrolyte containing a haloid salt in a vat, electrolyzing the same setting free the halogen, under pressure at the positive electrode and the base without pressure at the negative electrode, conveying the halogen to a closed gas-holder or accumulator, under pressure, conveying the base into a tank, and tapping the halogen in the gas-holder, when desired, and conveying the same to the tank where the product is formed.

536,855. System of Electrical Propulsion for Railway Cars. Leon Dion, Natick, Mass. Application filed June 14, 1894.

A closed conduit having a cover or top made in sections insulated one from the other and formed of metal which is capable of electrical conductivity, but not susceptible to magnetic attraction, a main electrical conductor and an auxiliary conductor both inclosed within and insulated from the bottom of the conduit, the auxiliary conductor being super-imposed upon the main conductor and composed of members or portions of conducting material, the connected members or portions of the auxiliary conductor being susceptible to magnetic attraction.

536,856. Shade for Incandescent Lamp Globes. Leon Dion, Natick, Mass. Application filed June 14, 1894.

The combination with an adjustable closed globe, or bulb, for an incandescent lamp, of a continuous, concavo-convex shade adjustable at different angles upon the globe and having a flange concentric with and projecting nearly at a right angle from its concave face, the inner surface of the flange having an annular elastic cushion near its edge to bear against the bulb, which partly enters the flange.

536,857. Means for the Insulation of Conductors of Electricity. Leon Dion, Natick, Mass. Application filed December 6, 1894.

This insulation consists of a waterproof sheath, a conductor arranged therein, and glass balls interposed in and filling the space between the sheath and conductor.

536,871 Electric Double Semaphore Block Signal. Nathaniel O. Goldsmith, Cincinnati, Ohio. Application filed March 24, 1894.

This device consists of two or more track circuits each operating an armature and magnet, two signal circuits each having terminal connections made through the armatures, signal mechanism operated by the circuits whereby the signals are each controlled by trains on each sub-section and adjacent sub-sections.

536,872. Electric Block Signal. Nathaniel O. Goldsmith, Cincinnati, Ohio. Application filed March 24, 1894.

The first claim is for an electric railway block system, consisting of a series of insulated sections of rails, an open track circuit for each section adapted to be closed by the train, a magnet and its armature in each track circuit, two or more terminals on the armatures, two independent signal circuits connected through the terminals, and signal moving mechanism operated by the signal circuits and adapted to move the signals one step by the closing of one of the track circuits.

536,914. Telephone. Fred H. Brown, Chicago, Ill. Application filed October 17, 1894.

In a receiving telephone, the combination is claimed with a suitable casing and a diaphragm, of a centrally located permanent magnet projected into the casing with its pole adjacent to the diaphragm, and a semi-circular permanent magnet arranged within the casing with its body and poles remote from the other magnet, so that the interior magnet is charged with the same polarity as the contacting pole of the other magnet.

536,915. Supply System for Electric Railways, John M. Byron, New York, N. Y. Application filed June 16, 1894.

The first claim follows: In an electric railway, the combination, with the main-line wire, and a trolley rail composed of sections insulated from each other, and a trolley contact arranged between the sections, of the switch, consisting of oppositely-arranged magnets, a pivoted double armature, a sector-shaped arm, pendant from the armature and swinging with it, and having a portion of its arc insulated, two switch contacts on which such arc slides, and electrical connections between all the aforesaid contacts and other parts mentioned.

536,918. Closed Conduit System for Electric Railways. Edwin D. Chaplin and Leon Dion, Natick, Mass. Application filed June 14, 1894.

The chief features claimed are a conduit or subway entirely closed at all points, a main conductor or feeder, arranged therein, and an auxiliary conductor consisting of a series of strips or filaments having conductivity and susceptible to magnetic attraction, their ends being overlapped and connected by a slot in one and a tongue and cross-head on the other.

536,920. Telephone System. Frank R. Colvin, New York, N. Y. Application filed December 20, 1894.

A plurality of subscribers' circuits leading to a common station, a call-receiving instrument in each subscriber's circuit, a direct current transmitter and telephone receiver adapted to be cut in at each subscriber's station, connectors at the common station for coupling two subscriber's circuits in series relation to each other, and a source of continuous current between the connectors for charging the transmitters.

536,923. Safety Device for Electric Railways Having Sectional Conductors. Leon Dion, Natick, Mass. Application filed June 14, 1894.

A car taking current from a series of contact plates, an electrically operated signal, and contact devices connected with the signal and adjustable toward and from the contact-plates, in order to follow the rearmost current collecting device.

536,926. Electric Clock-winding Mechanism. Martin V. B. Ethridge, Everett, and Joseph H. Eastman, Boston, Mass. Application filed April 28, 1894.

Claim 1 reads: The combination, with a time train, of a motor, an electric circuit including an electro-magnet, an armature controlled by the magnet, a circuit controller composed of a hermetically closed tube mechanically connected with the armature, a gravitating circuit closing and breaking device, and circuit terminals within the tube, and mechanical connections between the motor and the connected armature and circuit controller, through which the motor is set for action by the armature when the circuit is closed, and the circuit controller is caused to close the circuit when the motor is expending its force.

536,952. Conduit Electric Railway. Tyre C. Hughes and Arthur W. Adams, St. Louis, Mo. Application filed February 12, 1894.

A conduit, a working conductor therein normally held out of electric connection with the supply conductors or feeders, and a switch for making and breaking the connection between the working and supply conductors; with a flexible cord connecting the working conductor and the switch.

536,963. Dynamo-electric Machine. James F. McElroy, Albany, N. Y. Application filed July 24, 1894.

A disk composed of two like halves, each consisting of a segment having windings crossing diametrically and returning peripherally, and an armature shaft secured to the segments are claimed.

536,967. Trolley Support for Electric Railway Cars. Emil B. W. Reichel, Charlottenburg, Germany. Application filed October 25, 1894.

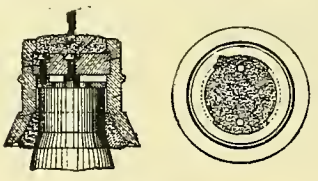
A support for a contact device of an electric railway car comprises an arm swinging at its lower end upon a horizontal pivot, which pivot is vertically movable and is provided with means for pressing the pivot upwardly.

536,973. Brush Holder for Dynamo-electric Machines and Motors. Gustaf Valley, Cleveland, Ohio. Application filed December 15, 1894.

A brush holder for dynamo-electric machines and motors comprising in combination the recessed body and brush sliding therein, a brush-feeding arm pivoted to the holder body and carrying a follower which bears against the brush, a guide-pin pivoted to the feeding arm and engaging an opening in the holder body, and a spring interposed between a rigid part of the holder body and a lug or shoulder on the guide-pin.

536,974. Electric Organ Coupling Mechanism. Edwin S. Votey, Detroit, Mich. Application filed April 7, 1894.

The last claim reads: In an organ coupler, a set of independent spring bars, a corresponding set of independent contact bars, electrical conductors connecting the organ action with the contact bars, a battery in circuit with the conductors, electrical conductors independently connecting each of the spring bars with the battery, a key connected with the set of spring bars to simultaneously make and break electrical connection between each of the spring bars and its opposing contact bar, and a switch located in one of the conductors connecting the spring bars with the battery whereby the circuit through one of the spring bars may be opened or closed at the will of the operator while the circuit through the remaining spring bar is closed.



NO. 536,792.

536,975. Electrically Controlled Magnet and Valve for Pipe Organs. Edwin S. Votey and William D. Wood, Detroit, Mich. Application filed April 7, 1894.

An electrical magnet having in combination a metal base provided with inlet and exhaust orifices communicable with each other, an armature to control the communication, a core and its windings to operate the armature, and a thimble having a threaded engagement with the base, to hold the core and its windings in connection therewith.

536,977. Electro-magnet for Pipe Organs. Edwin S. Votey, William B. Fleming and William D. Wood, Detroit, Mich. Application filed April 7, 1894.

An electrical magnet constructed with a metal cup or base provided with communicable channels and with a flange or seat toward one end thereof, an armature controlling the communication of the channels, a magnet core and its windings having its poles united by a closed plate seated upon the flange, and a metal cap engaged with the cup over the plate to hold the plate to its seat.

536,978. Electro-pneumatic Stop Action for Pipe Organs. Edwin S. Votey, William B. Fleming and William D. Wood, Detroit, Mich. Application filed April 16, 1894.

In an organ, the combination with a stop action magnet box provided with a pneumatic, a supply duct and a duct leading to the pneumatic, of an electrical magnet constructed with channels communicable one with another therethrough, an armature to control the communication, one of the channels communicating with the duct and the other channel communicating with another duct.

Western Electrician.

EVERY SATURDAY.

Vol XVI. CHICAGO, APRIL 20, 1895. No. 16

## Distribution of Power from Niagara.

By Frank C. Perkins.

With the announcement that the first 5,000 horse power dynamo at the generating station of the Niagara Falls Power company is soon to be electrically tested, comes the not less interesting information that several of the corporations that intend to take current from this plant are rapidly completing their arrangements and that they will in all probability be in readiness as soon as the work at the power house is far enough advanced to permit starting up part of the machinery. Prominent among these are the Pittsburg Reduction company and the Carborundum company, exterior views of the works of both being shown in Fig. 2.

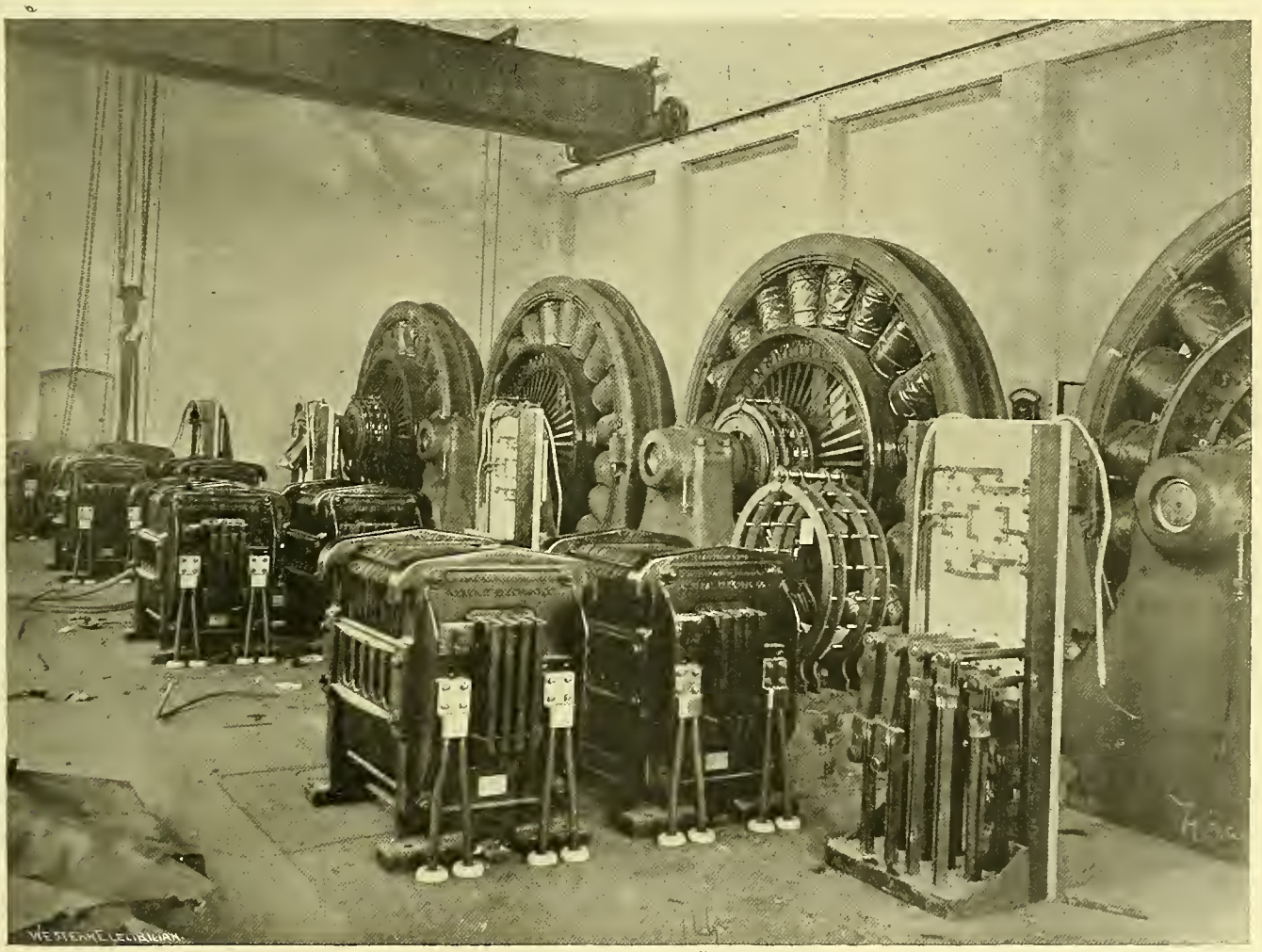


FIG. 1. DISTRIBUTION OF POWER FROM NIAGARA.—GENERAL VIEW OF TRANSFORMER ROOM, SHOWING ROTARY AND STATIONARY TRANSFORMERS, ALTERNATING CURRENT SWITCHBOARDS AND TRAVELING CRANE.

The Pittsburg Reduction company will occupy the large building in the background, while the Carborundum works will be located in the brick building shown in the foreground. The latter company will need 1,000 horse power at the beginning, and its plant will be enlarged as soon as additional power can be secured from the Niagara company.

Just now there is an air of mystery about the power house, owing to the fact that no one can obtain admission, except employes, without the consent of the Construction company. There are orders on the door to this effect, and it is useless to try to gain admittance without a passport, unless in company with an official. This state of affairs is the result of orders received from the New York office some weeks ago. Those in charge of the work now are W. I. Breckenridge, chief engineer of the Cataract Construction company; L. B. Stillwell, electrical engineer of the Westinghouse company, and Superintendent Hand of the I. P. Morris company. The test will be in charge of Engineer Stillwell and it is to be a thorough and practical one. There are many minor parts of the dynamo yet to be attached. A thorough mechanical test was recently made in the presence of a number of the stockholders, and the result, it is reported, was satisfactory in every respect. This has been erroneously reported as an electrical test. As yet no electrical test has been made, and it is announced that considerable time will be required to complete the arrangements for it. Work on the second dynamo has been started; portions of the other two machines are arriving daily and all of the parts are expected in a few days. Between 20 and 30 men are now engaged in construction work at the power house. Several changes in details have been determined upon. The plans of the switchboard have been materially changed and it is now said that instead of having a regular upright switchboard mounted upon the switchboard room or platform, the electrical instruments and controlling mechanism for the switches will be mounted and operated from tables or standards upon the switchboard platform.

The principal object of this article is to show what progress has been made in the preparations for utilizing the power to be generated at the Falls. It may be said that of all the manufacturers who have contracted for electric power none has taken as bold steps to utilize the current, nor invested capital as lavishly, as the Pittsburg Reduction company. This company has now installed apparatus for utilizing about 2,000 horse power, with provisions made for duplicating the present capacity, making a total of 4,000 horse power.

### PITTSBURG REDUCTION COMPANY'S ELECTRIC PLANT.

The transformer plant of the Pittsburg Reduction company is about complete and ready to receive current from the generators at the power house.

At present this plant consists of four rotary transformer of 500 horse power each, and eight static transformers. The illustration on this page, Fig. 1, gives a good idea of the general arrangement of the interior of this plant, showing the rotary transformers, the static transformers and the switchboards. The traveling crane used for assembling the heavy parts of the electrical machines may be seen in the background. The transformer room is 87 feet long and 50 feet wide and at present there are installed on the right side the four rotary transformers, eight static transformers and two switchboards—one direct and one alternating—for each rotary transformer. A duplicate plant of the same sized machines may be installed on the left.

The cables from the power house are laid in a subway Fig. 3, and are four in number. They are laid upon the wooden floor of the subway without insulators, the only wires run on the iron supports being those used for telephone purposes. The high-tension cables are lead covered and were furnished by the General Electric company. They are 1¾ inches in diameter, outside measurement, and the conductors in these cables are each of 950,000 circular mils. The cables enter the transformer house pit through a somewhat smaller connecting subway. The alternating current at 2,000 volts, as received from the main cables of the Niagara Power company, is conducted through the small subway and pit under the stationary transformers and air blowers by four sets of cables, two in multiple. These cables are lead covered and are $\frac{17}{32}$ inch in diameter and are composed of strands of No. 17 wire. They were furnished by the General Electric company. They lay on the floor of the pit, which is three feet deep and eight feet wide. These high tension cables are con-

nected to the static transformers after passing the double-throw switches just above the pit. The connections to the transformers and switchboard in the pit are very large, and the view of the pit and these connections, which are very interesting, may be seen in Fig. 4. In this view may be seen also the porcelain supports attached to the iron framework and the heavy alternating low-tension bus-bars, the small, high-tension cables at the right, and the large cables at the top passing through porcelain tubes to the stationary transformers above.

*Transformation to Direct Current.*

The two-phase alternating current at 2,000 volts is transformed by static step-down transformers to 115 volts. The alternating current is then conducted to the collector rings of the rotary transformers at 115 volts, and is converted into a continuous current at 160 volts potential. It is then ready for use in the reduction of the metal aluminum. For this purpose a continuous current is necessary.

*Direct Current Conductors.*

The rotary transformers are connected in parallel on the direct current side. The direct current bus-bars are six inches by one-half inch, increasing as the machines are added to six inches by one and one-half inches. It is intended that ordinarily only three machines will be used, the fourth being held in reserve, although all may be connected and used to deliver fully 10,000 amperes at 160 volts at full load if desired.

*Alternating Conductor Pit and Switchboard.*

Alternating current of high tension is conducted to the alternating distributing switchboard, a front view of which is given in Fig. 5 and back view in Fig. 6. The upper part of the switchboard controls the high-tension alternating current and the lead covered high-tension cables may be seen hanging over the top of the switchboard in Fig. 7, as they have not yet been connected. On the high-tension circuit there are to be connected four General Electric high-potential alternating current ammeters reading about 150 amperes. Potential indicators are to be mounted on the switchboards which simply note whether the voltage is high, low or normal.

The high-tension alternating current leaving the switchboard enters the static transformers at 2,000 volts and is delivered again to the switchboard at 115 volts. The alternating low-tension bus-bars are mounted on porcelain insulators in the pit. The connections to transformers and switchboard below in the pit may be seen in Fig. 4 and on the lower part of the alternating switchboard in Fig. 6. This pit contains all the alternating conductors, cables and bus-bars for both the high and low-tension circuits. The low-tension alternating current bus-bars are arranged with four

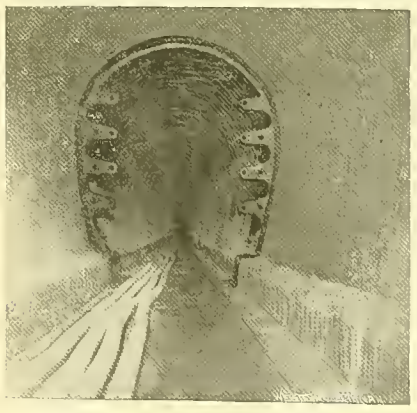


FIG. 3. DISTRIBUTION OF POWER FROM NIAGARA.—SUBWAY, SHOWING HIGH-TENSION CABLES ON FLOOR AT THE LEFT.

sets, two in multiple, and consist of copper bars four inches by one-half inch.

It has been announced that there will be no magnetic or fusible cut-outs used on either the direct or alternating circuits in the transformer house. An antomatic cutout will be employed on the main circuit at the power house to protect the machines.

*Static Transformers.*

There are two static transformers for each rotary transformer, making a total of eight stationary transformers, and they are specially designed to meet the required conditions. These transformers are expected to have an efficiency of 97 per cent. at full load and a variation in temperature not to exceed 40 degrees C. above the temperature of the room under continuous working conditions. These converters have iron cores 27 inches by 39½ inches by 53 inches and each has a capacity for 200 kilowatts. The transformers are installed directly over the alternating conductor pit and occupy a floor pace of 36 inches by 52¾ inches.

*Blowers for Ventilating the Static Transformers.*

The ventilation of these transformers is accomplished by the use of the air blast. The blowers, two in number, are operated by electric motors. Each blower has an electric motor coupled directly to the blower shaft. The blowers are mounted over the conductor pit at one end of the transformer house and the air is forced into the pit, which is sealed air-tight, except at the base of the converters. The bed plates of the converters are perforated and the amount of air admitted to the transformers is controlled by dampers or slide valves. The air is thus forced upward through the transformers into the transformer room at a pressure of about one-half ounce to the square inch. In order to accomplish this thorough ventilation, the transformers, as shown in Figs. 1 and

FIG. 2. DISTRIBUTION OF POWER FROM NIAGARA.—PITTSBURG REDUCTION COMPANY'S AND CARBORUNDUM WORKS.

6, are built up of laminated sheets in the usual way, but instead of being bolted into one solid mass the laminations are divided up into sections through which the air is forced from the pit below.

*Test of Static Transformers.*

The cables connecting the alternating low tension secondary of the static transformers to the lower part of the alternating switchboard have a section of 1,500,000 circula mills. The double-throw switches for both high and low alternating current may be seen in Fig. 5, and the peculiar heavy connections may be seen on the back of the switchboard, Fig. 6. From a test of the static transformers made at Lynn it was found that by the aid of the air blast the temperature of the converters reached a maximum of 61 degrees C. after a nine hours' run; while the maximum reached without the air blast was 92 degrees C. after seven hours.

*Alternating Side of Rotary Transformers.*

Alternating current of low tension at 115 volts after passing the double-throw switches het alternating current switchboard is conducted by four sets of cables, two in multiple, to the collector rings of the rotary transformers. These cables are 1⅝ inches in diameter, and the conductors each have a cross-section of 1,000,000 circular mills. The collector rings, four in number, receive the current from 56 brushes and conduct the same to the transformer armature coils.

*Direct Current Side of Rotary Transformers.*

Coils, in which the direct current is generated, are wound on the same armature and the current is taken from the commutator by 60 brushes. The spider and commutator and direct current side of the rotary transformers may be seen in Fig. 7. The cut shows that the transformer is very large and it also gives a side view of the direct current switchboard at the right. The armature makes 150 revolutions per minute and is driven as a quarter-phase motor having 400 kilowatts capacity. The rotary transformer has twenty poles, which may be best appreciated by reference to the illustration, Fig. 6. These machines stand 11 feet 6 inches high and the base of the transformer occupies a space 13 feet 6 inches by 9 feet 10 inches. The diameter of the armature is 90 inches and the magnet frame, as will be seen in Figs. 6 and 7, extends considerably below the floor line.

*Regulation and Efficiency.*

The regulation and efficiency of the rotary transformers are no doubt very high, and the efficiency of the static transformers should be 97 per cent. The regulation is also expected to be very high, five per cent. being the maximum variation in electromotive force. It is said that 94½ per cent. is the guaranteed efficiency of both rotary and static transformers combined.

*Direct Current Switchboard.*

From the direct current brushes the current is conveyed to the direct current switchboard, illustrated in Fig. 8 and also seen in Fig. 7, showing connections on the back. After passing through the heavy main switches and Weston ammeters, the direct current at 160 volts pressure is conducted to the bus-bars in the direct current conductor pit. These bus-bars are one-half inch thick and six inches wide and conduct the current to the cables or conductors leading to the aluminum pots, its final destination. The Weston ammeters for measuring the direct current are mounted on the switchboard at the top and read to 3,000 amperes. The potential indicators were built by the General Electric company and simply note whether the voltage is high, low or normal.

No data or illustrations of the aluminum pots and furnaces for the reduction of the metal from the ore, or views of the interior of that portion of the works containing the same could be obtained, as the company wishes to keep that part of the work secret.

OTHER PROJECTS.

In addition to the contracts already alluded to, there are many more schemes on foot based upon the supposition that power can be produced cheaply from the Falls company. Of these several have reached a stage where the projectors and advocates are making definite plans, but there are of course numerous other schemes that have not yet assumed tangible shape.

*Niagara Falls Electric Lighting Plant.*

The Buffalo and Niagara Falls Electric Light & Power company, a view of whose station is given in Fig. 9, is now supplying current for the arc and incandescent lights and electric motors for the city of Niagara Falls. The total power used is from 300 to 500 horse power. This company will undoubtedly contract for power with the Niagara Falls Power company, if satisfactory terms can be made. At present a Reynolds-Corliss engine is used, the size being 22 by 48 and developing 260 horse power at 125 pounds steam pressure and at 95 revolutions per minute. A 100 horse power Rice automatic engine operates the day load for light and power circuits. There are in use at present about 280 street arc lights, 40 private arc lights and 1,000 to 1,500 incandescent lights. Brush arc light apparatus is used and Brush and Westinghouse alternators for the incandescent lights. No doubt the rates for current in the city of Niagara Falls will be reduced if the proposed plan is adopted.

*New York Central Railroad Plant.*

That the New York Central Railroad company has decided to use electricity generated at the Falls for operating trains between Buffalo and Niagara Falls is now a certainty. The *Buffalo Express* says: "The present road will be equipped with a monster trolley system and motor cars will be procured of such power that trains of the latest and best in passenger coaches may be drawn over the line with no decrease from the present rate of speed, though comfort in travel will be enhanced and fares will be reduced. Orders have been issued to begin the work at once and it is

FIG. 4. DISTRIBUTION OF POWER FROM NIAGARA.—ALTERNATING CURRENT CONDUCTOR PIT, SHOWING CONNECTIONS TO SWITCHBOARD AND BUS-BARS.

expected the line will be ready to care for a large part of the heavy summer traffic. Trains will be run between the Exchange street station and the Falls at frequent intervals and stops will be made at the usual stations. It is not known that the Central intends to apply the new system to transporting freight, but the local passenger service is to undergo a complete change from steam to electricity." There is no doubt that power from the Falls will be utilized for the purpose of operating these trains.

*Buffalo Water Works to Use Electric Power.*

The subject of making a contract with the Niagara Falls Power company to supply current to Buffalo is now under discussion by the city council, and is said to be about decided. A sub-committee has been appointed to draft an electric power franchise. The meetings of the street committee are now held in secret and the details of the discussion are withheld from the public, but the following statements obtained and published by the *Buffalo Commercial* are of special interest, as they relate to a rate of $20 per horse power which the city wishes to pay for electric power to operate the pumps at the city water works, and a rate to the Buffalo General Electric company, so that the city may

obtain arc lights at $50 per annum, while at present the rate is about $127 per horse power per annum. It says:

The action taken at the session may be summarized as follows: A franchise was favored. Fifteen years was fixed as the time limit. The right was reserved to buy the plant at appraisal at the expiration of the grant. It was decided that the city should pay $50 per annum for each arc light, and $20 per horse power per annum at the water works. These were the primal recommendations of the joint committee to the sub-committee appointed to frame the bill together with the corporation counsel.

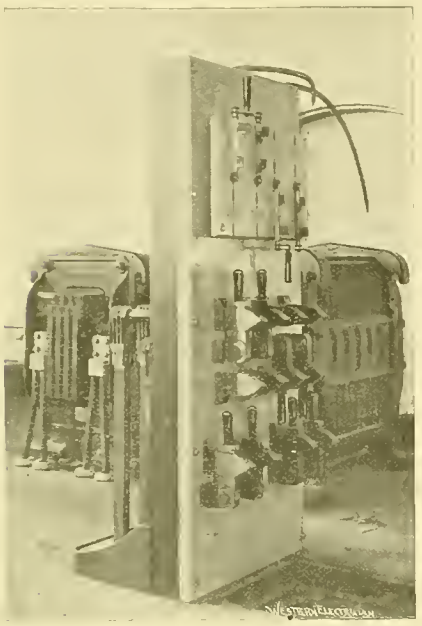


FIG. 5. DISTRIBUTION OF POWER FROM NIAGARA.—FRONT VIEW OF ALTERNATING CURRENT SWITCHBOARD, SHOWING DOUBLE-THROW SWITCHES.

In addition to the foregoing recommendations, there were subsidiary discussions regarding the amount of power to be delivered, the fixing of a flat rate and the influence of locality on price. These matters were left to the sub-committee, as no decision was reached.

The method of transmission of the power was discussed and the suggestion was offered that the conduits could be laid beside the Belt Line tracks and thus circle the city without material interference with the street system.

The quantity of the electric power was the next problem. A stipulation of 10,000 horse power a year for the next three years was suggested, but the question was left to a sub-committee. Another suggestion was that a clause be inserted in the franchise, stipulating that at the expiration of ten years or such a time as the income should overbalance the necessary expenditure, the company should pay 2½ per cent. of its gross earnings to the city, as in the case with the street railroad company. By such a provision it was argued the taxpayers would derive a direct benefit from the corporation. The motion, however, was defeated by a considerable majority.

The plant, it was determined, should be constructed and operated in such a manner as to secure life and property; the work to be under the direction of the Board of Public Works with the approval of the Common Council and subject to modification at any time, and the company agreeing to indemify the city against any and all damage.

The effect of locality on the price of power, owing to a wide diversity of opinion, was also relegated to the sub-committee.

The price of arc lights and cost of power for the water works was then discussed and $50 per light and $20 per horse power were the figures that the sub-committee were recommended to draft.

## Electric Mail Cars for Boston.

Arrangements have been made between the postal department of the government and the West End Street Railway company of Boston for the distribution of mail between the central postoffice and sub-stations of Boston by electric cars. The details of the arrangement were completed last week by President Little of the West End company and General Neilsen, representing the Postoffice Department. The service will go into effect May 1st, at which time many of the mail teams will be dispensed with. By this arrangement Boston will have the longest street car service of any city in the United States now carrying United States mails, the number of miles to be run being about 390. The cars to be run will be especially fitted up as railway mail cars. Three cars will be devoted entirely to this service and four will be apartment mail cars.

## The Telephone Question.

Although the plans of the Standard Telephone company, as published in the WESTERN ELECTRICIAN last week, were the general topic of conversation among electrical and financial men, little was added to the details of the story as printed. It is the general impression that an arrangement will be made with the Postal Telegraph company by which the new corporation will be given valuable assistance. It is announced that the new company will at once take offices in the Postal building in New York, which will be the headquarters of the corporation. Mr. Mackay, of the Postal company, is one of the stockholders in the concern. Mr. Barnes confirms the statement that the capital of the company is all paid up, and that there are fifty different companies chartered and organized. He says further: "We have over two hundred prominent capitalists in the United States interested in the company. We propose to commence our service this summer in New York with a rate of $3 a month for telephones. We have purposely kept the matter very quiet for nearly three years until we had secured the franchises we wanted. One of the counsel, the Hon. C. H. Aldrich, who is the counsel, also, for Milo G. Kellogg, who controls the only switchboard that can be used against the Bell patents, is now in this city with his client conferring with our people."

Director Felix Rachemann, of Balch & Rachemann, Boston, said, speaking of the new telephone company:

"There are some surprises in store. I may say that, though the agreement that President Barnes shall be the official spokesman of the corporation prevents me from entering into details. Those who believe the telephone has reached its limit of development are making it an exception to all other mechanical appliances, when there is no reason

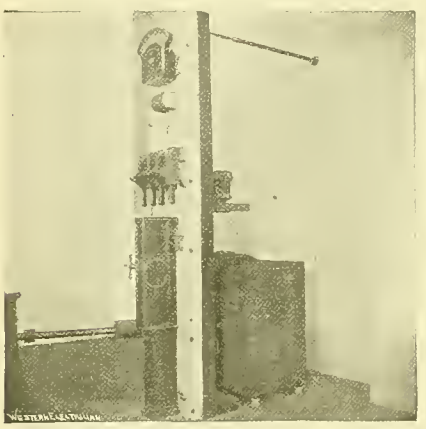


FIG. 8. DISTRIBUTION OF POWER FROM NIAGARA.—DIRECT CURRENT SWITCHBOARD.

for supposing it has reached perfection any more than scores of other good things."

"Will there be any increase of capitalization by the parent company."

"I hardly think so. That stock, I imagine, will be held somewhat closely, as some very rich men are among its stockholders—Rockefeller, Senator Jones of Colorado and others of large means and interests."

The Boston correspondent of the WESTERN ELECTRICIAN says:

"Here in Boston there is very little information from what may be considered an authentic source in relation to the new Standard Telephone company, and those who are interested say that there is really not much to be given out just yet. John W. Candler, the ex-congressman, who is named as the president of the Eastern Standard Telephone company, is not in town, but it seems certain that he is interested in the company. Stillman F. Kelley, who was named in the dispatches received in this city from New York to-day, knows nothing about the new company except that he was asked to become a director and he agreed to consider the matter when the company was further along toward materialization. At the Bell Telephone company's office Allen T. Nye is almost an unknown name, although to-day's story from Chicago stated that Mr. Nye made a prolonged fight against the company some ten years ago. The company's records make no such mention of any such suit. If Mr. Nye is an inventor of telephones, his patents must be comparatively new, as his name does not appear in the index of the Patent Office from 1871 up to a very recent date. At the office of the commissioner of corporations for Massachusetts nothing is known about the company, and under Massachusetts law it will be impossible for the company to be incorporated with a capital of over $1,000,000 in this state without a special act of the Legislature. One of the Boston men interested said that he did not know where the papers of incorporation were taken out, nor what special patents the new company had. The quotations on Bell stock show that there are some who believe that the new company will become an actuality and a strong rival of the Bell company. Trading in Bell telephone was the feature in the stock market in Boston to-day, and it opened at ¼ lower, at 187, slipping down by points and fractions until 182, its closing figure, was reached. This is a net loss of about $10 a share since last Monday. Local transactions in the stock were 2,652 shares, as compared with 780 shares on Friday. Erie telephone was sympathetically weak but not to any such extent as Bell, losing only ½ to 53."

Speaking of the new corporation and its promoter, the Syracuse, N. Y., *Post* says:

Interest in the new telephone company which will contest with the Bell syndicate for business all through the country centers in and about Syracuse. Allen T. Nye is the promoter of the enterprise. His inventions will be used by the company, and he has a big interest in its formation. Nye came from Clyde, Wayne county, and lived here for many years. He was the promoter of the Overland Telephone-Telegraph company, which never developed and whose scrip is still held in the safes of many who held interest in the concern.

The names of the legal advisers of the new company are not all furnished, but it is known that it is largely acting under the advice of Marcellus Bailey of Washington, who drew the specifications for the original Bell patent, and who is, probably, with Hon. Charles H. Aldrich, ex-solicitor general of the United States, who was so prominently identified with the so-called Berliner patent case before Judge Carpenter, one of the best informed counsel in regard to telephone matters in the United States.

Mr. Aldrich, who has been in New York for some time doing the legal work for the company, gave a comprehensive account of its plans to a *World* reporter.

"The impression prevails," said he, "that the Bell company controls patents without which no telephone service can be operated. That is a great mistake. It has not been the patents, but the capital of the Bell people that has given them their power. The Standard company controls about twenty-five patents that will place it in as good a position as the Bell companies for furnishing service.

"We have been busy for two years on our plans for placing in the field a rival to the Bell monopoly, and it is only now that anything at all has come out. Our plans will not be fully known for two months, by which time we expect to have begun work in New York—that is, the laying of wires and the construction of our building."

A dispatch from Boston, dated April 5th, says: "By a vote of 47 to 70 the House of Representatives refused to-day to reject the bill taxing the American Bell Telephone company on its shares held in foreign sub-companies."

## Cheaper Telephones in New Hampshire.

According to a dispatch from Manchester, N. H., the big rival to the Bell Telephone company in that city has four canvassers out in the interest of its system. The company is known as the Citizens' Telephone company of Manchester and is incorporated. It is said to have a capital stock of $10,000,000. The company will supply telephones at a rate below what is now paid. The contracts, which have been passed among business men about the city, agree to furnish a telephone at a place of business for $30 a year and at a residence for $20. These telephones are to be of

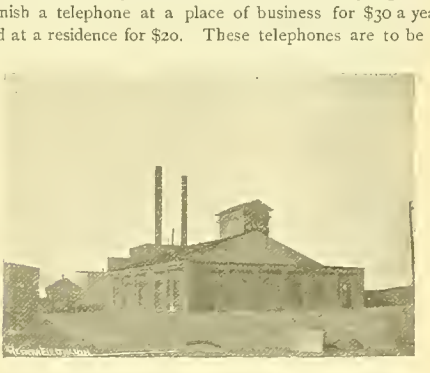


FIG. 9. DISTRIBUTION OF POWER FROM NIAGARA.—BUFFALO AND NIAGARA FALLS ELECTRIC LIGHT & POWER COMPANY'S STATION.

modern construction, with all the recent improvements. No charge is to be made for rental until 300 'phones are engaged in the city. The contract that is passed about is for four years. The incorporators of the concern are reticent as to their plans and backing, but it is believed they represent the new Standard Telephone company.

## More Competition in Wisconsin.

Advices from Milwaukee announce that a new telephone company to work in that city and throughout Wisconsin was formed April 10th. It will use the automatic patents of the Strowger Automatic Telephone company of Chicago. It will incorporate under the laws of Illinois and will be

known as the Automatic Telephone company of Wisconsin. It will have a capital of $500,000, all of which has been subscribed for by ten Milwaukee capitalists. J. Harry Theobold of Chicago will be the manager of the new company The company promises to be in operation in less than a year and announces that it will put in telephones at a rate of $20 to $25 per year.

## Brooklyn Aldermen Favor Competition.

The Brooklyn Board of Aldermen last week, by a decisive vote, overrode two vetoes of Mayor Schieren directed against the New York & Eastern Telegraph & Telephone company, which has been trying for over a year to get a foothold in that city. One veto was of a resolution giving the company permission to connect its wires with the city hall, municipal, and other public buildings, and the other of a resolution giving the company the special privilege of stringing its wires on the poles of the Fire Department. Mayor Schieren based his objection to the action of the aldermen on the ground that the company had not got the consent of the subway commissioners. Both vetoes were set aside by a vote of 13 to 5. One alderman intimated that there was a big organized monopoly behind the opposition to the new company, the subway commissioners having even refused to obey an order of the Supreme Court which was in its favor. It is said that some influential Republican politicians are behind the New York & Eastern company.

## Marked Difference in Rates.

[From the New York *World.*]

The Metropolitan Telephone company (Bell) of New York, which Wheeler H. Peckham says pays $50,000 a year for "peace," meaning, presumably, to avert hostile legislation at Albany, charges $175 and $240 for the use of an instrument. The Standard company's representatives say that when they charge $24 and $36 they will be making a good profit.

## Reductions Already Proposed by the Bell Company.

[From the *Boston Herald.*]

Perhaps the alleged new telephone company may turn out to be a powerful rival of the Bell and perhaps not. There's no doubt, however, that the prospective rivalry has led to rather sweeping reductions in the rates hitherto charged by the Bell company. This may or may not be occasioned by the fear of competition. It is satisfactory to the general public, all the same, and the increased use of telephones may make the reduction of rates equally satisfactory to the stockholders in the long run.

## Chicago Telephone Company's Departure.

By a new arrangement the Chicago Telephone company announces that it can supply telephones in residences at rates varying from $40 to $125 per year. The higher rate is for a long-distance instrument on a metallic circuit with the best service attainable. For $100 a grounded circuit is furnished. Party-line instruments are given at the following rates: Two instruments on a circuit, $75; three-instrument circuit, $70; four or more, $60. An "out" telephone is given at $40 per year. An "out" telephone, it may be explained, is one in a private residence by which the customer can call up and talk to any other subscriber, but which cannot, in its turn, be called up. In other words, for this compensation the company makes connections asked for over an "out" telephone, but does not undertake to supply the apparatus and service necessary to "ring up" this class of telephones. The party-line and "out" telephone service at comparatively low rates marks a new departure in the company's policy. In view of the active opposition to the Bell interests now manifest in all parts of the country, it might readily be assumed that the Chicago company had reduced rates in view of coming competition. General Manager Hibbard insists, however, that this is not the case. He says that the party-line service—which is now being tried on the North Side—is entirely new in Chicago, and that by reason of recent improvements, which permit of ringing four or more telephone bells successfully on one metallic circuit, it is possible to furnish facilities for conversation not quite so good as by independent circuits, but still satisfactory and much cheaper. When asked by a representative of the WESTERN ELECTRICIAN whether the commercial rate—$175—was likely to be reduced by the competition of other exchanges, Mr. Hibbard said that he thought not, as far as he could judge at present. He intimated that the company would bend all its energies toward the improvement and extension of its service. This, he thought, would please business men better than lower rates. What this class of customers desired, he declared, was not so much cheaper telephone rentals as more business coming in over the telephone. The company would endeavor to facilitate this enhancement of the value of each business man's telephone. The company certainly is in a better position than ever before, as far as perfection and effectiveness of apparatus is concerned. The total number of subscribers claimed is 11,000, and it is asserted that the Chicago Telephone company makes more connections in its main office than are made in any other exchange in the world.

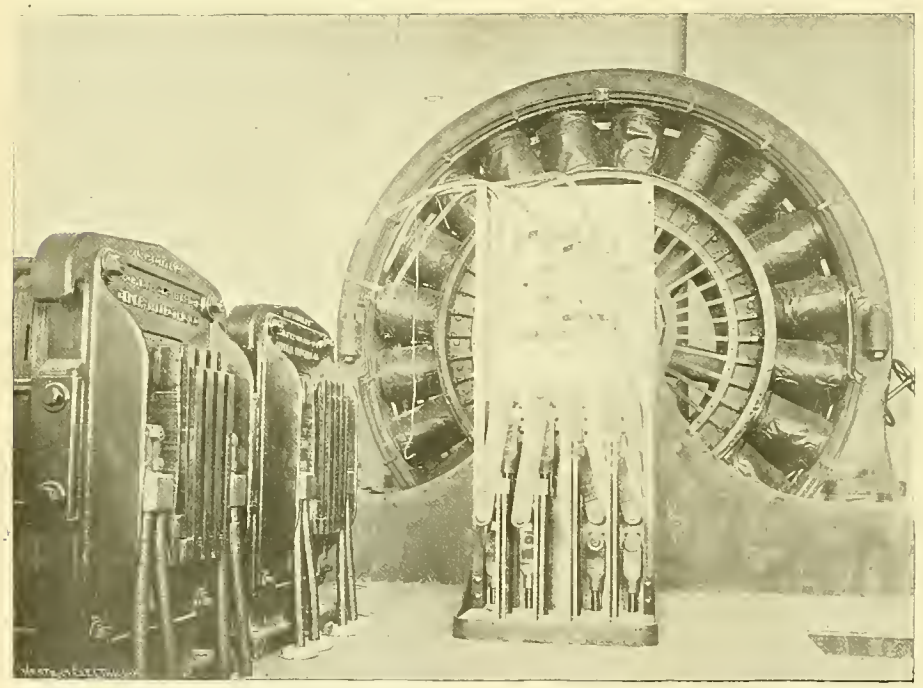


FIG. 6. DISTRIBUTION OF POWER FROM NIAGARA.—CONNECTIONS ON BACK OF ALTERNATING CURRENT SWITCHBOARD: HIGH-TENSION AT TOP, LOW-TENSION AT BOTTOM, STATIONARY TRANSFORMERS AT LEFT AND TWENTY-POLE ROTARY TRANSFORMER (ALTERNATING SIDE) AT RIGHT.

## Advertising Extraordinary.

A French journal says that M. Pierre Barton, the new director of the Comédie-Parisienne, has an advertising scheme which is both new and novel. A man wears a high hat and a peculiar head-dress. The latter is transparent, and contains a small lamp of four volts, fed by two small accumulators carried in the pocket. A switch in the man's hand permits of throwing in the current at will, and when a sufficient crowd is gathered he closes the switch, his hat is brilliantly lighted up, and the public can then read upon it the claims for public favor of the latest stage novelty.

The citizens of Carbondale, Pa., are about to organize a company for the establishment of a telephone exchange. Those who are prepared to furnish a complete and reliable system can obtain further information upon application to A. P. Trautwein, secretary of the Board of Trade.

## Death of George M. Phelps.

The news of the death of George M. Phelps, president of the *Electrical Engineer* company of New York and treasurer of the American Institute of Electrical Engineers, which occurred in Brooklyn on Thursday, April 11th, after an illness of five days, came as a sad shock to a large circle of acquaintances in the electrical fraternity of the West. Pneumonia was the cause of death, and so suddenly did the disease develope from a cold that first confined him to the house on the preceding Saturday, that his Chicago friends did not know that he was ill. By his long connection with electrical industries and by his genial manners and sociable temperament Mr. Phelps had won the cordial regard of that large proportion of the electrical men of the country with whom he was personally acquainted. He was well liked, and his death is sincerely regretted.

George M. Phelps was born in 1843 at Troy, N. Y. He was a son of the late George M. Phelps, and received a public school and high school education in his native city. Since 1861, excepting an interval of five years, he had been continuously engaged in electrical interests, first in the shop of the American Telegraph company, of which his father was superintendent from the organization of the company till its absorption by the Western Union company in 1866. From 1863 to 1866 Mr. Phelps served in the auditing department of the American telegraph company. From 1871 till 1879 he was assistant to his father in the conduct of the Western Union company's factory in New York. When, in April of the latter year, the Telegraph company gave up its own manufacturing and disposed of its factory to the Western Electric company, Mr. Phelps was appointed superintendent of the factory by the latter company, which position he held until December, 1885. Early in the summer of 1886 he joined Franklin L. Pope in conducting the *Electrician and Electrical Engineer*, then published monthly, and acquired a proprietary interest in that journal soon after. When the *Electrical Engineer* was expanded to a weekly and its business incorporated, Mr. Phelps became president of the corporation, retaining this position until his death.

The deceased was a charter member of the American Institute of Electrical Engineers, and was elected one of its managers on May 19, 1885. He served on the council in this capacity until his election as treasurer on May 17, 1887, to which office he had been re-elected each year, and which he held at the time of his decease. He had been nominated for the same office by the council for the term beginning May 14, 1895. He was a member for many years, and at his death, of the Hamilton Club, Brooklyn, and the Reform Club, New York.

The funeral services were held at 8 P. M. on the 13th instant, at the family residence, 91 Division avenue, Brooklyn. There was a large attendance of electrical men.

## Electrical Minneapolis.

W. E. J. Deming, electrical inspector of Minneapolis, makes the following brief and interesting report for 1894:

The total number of permits issued to do electric wiring was 369, at a cost of $39,562. The total number of inspections made during the year was 1,228, of which 986 were accepted on first inspection, and 242 were condemned and ordered changed.

| INSPECTION IN DETAIL. | | Accepted. | Condemned. |
|---|---|---|---|
| Generators inspected | 44 | 41 | 3 |
| Motors " | 121 | 114 | 7 |
| Arc lights " | 576 | 565 | 11 |
| Incandescent lights inspected | 17,010 | 16,990 | 20 |
| " wiring " | 687 | 586 | 181 |
| Aerial wires " | 340 | 167 | 173 |
| Electric heaters " | 28 | 13 | 15 |
| Transformers " | 66 | 56 | 10 |
| Searchlights " | 3 | 3 | .. |
| Cells storage " | 12 | 12 | .. |

The electric fires during the year were as follows:

February 6, at 319 Nicollet avenue, current left on electric sad iron over night; damage $331.25.

March 18, at the Glass block, short circuit on multiple series lights in show window, causing lamp to explode; damage $2,697.39.

May 15, at 15 South Third street, water dropping on Edison street tube; no damage.

December 8, at 20 Northeast Second street, 1,000 volt current on 50 volt wires; no damage.

Total number of fires four; total loss from same $3,684 62.

One man and one horse were killed from electric shock as follows:

July 19, M. C Finley, an electrician, while working at the Central Market fire, was killed from coming in contact with a live wire.

June 25 a horse was killed at Washington and Sixth avenue, South, through coming in contact with a live wire which had fallen in the street.

I would recommend that the ordinance by which this branch of the department of buildings is governed, viz., The electric wiring ordinance be rewritten, a new ordinance passed, and the present one repealed. The rapid development of the electrical industry since this ordinance was passed makes this an absolute necessity. The ordinance makes no provisions for installing electric heating or multiple series arc lighting, both of which have been put to extensive use during the past two or three years. I find myself frequently obliged to accept work done and require it performed which is not strictly in accordance with the ordinance, owing to more modern and better appliances and methods.

I would also recommend that if the council has the power, — and if not, the Legislature be asked for such power, to require all electricians to take out a license, and that before

such license is granted electricians shall be required to undergo an examination before a board of electrical experts and prove themselves competent to do general electric work before being licensed, and that permits be only issued to licensed electricians.

Not as much work has been done by the several electric companies toward complying with the underground wire ordinance as I had hoped early in the season. I am of the opinion that the suit which the city has against one of the electric companies for maintaining wires across the streets, supported on house tops, and a failure as yet to get a decision in this case is largely responsible for this state of affairs, yet no small amount of work has been accomplished. About one mile of poles and fifty miles of overhead wires have been removed from the subway district during the past season. In addition to this the several electric companies have laid about three and one-half miles of conduits and cables which are now being connected, and I have every assurance that within the next sixty days at the least four miles of poles and 300 miles of overhead wires will be removed from the district. The above is outside of what the city itself has accomplished. Largely through the efforts of this department the council made provisions for burying its fire alarm and police wires. This work has been done under the direct supervision of the fire and engineering departments at an expense of $12,203.30.

The work performed included the building of 12,050 feet of steel conduit, the drawing in of 21,497 feet of cable containing 145 miles of wire, and the removal from the streets of about one and one-half miles of poles and twenty miles of overhead wire. All of the city's wires inside the subway district are now beneath the surface of the streets.

In addition to my work as inspector I have attended seventeen council committee meetings at the request of the committees and drawn specifications for wiring new fire department headquarters; for placing fire alarm and police wires underground; for a new electric light plant for the city hall and for wiring the new court house.

There are in the city seventy-one isolated incandescent plants running 26,825 lights; and ten isolated arc plants running 714 lights. The total business of furnishing electricity in the city, outside of the street railway companies' business, for power, heat and light is as follows:

| | |
|---|---|
| Incandescent lights | 76,435 |
| Arc lights | 2,303 |
| Motors (830 horse power) | 218 |
| Horse power in electric heaters | 30 |

## Electrical Traction in Europe.

Without altogether threatening the existence of steam and other power upon the railroads and street railways of Europe, the employment of electricity continues to make steady and progressive strides, and seems now to have entered upon an era of more general utility as a motive power. So far, electricity has been restricted in its application by the question of cost, which, as a rule, it is claimed, enters more largely into the calculations of European companies than efficiency of service. During the last two or three years, however, a great deal of economy has been effected in the working of electrical installations, and the advantages of quicker running, cleanliness and ease of manipulation are no longer counterbalanced by increased expenses. In France nearly all the large provincial towns, such as Havre and Bordeaux, are being supplied with electrical cars, to which the electrical current is furnished by contact with overhead wires, but in Paris, where such a system is not permitted, the employment of electricity has been restricted by the necessity of using accumulators. This difficulty has been overcome in Budapest, where an extensive system of tramways is being laid down by Siemens & Halske of Berlin, by the placing of the conducting wires in a conduit running between the rails and having a narrow aperture through which contact is effected by a metallic brush. One line of tramcars has already been at work for several months past, and the economy realized over the old systems of traction is considerable.

Under these circumstances it is not surprising that the progress of electrical traction during the last year should have been very marked. The number of lines at work was increased in that time from 43 to 70, and the total length from 305 to 700 kilometers. The power of the generating stations, which in 1893 was 10,650 kilowatts, rose last year to 18,150 kilowatts, and the number of electric cars increased from 538 to 1,236. Germany heads the list with 366 kilometers of line. Hamburg alone has 180 kilometers and France comes next with 100 kilometers, England being third with 69.

Electric cars are now running in Bosnia, Portugal, Roumania, Servia and Sweden. Yet the progress, while being relatively considerable, is insignificant compared with what will be done in the future, now that the improvements in electrical mechanism have given it a decided advantage over other forms of power. At the present time 28 new lines are in course of construction, which will increase the total by more than 200 kilometers, and there is hardly a town of any importance where new projects for electrical tramways are not being considered.

In France engineers are paying especial attention to the application of electricity to the driving of trains, and different systems of electrical locomotives have been experimented with upon the three principal lines for a long time. The only one that has so far given satisfactory results, and which is claimed indeed to have overcome all the difficulties in the way of adapting the new power upon the railroads, is the Heilman locomotive, which has been fully explained in the WESTERN ELECTRICIAN.

It is claimed that if the law did not set a limit upon the speeds at which trains may be run, the electric locomotive could be driven at close on 100 miles an hour. During the progress of the trials, certain minor defects were noticed, which necessitated the locomotive being taken off the line, but it is now said that in the coming season it will be put into service between Paris and Dieppe. Upon the canals, likewise, electricity is being employed to an increasing extent.

An ingenious system, invented by M. Armand de Bovet, has lately been tried with so much success that one of the largest transport companies is about to adopt it for the propulsion of boats. In the ordinary chain boat about 40 meters of chain are wound round the two drums to give the necessary adherence, and the friction thus taking place very often results in the breaking of the chain, to say nothing of the many other inconveniences and dangers resulting from the loose chain that is cast off when the boat arrives at the end of its journey.

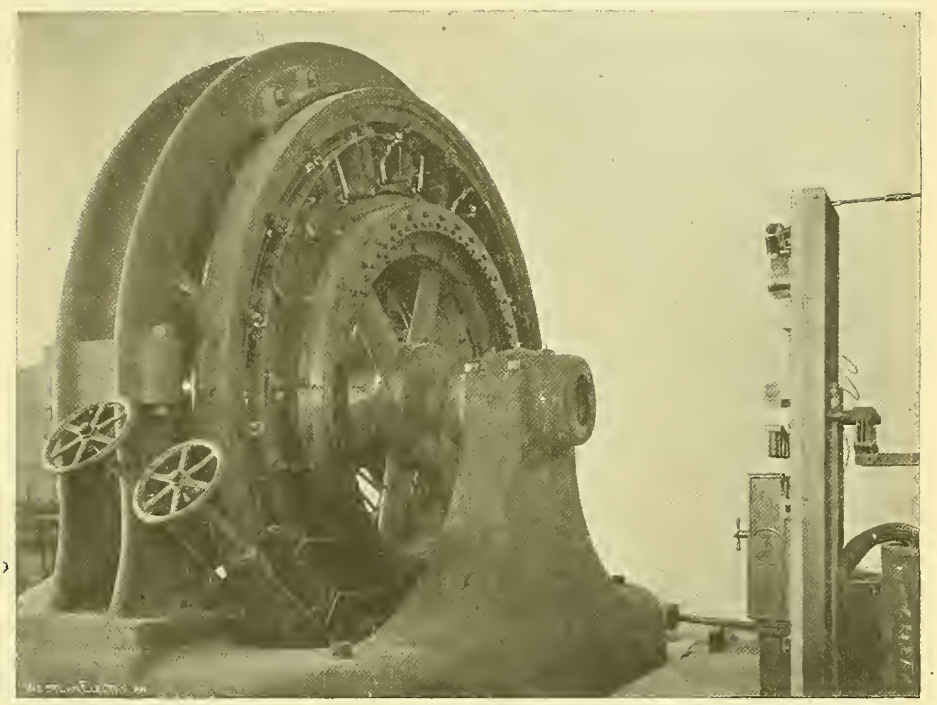


FIG. 7. DISTRIBUTION OF POWER FROM NIAGARA.—DIRECT CURRENT SIDE OF ROTARY TRANSFORMER, SHOWING COMMUTATOR SPIDER AND DIRECT CURRENT SWITCHBOARD.

## The Contest in Connecticut.

[From the New York *Sun*.]

The struggle between the electric or trolley railroads and the steam railroads in Connecticut has become very sharp in the State Legislature. The steam people are fearful of the competition of the electric people, fearful that the latter will take the greater portion both of the passenger and the freight traffic, and hence they oppose the granting of charters to them. The electric lines can carry both passengers and goods more cheaply than the steam lines, and they have greater facilities for stoppage at places along their route. It it be so, we do not see how the steam people can hold out against their electric competitors for any great length of time. We do not believe that any legislature can interfere very long with the operation of economic laws or forces.

It may be hard upon the steam railroads to lose business, but it is important to the community that transportation shall be as cheap as possible. The steam people have no right to complain even if they should be driven out. For, did they not drive out of business the old stage coaches by which folks traveled and the wagons by which goods were transported, and the horseback carriers who swept over the highways with their mail bags? Indeed, they did; and thus they threw hundreds of men out of employment in Connecticut, besides reducing the price of horses. They did not care a copper how many stage drivers were knocked out by steam, or how many country inns were ruined by the rail, or how many stables were closed because animals were superseded by engines. Not a copper, so long as they drew their dividends and rose to the top of society. If they, in their turn, are injured by the electric people, they must take the time to think that this world is but a fleeting show, and that the whirligig of time often gives compensation for losses suffered.

## Electrical Men's Thrift.

The Western Electric Building & Loan association of Chicago has issued its ninth quarterly report showing assets of $16,000. This association was organized two years ago among the employes of the Western Electric company with the object of affording a reliable depository for their surplus earnings and assistance in the building and improvement of their homes. Shares of stock are paid for in monthly installments of 50 cents per share. The funds are loaned only to the members and repaid at the rate of $1.33 per month for each $100 borrowed. All loans are secured by first mortgage on real estate in the city of Chicago or immediate vicinity or upon the paid-in installments of the stock. While the officers and a large percentage of members are employes of the Western Electric company, the membership is not so limited, and all who desire are welcome to join. The association operates under the Illinois statute governing similar organizations, and as such is under the supervision of the state auditor.

## Submarine Telegraphs of the World.

The International Bureau of Telegraphic Administrations at Berne published recently a table of the submarine telegraph cables of the world up to November 1, 1894, which contains some interesting statistical information. Among the oldest of these cables are the French-English, with four conductors, laid in 1851; the English-Belgian, with six conductors, 1853; Russian, from Oranienburg to Kronstadt, with three conductors, 1853; German, with three conductors, between Stralsund and Dainholm; the Ombla (Austrian), of six conductors, 1854. Over forty years have elapsed since these lines commenced their work of conveying thought through their silent cores, and still they are in perfect, constant service.

The longest submarine cable is that from Brest to St. Peter, placed in 1869, measuring 5,033 kilometers.

Of those owned and controlled by various governments, Great Britain leads with 135, having a length of 11,037 kilometers of conductors; Norway has 264, with wires measuring 484 kilometers, while France has 9,393 kilometers of wires in 54 cables, and Germany 7,008 kilometers in the same number of cables. The Dutch East Indies own 1,437 kilometers of wires in five cables, while Cochin-China and Tonkin have 1,472 kilometers on only two cables; and the British Indies 111 cables with 3,628 kilometers.

Outside the government control, companies owning the largest number of conductors are:

| Owner. | No. of cables. | Length in kilometers. |
|---|---|---|
| Grossnordische Telegraph company | 24 | 13,327 |
| Eastern Telegraph company | 79 | 47,322 |
| Eastern & South African company | 13 | 16,384 |
| Eastern Extension Australasia & China company | 27 | 32,239 |
| Anglo-American company | 15 | 23,873 |
| Commercial Cable company | 7 | 18,352 |
| Western Union company | 12 | 13,508 |
| Direct United States Cable company | 2 | 5,740 |
| Brazilian Submarine company | 6 | 12,658 |
| Western & Brazilian company | 16 | 11,397 |
| Central & South American company | 15 | 13,891 |

Of lines owned and controlled by governments there are 994, comprising 47,363 kilometers; owned and controlled by companies 310, comprising 262,273 kilometers; making a grand total of 1,304, comprising 309,636 kilometers, of which the states owning over 75 per cent. of the routes have less than one-sixth of the wire.

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CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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ADVICES from Atlanta give assurance that the transportation facilities will be adequate during the exposition. The electric street railway lines of Atlanta are making elaborate preparations to handle the immense crowds that are expected. The grounds will be reached by five lines, and the terminal will be in the form of a double loop of tracks, which will enable any number of cars to roll in, unload, load and roll out in the shortest possible time without delaying the cars behind them. The terminal facilities of both the electric and steam car lines will be ample, it is promised.

BY the death of George M. Phelps of the *Electrical Engineer* of New York the electrical interests of the United States lose a loyal, zealous and widely-known exponent. Mr. Phelps took a deep interest in all forms of electrical advancement and did much to promote the welfare of the industry through the columns of his journal and by unselfish work in other directions. His death is much to be regretted. To the surviving relatives and to the gentlemen who were so lately associated with him on the editorial and business staffs of the *Electrical Engineer*, the WESTERN ELECTRICIAN extends assurance of sincere sympathy.

EVERY department of literature, as well as scientific experiment and research and industrial pursuits, gives evidence nowadays of the universal interest that is felt in electricity and everything pertaining to it. The fascination of electrical phenomena for the readers of works of fiction has been recognized by popular writers and many books have found their way on the market, depending largely upon their electrical features for their popularity. The writers of these works have not always been strictly accurate in their details, but these imperfections have been generously overlooked by the readers. Evidence of the widespread influence that is being exerted in this field is shown by the fact that writers of short stories for boys and girls are now drawing on the seemingly inexhaustible store of ideas suggested by the varied applications of this wonderful something. The latest of these is an interesting tale by John Kendrick Bangs in the *New York Herald* on "The Runaway Trolley Car," a cleverly written sketch which will be scanned with interest not only by the younger readers of that journal but by every one who can appreciate a well-written story.

MORE interest is centered in the telephone to-day than has been manifested in it at any time since its introduction as a commercial instrument. Despite the policy of exacting exorbitant rentals, which the Bell company, as a monopoly, was enabled to follow, the telephone came into general use, and while the cost of the service placed it among the luxuries of life, its usefulness made it one of the necessities of large commercial houses. Now, however, the conditions have changed in many important particulars. A monopoly is no longer practicable; competition is springing up on all sides and more is bound to follow. It is an inviting field for ambitious investors, and while the last annual report of the parent Bell company shows that corporation to be possessed of vast wealth and great resources, it also gives a slight idea of the immense profits that the present rates yield, and these will lead many investors into this field. Legitimate competition will be welcomed by the public, and new companies formed to do business on a legitimate basis will be encouraged by the electrical construction and supply companies, whose business will of course be benefited by the expansion of the telephone field.

INTEREST in the work now in progress at Niagara Falls will be stimulated by the announcement that one of the great generators of 5,000 horse power capacity at the power plant is soon to be tested, and that the companies contemplating the use of power at this point have already made considerable progress in the installation of their machinery. The details of construction work at the big power house have been fully presented during the several stages of advancement in the WESTERN ELECTRICIAN, and Mr. Perkins' article on the "Distribution of Power from Niagara," which is a leading feature of this issue, is a continuation of this most interesting series on the great power transmission scheme. Engineers will find this article of special interest, particularly those who are engaged in similar enterprises. The details furnished are the most complete that have appeared on any work of such magnitude. It requires only a glance at the illustrations to convince the engineer of the scope of this project. The installation of the plant for the Pittsburg Reduction company, which is the central feature of this week's article, is the most important work of the kind that has yet been attempted. Plans of other enterprises that will receive current from the Niagara power plant are also outlined, but these are not yet advanced to the state of completion that the Pittsburg company's plant has reached. This work will be carefully followed in its progress and the development of the enterprises noted. The value of this work as setting a standard for future transmission work cannot be too highly estimated.

THAT the electric motor has many and marked advantages over the steam locomotive has been clearly demonstrated in several instances in which these rivals have met in competition in suburban and similar service. With a clear field and no favor the trolley has nothing to fear, but it has been seriously handicapped in many of its efforts to obtain a foothold. At the present time it is making a splendid fight in Connecticut, having invaded the territory so long held by the Consolidated company against every outside influence, and now it appears that the steam railway company finds that even with the advantages which it possesses in its long establishment and great contributing system and with the Legislature at its command, it cannot successfully compete with the much-abused trolley. The controversy has attracted much attention and there seems to be but one opinion of the probable result. It is generally recognized that the trolley will win eventually, and in this opinion many steam railway men concur. The common-sense view of the situation, expressed in the following editorial paragraph from the New York *Sun*, will commend itself to conservative men: "In the rivalry between the electric and the steam railroads in Connecticut, the Legislature of the state ought to refrain from interference. If the electric lines are injuring the business of the steam lines, it must be because they enjoy economic advantages not possessed by the other. The cheaper and more serviceable of the two powers will surely win in the end, whatever be the legislation enacted in regard to it." Judge Hall, the vice-president of the Consolidated company, has made the following announcement concerning the company's policy: "The road is not contemplating putting on trains for its summer service, as it is taking some off. If the electric roads of the state continue to be allowed to parallel our line throughout the state, many local passenger trains will be withdrawn, in accordance with a warning sounded by President Clark in his last annual report, which states that if the decrease in steam passenger traffic continues many local trains will be abandoned." This would indicate that the Consolidated company had reached the decision that it was unable to compete with the trolley roads in local service. The attitude of the New York Central officials when they were confronted with a similar problem was much more business-like than that of the Consolidated company. When the Central found that a trolley road paralleling its line between Niagara Falls and Buffalo threatened to make heavy inroads into its business, it immediately looked into the subject and determined to meet the competition instead of attempting to legislate the trolley company out of business. Finding that the only way to meet the trolley line was by substituting electricity for steam on this branch, it at once ordered the transformation, and the work is now well under way. The Consolidated company would do well to follow the example of the Central in this matter.

ARBITRATION for the settlement and prevention of strikes has found an influential advocate in John D. Crimmins, if the testimony taken at a recent hearing before the Assembly committee investigating the Brooklyn railway trouble is accurately reported. Such disagreements as the one under consideration, he is reported to have said, should be submitted for consideration to unprejudiced men, and, where public welfare was involved, he believed that arbitration should be compulsory. Mr. Crimmins has had practical experience in strikes, and as he is largely interested in surface railways his views on the subject are timely and significant. There is no doubt that Mr. Crimmins recognizes the fact that the public is growing tired of such contests as that recently witnessed in Brooklyn, where the people were the chief sufferers, and, like the sagacious manager he is, he realizes that if his position is sound he need have no fear of submitting it to arbitrators. The time to arbitrate is before the strike has been decided upon. It is contended, too, that corporations deriving valuable privileges from the state should not inflict upon the public inconvenience, pecuniary loss or other injuries without justification or excuse. In the report of the committee, which has just been published, this subject is considered and the committee believes that any attempt at compulsory arbitration must result in disappointment and failure, because it can conceive of no effective way in which the employer can be subjected to the decrees of the Board of Arbitration without an unjustifiable assault upon the principle of individual liberty to contract. It sees in such enforcement an intensification of the troubles between capital and labor. A remedy is suggested in the enactment of a bill, prepared by the committee, embodying the result of its investigation, in which it is provided that employes of railways in New York shall be required to take out licenses before they shall be admitted to such employment; that no railway employe shall quit work until after giving fifteen days' notice of his intention, under penalty of the loss of his license, and that he shall not be discharged except for good cause after thirty days' notice from his employers. This bill recognizes the fact that railway corporation officials have duties to the public as well as to their stockholders, and that if the men refuse to work on the conditions offered by the corporations, and the latter are thereby prevented from running their trains, the state is entitled to step in and provide a means of opening the deadlock so that travel may be resumed. The framers of this bill hope that it will work equally to the advantage of the public, the corporations and the employes. It is aimed to protect the men not only against unreasonable demands and starvation wages, but also against the tyranny of some of their own walking delegates. Again, it will save the people from the annoyance and damage that inevitably come with every railway strike, and it will give the companies ample opportunity to adjust any differences that may arise between them and their employes, or supply the places of dissatisfied workmen with others who are willing to accept the conditions imposed by the employers. The committee is in doubt whether the ten-hour law recently passed is constitutional, and fails to see how a satisfactory law of such a character can be devised. Another important suggestion is that the State Board of Mediation and Arbitration should be required to investigate all strikes and make a full report, placing the blame fairly where it belongs. The committee sets a good example in this respect by placing the responsibility for much of the lawlessness that prevailed upon the municipal authorities of Brooklyn.

## Court of Equity Cannot Enforce a Contract for Supplying a Varying Amount of Power.

An interesting dispute between an electric light company and an electric railway company has just been settled in Saginaw, Mich. The facts are these: On October 6, 1889, the Bartlett Electric Light company entered into contract with the Union Street Railway company to furnish all the power required to run its cars. Very soon thereafter the railway company complained of violations of the contract, that the requisite power was not being furnished according to the strict terms of the contract, and that such as was delivered was capricious and uncertain. The railway company thereupon filed a bill of complaint in the Circuit Court of Saginaw county to compel a specific performance of the contract according to all of its terms, and, as incidental relief, prayed for an injunction to prevent further breaches or violations of the contract. A temporary injunction was granted by Judge Edget. The next step was the filing of a demurrer on behalf of the Bartlett Electric Light company, claiming that even if the injuries existed, the terms of the contract were too vague to be enforced by a court of equity. Judge McKnight upheld this contention by sustaining the demurrer, although advancing the opinion that the complainant had a remedy at law. Finally the case was amicably settled by the railway company paying $5,000 in full for all claim against it and being released from the contract, which had five years to run. The street car company will soon operate its own power house.

Judge McKnight's opinion in sustaining the railway company's demurrer is interesting. It involves points that should be taken into consideration by all lessors of power. Following is an abstract:

This is a demurrer to a bill for specific performance and injunction to prevent the breach of a contract made October 6, 1889, by the terms of which the defendant agrees to furnish the complainant 150 indicated horse power for eighteen successive hours each day, beginning as early as 5:30 A. M., including Sundays, for the period of ten years, from December 6, 1889, at the price of 17½ cents per horse power, or $26.25 per day, to be paid by the complainant every thirty days. This sum to be paid for each day, whether complainant uses 150 horse power or less quantity.

The second clause of the contract provides that the defendant shall furnish from time to time room for additional dynamos and additional power over 150 horse power. Such additional power above 150 horse power to be paid for at the price of 10 cents per horse power per day of eighteen hours, or at the rate of one cent per horse power per hour, provided that for any number of hours less than eighteen the charge shall not exceed 10 cents per day per horse power.

There are seven other sections of the contract, involving details and stipulations, the essential features of which are not affected by this suit.

In case complainant desires additional room for additional dynamos, it may give defendant notice, and it is to be allowed reasonable time to provide additional room and machinery for furnishing the additional power.

No provision is made in the contract for any particular method of determining the quantity of horse power developed and delivered by defendant to complainant at any time. The contract contains no stipulation as to who shall determine whether additional power is necessary or not, nor any stipulation in regard to the manipulation and management of the machinery by complainant.

After the making of this contract and prior to the commencement of this suit, a dispute arose between the parties as to the meaning of the term "indicated horse power" in the first clause of the contract, and by reason of this, as to quantity of extra or additional power furnished by the defendant to the complainant, and for which the complainant was bound to pay under the terms of the contract.

This controversy was submitted to arbitration, and an award was made, finding that the term "indicated horse power meant net horse power delivered to the dynamos," which means that in computing the number of horse power delivered to the engine as indicated by the cards, the horse power required to move the engine and shafting is to be deducted from the gross horse power shown, and that the complainant is to be charged only with the net horse power delivered at the dynamos.

The bill complains of certain overcharges during the years 1891 and 1892, and also that the complainant notified the defendant that it would require under said contract all the power necessary to run the dynamos to the capacity of speed required by the complainant in order to run and operate all of its 23 cars at a rate of speed not less than eight miles per hour, and to successfully operate the railway system of the complainant. The bill alleges that the defendant neglected and refused on the 19th day of November, 1891, and at many other times since said notification, to supply the dynamos with necessary power constantly, and without sudden variations, or to furnish sufficient power to the dynamos to operate them to the capacity of speed required, and permitted the steam pressure to become so low as not to drive the engine sufficiently to convey power enough to the dynamos to run them at a rate of speed exceeding one-half of their capacity.

The bill further alleges that in order to operate the complainant's road successfully the line shaft which delivers the horse power to the dynamos needs to be kept constantly in motion, and at a rate of speed which shall not vary more than two per cent., and that the defendant be prepared at any instant to deliver the maximum of 275 net horse power, and be prepared to deliver an average of 190 net horse power to the dynamos at any time.

This controversy arose under the second clause of the contract.

I think the complainant has a complete remedy at law for nearly all, if not all, the injuries complained of.

The notice referred to, that the defendant was required to furnish sufficient power to the dynamos, so that the complainant might operate all of its 23 cars at the rate of speed of not less than eight miles an hour, would not give enough information to the defendant to enable it in any way to compute or determine how much power was needed.

It seems to me that two questions are decisive of the issue presented by this demurrer.

First—The contract is too vague in certain of its essential terms to be specifically enforced by a court of equity.

If written contracts are not certain in themselves, so as to enable the court to arrive at a clear result of what all the terms are, they will not be specifically enforced.

[Here the court enumerates several precedents.]

Second—In order to enforce this contract the court of equity would be required to exercise continuous supervision of the management and operation of the defendant's machinery, and would be required to engage in the continuous duties, which could be performed only by one skilled in mechanics. In no other way could it be determined whether the requisite amount of power was being furnished or whether the machinery was being operated according to the terms of the contract.

A court of equity cannot engage in any such business.

[More precedents are given to sustain this position.]

It is obvious that the court of equity cannot make a single decree enforcing the rights of the parties to this contract; these needs will vary according to the requirements of the business contemplated by the contract; hence, if the court assumes jurisdiction constant supervision of the business would be required.

The demurrer will be sustained and the bill of complaint dismissed. The defendant will recover its costs to be taxed.

## French Electric Carriage Operated by Tommasi Accumulators.

An electric carriage which has been running in Paris for some time is distinguished by simplicity of mechanism and the use of Tommasi accumulators. The latter are in a box placed behind the seat of the carriage. A small motor is fastened beneath the body of the carriage, and a two-armed steering gear, a powerful foot-brake and a switch, all suitably disposed, complete the mechanism.

The Tommasi accumulators differ from others by the special method of supporting the oxide of lead. Each electrode is provided with a celluloid covering having a large number of small holes filled with active material, in the center of each of which is placed a piece of lead serving simply as a conductor of the current and not as a support for the active material, as in all other batteries. By this arrangement the disintegration of the electrodes and falling out of the active material is prevented. Electrodes of similar polarity are soldered together by a connecting rod, and separated from the neighboring electrodes by vertical celluloid rods. The shell is of wood, lined with celluloid and closed at the top by a perfectly tight and transparent cover. This battery is small in size and relatively light in weight; its capacity is about 25 ampere hours per kilogramme of plate. It admirably withstands shaking and violent treatment.

These batteries are manufactured in France by the Société Fulmen. They will stand a very heavy discharge rate. The battery which operates the motor on the carriage consist of 21 cells, each weighing 13 kilogrammes 300 grammes and is placed in seven boxes, each containing three cells. The cells, connected in series, give an average current of 100 amperes at 40 volts; when starting and when climbing heavy grades the discharge is as high as 200 amperes. These results are obtained: 7.5 ampere hours per kilogramme at minimum; 11 ampere hours per kilogramme at mean; 15 ampere hours per kilogramme at maximum. At lower rates the capacity is much higher, thus: 22 ampere hours at a rate of 1 ampere per kilogramme; 18 ampere hours at a rate of 3 amperes per kilogramme; 15 ampere hours at a rate of 6 amperes per kilogramme.

The total weight of the carriage with two passengers is about 1,200 kilogrammes and the speed 20 kilometers per hour. All parts are of exceptional strength. Stops can be made instantly if necessary. The carriage runs silently and its management is extremely easy. A switch enables the battery to be cut off entirely from the motor during a long stop. The great durability of the Tommasi accumulators and their great capacity will undoubtedly be important factors in the solution of the problem of electric road traction.

## To Renew the Manufacture of Incandescent Lamps.

It is said that the Economic Electric Light company, which formerly manufactured incandescent electric lamps in Brockton, Mass., and which was enjoined for alleged infringement of patents, is likely to resume business again, recent decisions having established the fact that its business is not an infringement.

W. B. Sudlow & Son of Florence, S. C., are about to install a plant for 40 arc and 500 incandescent lights. They wish estimates on engines, boilers, dynamos, wiring and lamps.

## Lineman Takes His Own Risk.

In the case of Junior against the Missouri Electric Light & Power company (29 Southwestern Reporter, 988) the Supreme Court of Missouri has rendered a decision of much importance to all linemen and central station companies. This was a suit brought to recover damages from an employing company for the death of a lineman. The man was killed by touching the uninsulated ends of "live" wires. The exposed ends of these wires were thirty feet from the ground, on a pole, and were perfectly obvious. The lineman killed was an experienced employe, and ascended the pole for the express purpose of connecting the wires; he was provided with non-conducting rubber gloves, but did not use them.

The Supreme Court says: The facts of this case bring it within the familiar principle that if a servant capable of contracting for himself, and with full notice of the risk he may run, voluntarily undertakes a hazardous employment, he places himself in a hazardous position, or if he works with defective tools or appliances, the employer is not liable for injuries received from these known risks. It often happens that both natural and artificial persons (corporations) are engaged in exceedingly dangerous business, and if it is not unlawful, may employ servants to perform dangerous duties, and yet not be liable to such employes for injuries received in such work, if such employes are capable of contracting and know the risks attending the business. The handling of live wires is a most dangerous business, but the deceased knew when he entered into the employment that it was so. He was not a minor, nor an inexperienced workman, to whom the dangers of the business were unknown. The danger to which he was exposed was open and obvious. He was as cognizant of the danger, if not more so, than the foreman, and the failure to caution him cannot avail where he is as well acquainted with the hazard as his employer. By way of argument it was contended that it was negligence to leave the ends of the two wires uncovered without some proper protection, but it will be remembered that no one but a lineman could be exposed to these uncovered ends, elevated as they were on poles thirty feet above the surface of the earth, and in this particular case had these two ends been insulated with buttons or caps they must have been removed by this lineman to enable him to connect the wire with the store, where light was desired. It seems clear that this misfortune befell him through his neglect to use the rubber gloves provided for this sort of work. He assumed the risk of handling these wires charged with electricity. The employment was very hazardous and inherently dangerous in its very nature, but he undertook it with knowledge of its dangers, and he was bound to exercise care to avoid the consequences. The evidence shows most conclusively that, by his own neglect of the means furnished by his employer, he brought his hands in contact with the wires, and lost his life. It is greatly to be regretted, but the master is not liable.

## Technical Education in America.

In an address at the twenty-third convention of the alumni of the Polytechnic Institute of Zurich, Professor Ritter is reported to have said concerning the condition and progress of technical education in the United States:

What the German universities have not been able to accomplish by centuries of traditional agitation, the Americans have already done. They have not only mastered the technical sciences, mathematics and jurisprudence, but have given form to distinct faculties of the sciences of engineering or have even founded them with an explicit purpose of promoting engineering. * * * * So far as regards instruction in mechanical engineering, Cornell University, of Ithaca, N. Y., stands at the head of American institutions.

If we compare this, which, according to our own ideas, is an incomplete development of technical education, with the truly grand achievements in engineering and in machine construction in the United States, this question seems to us proper: What has the American technologist to offset this deficiency in theoretical instruction? And do not we Europeans overshoot the mark in our more elaborate theoretical education?

## An Ohio Novelty.

It is impossible to restrain the enthusiasm and fertility of the electrical inventor. To him stone walls do not a prison make nor iron bars a cage. The following, from the London, Ohio, *Times* is in point:

Charles F. Kline, a life prisoner under the habitual criminal law, in the Ohio penitentiary, and an expert electrician, who has already patented some important inventions, is at work upon an acoustic battery, of which he expects the most important results. He claims that by the use of loud sounds as an excitant, a current might possibly be generated which would be of the required force and quantity to operate motors. On the subject Kline says:

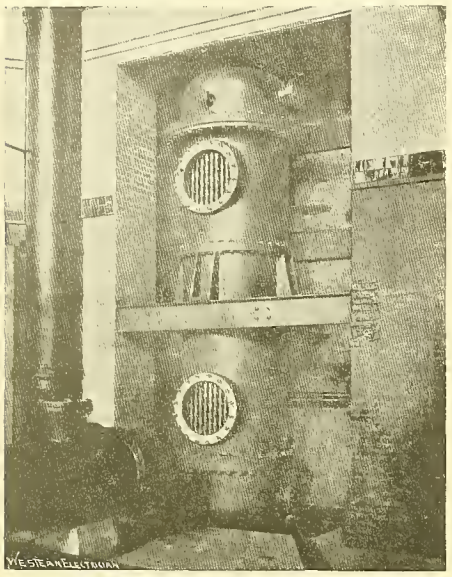
Shops might be lighted, to some extent, by the noise of the machinery. A clock might be made self-winding by the sound of its ticking, and then perpetual power would become as common as spring power. What the internal resistance of this battery would be when working under the influence of extraordinary loud sounds remains to be determined.

The noise made by walking upon the floors, or by the

shutting of doors, might be made to charge small storage batteries, and electricity on tap would become as cheap as water.

## A 4,000 Horse Power Feed Water Heater.

The Goubert Manufacturing company of New York has recently installed at the First District station of the Edison Electric Illuminating company in Pearl street, Brooklyn, a 4,000 horse power vertical Goubert feed water heater. A good view of this immense heater—one of the largest ever built—

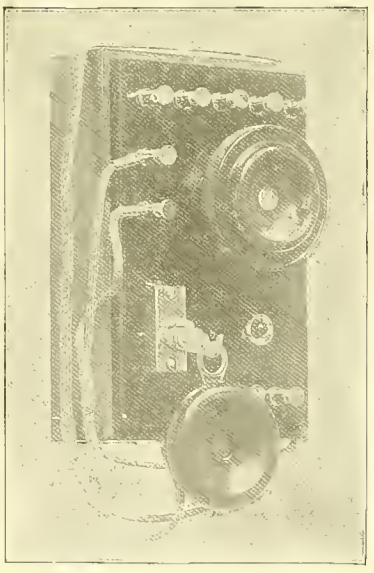


A 4,000 HORSE POWER FEED WATER HEATER.

is shown by the picture on this page. It is a fine piece of work and designed expressly to fit into the limited space available.

The heater is made entirely of cast iron and brass, and is of the latest improved Goubert type with curved upper and lower tube plates and patent flexible expansion joint. This is the only joint in the heater that is not rigid, the differential expansion between the shell and the brass tubes being taken care of at this point.

The Goubert heater is especially desirable in connection with plants of magnitude and heavy duty. The Goubert Manufacturing company is doing an extensive business in large units, especially for electric plants, both lighting and traction, operated by the principal companies throughout the



NEW INTERIOR TELEPHONE.

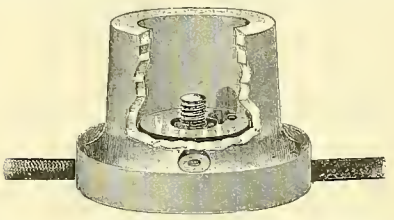
country. It now has branch offices in many of the principal cities.

## Bryant Weatherproof Socket Side Connection.

For special work different designs in sockets are needed to accomplish desired ends. The weatherpoof socket with side connections illustrated in this issue has been devised to fill a demand for illuminated sign work which is becoming very popular at the present time. The Bryant Electric company has recently placed this socket (and also one with bottom connections) on the market. Grier Bros., managers of the western office, have a stock on hand in their storeroom in Chicago. This socket is an excellent one for cellars, stockyards or damp places and can be used for cleat work as well as concealed work.

## New Interior Telephone.

Appreciating the demand for a high class, compact telephone for interior use in private houses, hotels and public buildings, the M. & B. Telephone company, Bullitt building, Philadelphia, has designed the instrument illustrated herewith, which it calls "style C." It will be the company's standard form for interior work. This instrument is noted for its clearness and volume of sound. It is handsomely finished with slate back and oak case. All the fittings are nickel, and the instrument presents an elegant

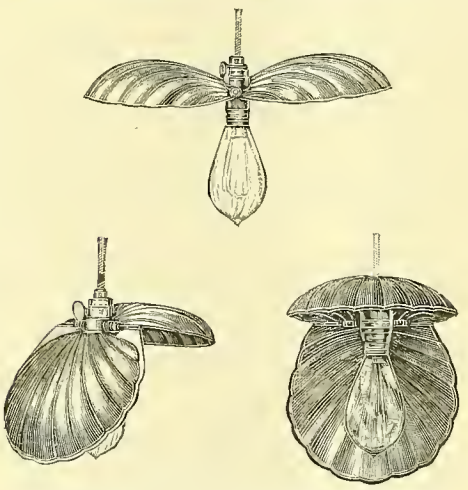


BRYANT WEATHERPROOF SOCKET SIDE CONNECTION.

appearance. It is only five by seven and one-half inches in size, and is equipped with a bell push and return signal call. Either a buzzer or loud call bell can be furnished as desired. In hotels this instrument will be found especially useful, as the bell on the telephone in guests' rooms can be used as a call or "wake-up" bell if desired.

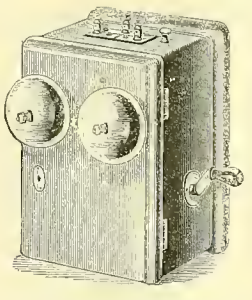
## The Curtis-Donnally Adjustable Lamp Shade.

The accompanying cuts illustrate one of the latest novelties in electric light shades. Generally speaking, this shade



THE CURTIS-DONNALLY ADJUSTABLE LAMP SHADE.

may be described as being similar to a clam-shell. It consists of two halves, as shown, hinged on a clamp which embraces the lamp socket and permits the two portions of the shade to be moved and set at any angle. The manufacturers claim for this shade that there is no other similar device in the market through the aid of which the light of an incandescent light can be more conveniently suited to circumstances. As will be readily appreciated, this shade can be manipulated so as to produce any desired effect of either

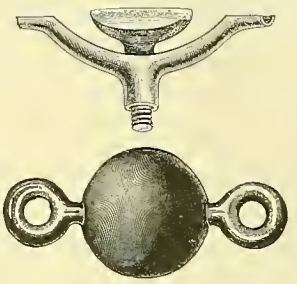


GILLETTE MAGNETO BELL.

light or shade. It has an economical point, too—it gives increased light through its reflecting power, and may be utilized to reduce the necessity of having numerous lights. Being metal, it is practically indestructible, and by reason of its being a reflector it is especially adapted for billiard and pool table service, and also for show window effects. These shades are furnished nickel-plated and burnished; also in satin-finished brass and in decorated tin. The Curtis-Donnally shade is handled by the supply department of the Chicago Edison company.

## Medbery Overhead Devices.

The greatest annoyance to practical electric railway linemen is the very unsatisfactory style of trolley wire clamp heretofore used. The Davids clamp furnished by the Fiberite company, manufacturer of the Medbery material, seems to have done away with all the objections made, and the roads now using this device claim that it is a perfect preventive of all the trouble experienced with other clamps. Fig. 1 shows the device, and it will readily be seen that it is so simple that the fastening can be made in a few seconds' time. There is no soldering or even bending of the clamp necessary, and it is impossible for the wire to drop; in fact no emergency wagon is needed where this clamp is used. Fig. 2 shows the Medbery globe strain insulator, made in three sizes. The great strength and perfect adaptability of this device commend it to all practical construction men. Insulated with the Medbery material it is practically inde-



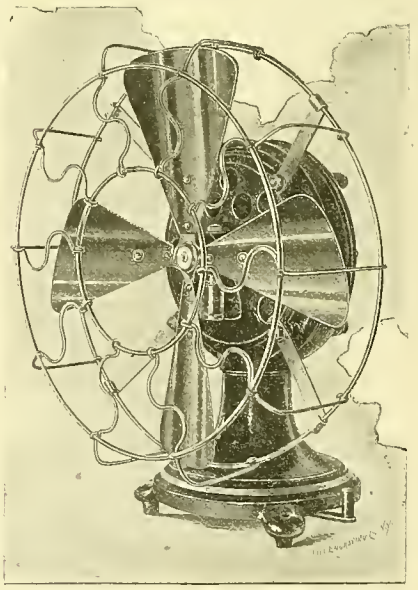
FIGS. 1 AND 2. MEDBERY OVERHEAD DEVICES.

structible. A test made by Prof. Morton showed a resistance of 350,000 megohms and a breaking strain of 7,600 pounds. Over 7,000 of these insulators are in use in Chicago. The Medbery material is carried in stock by the Mason Electric Equipment company, 24 Plymouth Place, Chicago, which is the sole western selling agent for the Medbery specialties.

## Lundell Alternating Fan Motor Outfit.

The demand for an alternating fan motor is now met by the latest production of the Interior Conduit & Insulation company of New York. In appearance the Lundell alternating fan motor outfit, herewith illustrated, presents beauty of design and finish equal to the direct current outfit, having a cylindrical field-magnet on a hollow cast-iron base. It is designed in two types, high frequency (14,000 to 16,000 alternations per minute) and low frequency (7,200 alternations per minute) at 52 and 104 volts.

Tests of the high frequency motors show that a current of 1.3 amperes at 52 volts, with 12 inch fan, is a fair average



LUNDELL ALTERNATING FAN MOTOR OUTFIT.

for their operation. Like the Lundell direct current motors these machines are finished in rich black japanning with gilt stripings. All outside brass fittings, fans and guards are either polished brass or nickel plated. Self oiling and self-aligning bearings and a regulating switch giving three speeds are also features. These motors are manufactured under the patents of Robert Lundell by the Interior Conduit & Insulation company of New York city. The western agent is the Central Electric company of Chicago.

### Gillette Magneto Bell.

One of the most familiar adjuncts to a complete telephone plant of to-day is the magneto call bell. The cut on page 196 represents the external appearance of the apparatus manufactured by E. & F. Gillette of New York. There enters into the construction of these bells nothing but first-class material. Sheffield steel magnets, charged by a pair of large electro-magnets, are used both on the bell part and generator. The cabinet work, either black walnut or oak, is heavy and of the finest French finish. All exposed metal parts are heavily nickeled. A feature of these bells that will be appreciated by the trade is the excellent tone of the special cast-bronze gongs. The internal mechanism is substantially made. These bells are not rated at their maximum capacity, as they will ring through resistances from 1,000 ohms to 10,000 ohms more than they are guaranteed to do. E. & F. Gillette have had an excellent opportunity of acquiring knowledge of the telephone business, as their father, Webster Gillette, the inventor of the powdered carbon long-distance telephone, has had wide experience as a pioneer in the telephone field.

### Electric Plant to Be Driven by Gas Engines in Chicago.

The American Gas Engine Electric company, with offices at Chicago, has recently completed negotiations which give it the manufactory and the sole American right to the patents formerly owned and operated by the Nutting Electric company of Chicago. The new company will continue the manufacture of the Nutting arc lighting apparatus. The American Gas Engine Electric company was organized some months ago to go into the business of installing gas engine electric plants. The engine used will be the Kilmarnock double acting engine as manufactured by Dick, Kerr & Co., London, England, who are making them at present up to 1,000 horse power. Dick, Kerr & Co. are to-day the only manufacturers of gas engines of 350 horse power and upward, and have a large number of good-sized stations now operating their engines in Europe. One of the most interesting stations recently installed is that at Belfast of four engines aggregating 600 horse power. These engines are driving Siemens dynamos and are lighting the streets at Belfast. Owing to the double-acting principle the engines are said to be much more steady than any gas engine previously placed on the market, and with the electric light governor regulate within 2½ per cent. The officers of the new company, which is capitalized at $300,000, are: President, J. Ensign Fuller; vice-president, Albert F. Dexter; treasurer, O. G. Waterman; electrical engineer, Carl K. MacFadden. The cheapness of gas engine power has never been questioned, and the main difficulty that has stood in the way of its development has been the restriction among American makers of small-sized engines. The American Gas Engine Electric company is installing in Chicago a plant which will use nearly 300 horse power of gas engines, making a plant which is several times larger than the next largest gas engine plant in America. The engines are belted directly to the dynamos, no counter-shafting being necessary.

### Friendly Receivership for the Mather Company.

Charles M. Jarvis, president of the Berlin Iron Bridge company, has been appointed receiver of the Mather Electric company of Manchester, Conn. The appointment was made on application of Attorney Charles E. Perkins, one of the directors, acting on vote of the board. Attorney Charles J. Cole, as counsel for the company, appeared with Mr. Perkins. Mr. Perkins and Mr. Cole furnished bonds for Mr. Jarvis.

This move is in the interests of the present corporation. The new receiver is a director and a large stockholder, and an order of court permits him to carry on the business in the regular way.

The difficulty is that although the assets of the company exceed its liabilities, since September the company has been doing a larger business than is warranted by its capital. The company has also been disappointed at not receiving assistance from certain sources. There are now sufficient orders on hand to keep the works running till July, before which time it is expected that the financial difficulty will be adjusted. The business at the factory doubled itself from last fall to the first of this year, the company employing at the latter date 125 persons, with a payroll of between $1,300 and $1,400 a week. During the month of December the works ran twenty-four hours per day, and since then, until about a month ago, the factory has been run three nights per week. The capital of the company is $216,000, and the officers are: Vice-president, Thomas C. Perkins; secretary and treasurer, John L. Bunce; directors, C. E. Perkins, Charles M. Jarvis, Henry A. Redfield, George H Day, Thomas C. Perkins, John L. Bunce. The company has agencies at New York, Boston, Chicago, Philadelphia, San Francisco and New Orleans and subagencies in all the principal cities in the country.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, April 13.—George Westinghouse was at the Windsor Hotel this morning. In relation to the report of an understanding between his company and the General Electric people, he is reported to have made the following statement: "I have no more business on hand this trip than I generally have. Of course, we were all glad that the Supreme Court sustained us in our fight. I do not see why we should enter into a combination with the General Electric company after winning our suit. Had we been defeated parties in the suit, we might have talked about consolidation. There is no truth in the report that the companies will consolidate. Each has a field and its work will be carried on as usual." As the Westinghouse company advertises that it has brought suit against the General Electric company for infringing the Tesla polyphase patents in the monocyclic system, it is possible that there is not as much truth in the talk of a patent pool as had been thought. The Westinghouse company also announces that it has sued the Stanley company for infringing the same patents by the S. K. C. two-phase apparatus.

A contract has been made with the Brooklyn Heights company for the transportation of mails, beginning May 1st, on the Third avenue and Fort Hamilton trolley-car line. This will greatly facilitate the mail service in connection with Station C, at Third avenue and Forty-sixth street, and also at the postoffices in Bay Ridge and Fort Hamilton. Postmaster Sullivan is not only much gratified by the success of this system in Brooklyn, but is delighted with the prospect of its introduction in other cities. In New York the cable lines are soon to be used for carrying mails in Boston the trolley roads will be extensively employed, and in Philadelphia and Chicago the postmasters are anxious to introduce the same idea on a large scale.

A suit has been brought in the Supreme Court by the New York Insulated Wire company against the Westinghouse Electric & Manufacturing company to recover $35,411.51, alleged to be due as a balance for the work in supplying the electric lighting for the World's Columbian Exposition. The Westinghouse company made a contract with the World's Columbian Exposition to maintain the incandescent lighting for the fair. At the same time it made a contract with the New York Insulated Wire company to furnish the labor and material required for the wiring and construction for about 80,000 lamps. The Westinghouse company promptly obtained from Justice Beekman of the Supreme Court an order dissolving the attachment. The Westinghouse officials contend that they have a good defense to the action and that the procuring of an attachment against the property was a spiteful attempt on the part of the Insulated Wire company to do it an injury.

W. F. O.

### New England News.

BOSTON, April 12.—The trolley mail car in Boston is one of the probabilities of the future. Postmaster Coveney has been conducting experiments in the matter, and from 10 to 30 minutes have been saved on the trips over the old-fashioned method of delivering mail from the central office to the sub-stations by wagons. Under its present charter the West End road has the right to carry mails, and twenty years ago the various horse car lines used to transport the mail to the sub-stations on their respective routes. The large square in front of the postoffice affords an excellent opportunity for the loading and unloading of mails on the cars; or, if necessary, the cars could be run into the postoffice by means of the archway now used by the wagons.

There is a bill before the Legislature, which is being pushed by the Massachusetts Street Railway association, praying that the right be granted all street railways corporations in the state to make contracts with the government for carrying mails. The only opposition so far comes from the Central Labor Union, which has affiliated with it all of the other labor bodies in the state. There are a great many postoffices which are off the line of steam roads, but which are on the direct route covered by the electrics, and the main argument of the petitioners is that the public would be served much quicker if the street cars were hired to carry the mails.

A meeting of Palmer and Monson business men was held recently, and the Palmer & Monson Street Railway company was formed with a capitalization of $60,000. It is proposed to build an electric road from Monson to Palmer, to Wilbraham and thence to Ludlow, connecting with the electric road there from Springfield.

The town of Northfield, Vt., has voted to purchase the electric light plant.

The Portland, Me., street railway has been given permission by the board of aldermen to use electricity.

A construction company has contracted to build an electric street railway through Essex to Beverly, some 18 miles in length.

The New York, New Haven & Hartford Railroad company, better known as the Consolidated, has got the electric fever and has got it bad. The road has also a big fight on its hands in Connecticut in the contest for supremacy which has been raging for a year between the electric and steam roads in that state. While the electric road managers have been securing hearings before the railroad committee of the Legislature, the Consolidated has been active in securing a formidable array of statistics showing how seriously, to its way of thinking, the electric roads, if allowed to carry out their proposed plan of gridironing the state with trolley systems parallel to the Consolidated lines, will injure the steam roads and damage their charters. Judge Hall, vice-president of the Consolidated, says in this connection: "We have prepared an elaborate map showing how vitally the schemes of the electric roads affect us, although we have no direct contest with them. Their scope is between cities and their suburbs, but it is not fair treatment to the steam companies of the state, which have spent vast sums of money to secure the right of way, and have erected costly depots and fitted up handsome grounds, to have a parallel electric system organized unless the public necessity demands it. Then, as soon as it is practicable and economical we shall introduce electricity as a motive power over our own system and run our cars and trains much more frequently than now, as we are to do on the Nantasket Beach branch in Massachusetts." This is the first direct acknowledgement by the officials of the Consolidated road that electricity will be adopted if it prove practicable. Rapid progress is being made on the equipment by electricity of the Nantasket Beach branch of the Consolidated. The new cars are to be of a novel type, 50 feet long, equipped with air brakes and convertible into steam cars. Twelve of the cars have been ordered from a New Haven firm. They will have interchangeable wheel couplings so that freight cars can be attached.

At the annual meeting of the Holtzer-Cabot Electric company in this city the officers and directors elected were as follows: President, Charles W. Holtzer; clerk and treasurer, Ira A. Foster; directors, Charles W. Holtzer, Ira A. Foster, Henry B. Cabot, George O. Cabot and Philip L. Holtzer. The report of operations for the year ended December 31st, showed that the company did a gross business of about $200,000, and earned enough to pay $6,000 in dividends, and allow about $5,000 to be charged off.

There is one town in Massachusetts which seems to have benefited by owning its own electric light plant. Braintree is located about ten miles south of Boston, and, according to the report just filed, the citizens have been given house lighting for 6 mills per lamp hour. The charges made by private companies in Massachusetts are from 1 to 1¼ cents an hour. At 1 cent an hour the cost to Braintree consumers would have been $5,596, instead of $3,445.93, so that the saving is $2,150. The cost of operating the street lights was $47.55 a lamp of 1,200 candle power run one year all night on a moon schedule. Reckoning interest at 4 per cent. and depreciation at 5 per cent., less renewals and repairs, $22.10 is to be added for each lamp, making a total cost of $69.95. The price charged other towns in Massachusetts for a service of like quality by private companies averages $95.38. The cost to the town from its own plant thus shows a saving of $25.73 a light, or $3,036.14 on all lights in use.

A measure which has passed the Connecticut House of Representatives and is now pending in the Senate has created considerable discussion. The bill is one permitting the New Haven Electric Lighting company to increase its capital stock from $400,000 to $2,000,000, and to own and acquire all sorts of electric property, including electric railways, in the towns of New Haven, Orange, Hamden and East Haven. The company is also authorized to issue bonds in amount not exceeding one-half of its capital stock. The company has heretofore devoted its plant to the production of light and power for the ordinary use. Directors and stockholders of the company declare that there is nothing in the new legislation to excite suspicion and opposition—that it was made necessary by increasing business. They declare that it is not the intention of the company, as has been hinted, to acquire existing railway plants—that would require capital far in excess of the amount authorized by the bill that has passed the house. The matter will probably be ventilated when the measure comes up in the Senate.

E. Moody Boynton of bicycle railroad fame was before the railroad committee of the Massachusetts Legislature on the 15th, in advocacy of his petition for charters to build and

operate his electric system. The routes wanted are from Boston to Brockton; Boston to Dedham and the Massachusetts state line nearest Providence; Boston by way of Charlestown, Lynn and Salem to Beverly, and Boston to Lowell. These roads, Mr. Boynton explained to the committee, were to be all elevated, single-post steel railways. There would be no grade crossings, even in the pastures and fields in the country districts, and no possibility of injury to persons or property. They would be run exclusively by electricity, silent and dustless, and capable of speed of over 100 miles an hour. The double flanged spindle wheels below and the steel guides and safety wheels above render accident impossible.

An agreement has been reached, it is said, whereby the New York, New Haven & Hartford Railroad company is to purchase a controlling interest in the Westport & Saugatuck horse railroad, provided a charter to equip it with electricity can be secured.

By a decision of the Supreme Court the plant of the Woburn Electric Light company has been ordered to be sold on May 15th, subject to the first mortgage of $35,000 and all incumbrances and liens, except the second mortgage for $100,000 and the receiver's certificates, amounting to $1,000 more. The company for a year has been in the hands of receivers, who were appointed without prejudice to the taking of steps in insolvency. Insolvency proceedings subsequently followed, and assignees were also appointed. The full bench of the Supreme Court decided that the mortgage, which was given by the company to secure the payment of some $65,000 in bonds, which it issued, was invalid as against the real estate of the company, as it was not recorded within the time prescribed by law, and that it was a good mortgage as against the personal property only. The principal creditor of the company is the General Electric Light company, whose claim is for about $125,000. Since the adjudication of the validity of the mortgage of the bondholders there have been several hearings relative to the manner in which the property should be sold. The bondholders decided to sell the property against which it was decided their mortgage was valid. The receivers desired the court to order a sale of the property as a whole, and this is the form which the court has adopted. There has also been considerable contention between the counsel for the bondholders and for the receivers as to what property the bondholders' mortgage attaches to, and also as to whether the franchise is property within the legal signification of the word, and whether their mortgage covers the dynamos, poles and the 300 miles of strung wire. The court did not determine this aspect of the case, but ordered the sale to proceed, and the case to be referred to H. W. Bragg as master, to determine what pieces of property belong to the bondholders and what to the assignees for the general creditors, and the values thereof. The real estate sold is subject to another mortgage for $35,000, given to Dr. J. M. Harlow, and this is held to be valid.

J. C. E.

## Milwaukee, Wis.

MILWAUKEE, April 13.—After the Board of Public Works had rejected one set of bids and re-advertised, it awarded the contract for furnishing the light and power generating plant for the new city hall to the Western Electric company of Chicago at a figure several thousand dollars lower than the bids received the first time. The first bids were as follows: E. G. Bruckman, $39,856; Western Electric company, $43,000, $36,718 and $40,550; General Electric company, $39,687, $45,080 and $38,262. The Board of Public Works and Charles G. Armstrong of Chicago, the expert who prepared the plans for the plant, had estimated that the cost would be about $26,000 or $27,000. The board suspected that there was a combination of electric light interests and decided to call for new bids. At the same time the board concluded to specify horizontal engines instead of vertical engines, which had been provided for in order to economize room as much as possible, the idea of the change being that horizontal engines would cost less; to omit the fourth engine for the present and to reduce the reserve power from 50 per cent. to 33⅓ per cent. The second bids, under these changed conditions, were very much lower. The Western Electric company put in a number of bids for different kinds of engines, its figures running from $25,408 to $33,150. The bids of the General Electric company ranged from $29,980 to $35,137. The Westinghouse company asked $26,315 and D. Elmer Roberts of Racine $42,801. E. G. Bruckman of St. Louis made bids of $30,282 and $31,781. The plant will have to furnish the necessary current for 4,841 lamps, including a 3,000 candle power arc light at the main entrance to the city hall. It is provided in the specifications that upon the tender of the plant for acceptance a careful and impartial test shall be made by the Board of Public Works, to extend over a period of thirty days. The dynamos shall regulate so perfectly that a variation of 75 per cent. of their load will not affect the electromotive force more than 2 per cent. They are to be capable of being operated for twenty-four hours at full rate load without increasing in temperature more than 80 per cent. above the temperature of the surrounding air. Within six months after the complete installation of the plant, an engine economy test of twelve hours' duration must be made under the usual and established rules.

There were thirteen bidders for furnishing the electric and gas fixtures for the city hall. The architect had estimated that the fixtures would cost about $12,000, but the lowest bid, that of the Cassidy & Son Manufacturing company of New York, was only $6,382. The W. C. Vosburgh Manufacturing company of Chicago asked $12,128. A. H. Revell of Chicago intended to make a bid of $12,500, but by mistake inserted the figures $1,250 in his bid. The Common Council released him from his liability in the premises. The contract was awarded to the Cassidy company.

The plunging into an open draw of a Kinnickinnic avenue car and the consequent loss of the lives of the motorman and two of the passengers have resulted in the formulation of a plan for guarding the approaches to open bridges. The plan includes the turning of all the bridges in the city by electric power. Three men are to be stationed at every bridge and it is proposed that while one of them is attending to the machinery, the others guard the approaches with chains, which will be stretched across the roadway. The chain, it is intended, shall be fastened at each end and shall be strong enough to stop a street car moving at the usual rate of speed. The system has been tried in Chicago and it meets with the favor of the city officials.

An extraordinary accident occurred on the Farwell avenue electric street car line recently. South of the Northwestern railroad crossing is a long hill, and a north-bound car got beyond the control of the motorman and dashed into the railroad gate at the crossing, the gate having been lowered to allow a freight train to pass. The street car not only broke the gate but, strange to say, derailed the freight car—the second one of the train—which it struck. The street car was not very badly injured and nothing happened to the passengers beyond a shaking up. In an official statement which he made regarding the accident, General Manager Wyman of the street railway company said that there had been a light fall of snow during the evening and that the tracks were exceedingly slippery, so that when the motorman applied the brakes, the wheels slipped and it was impossible to stop the car altogether. It was possible, Mr. Wyman stated, that the motorman may have miscalculated his distance somewhat and thought that he had enough distance in which to stop, when he did not. The brake and other machinery around the car were thoroughly examined immediately after the accident and found to be in perfect condition. The sand box also contained a plentiful supply of sand. The motorman was suspended at once, but as he had bravely stuck to his post and thereby prevented a worse accident, some of the passengers interceded for him and he was reinstated very soon afterward. The city ordinances and the rules of the company require motormen to stop their cars within fifty feet of railroad crossings and some of the city officials asserted that the accident was due to the failure of the motorman to comply with the law and with the rules under which he was working. The accident has had the effect of rousing the people of that part of the city to the danger of grade crossings and there is talk of erecting a viaduct at that point.

The Common Council of Eau Claire has passed an ordinance granting to D. B. Moon and David Drummond a franchise to construct and operate an electric light system. They will compete with the Eau Claire Street Railway Light & Power company, which now furnishes that city with light.

The village board of Waukesha has decided to grant to the Northwestern Telephone company a franchise to build an exchange in that place.

F. Kraus and Henry Weber of Milwaukee have been in Sheboygan recently in the interest of the National Telephone company, which is trying to get a franchise in that city. Both of them are stockholders in the company. They state that although the ordinance pending does not provide that a metallic circuit shall be used, the National instrument does not work without a metallic circuit; hence it will be put in.

Marshfield, for the first time in its history, is connected by telephone with the outside world. A line has been built from Marshfield to Arpin, where it connects with the Grand Rapids line. The cities in that part of the state are putting in lines of their own. Marshfield has never had the Bell system.

The Milwaukee Street Railway company has ordered twelve new cars for the Wells street line.

Dr. J. E. Davies of the Wisconsin University lectured recently before the Electric club upon "Electric and Magnetic Waves." He showed how the theoretical work of Maxwell had become verified in the experiments of Hertz and others, and would very likely soon bear fruit in the way of practical results equaling all that modern invention has done in the application of electricity to business needs.

C.

## PERSONAL.

W. H. Train, formerly of the Water, Light & Power company of Hot Springs, S. D., has retired from that concern and is at present located in Burks Falls, Ont.

Mrs. William H. McKinlock, son and daughter, left on the steamer La Touraine for Paris on April 10th, to be absent one year. Mr. McKinlock accompanied them to New York.

Felix T. Meysenburg, of the firm of Kroell & Meysenburg, St. Louis, is in Chicago. Mr. Meysenburg is a construction and supply man, and he reports that a large amount of business is under way in his territory.

The many friends of Henry W. Frye of the *Electrical World*, who is now sojourning in New Mexico, will be pleased to learn that he is greatly improved in health and that he contemplates returning to his post early in the fall.

On Monday, April 15th, G. E. Paine assumed the position of manager, at Chicago, for the Postal Telegraph-cable company, to which he had been appointed by E. J. Nally, assistant general superintendent, to take the place of F. G. McCurdy.

The death of Isaac B. Davis at Hartford, Conn., on the 9th instant, removes a gentleman who is well known to the electrical trade through the manufacture of the Berryman water heater. This business was for many years conducted successfully by I. B. Davis & Son as the Berryman Manufacturing company. In 1890 Mr. Davis withdrew from active management of the business, which has since been conducted by his only son, John O. Davis. This business will be continued at Hartford.

J. R. Wiley, who recently assumed the management of the western sales department of the Standard Underground Cable company, with offices in the Rookery, Chicago, has just returned from an extensive western trip. Mr. Wiley spoke most enthusiastically of his company's present business and seemed to think the prospects were very bright indeed for increased trade in the near future. Mr. Wiley, who was formerly a resident of St. Louis, but has been living here for a number of years, has been renewing many old and pleasant acquaintances.

H. W. Phipps, who has been for some time superintendent of the works of the Brush Electric company of Cleveland, O., tendered his resignation on April 8th. C. N. Black, the assistant superintendent, who in connection with Mr. Brush is also electrician for the Brush Electric company, was appointed in his place. Mr. Black was graduated from Princeton University in 1888, with the degree of B. A. He pursued a two years' post-graduate course in electrical engineering under Professor Brackett, after which in 1890 he secured a position in the shops of the Brush Electric company. Since his entering the Brush shops, he has had an experience in every department, so that he is absolutely and personally familiar with the work required of each man in the shops and in nearly all cases has performed similar work himself. At one time he was at the head of the drafting room and is an expert draftsman. Again he was in charge of the testing room and became perfectly familiar with the machinery manufactured by the Brush company. Not long since Mr. Black received an offer from one of the largest manufacturers of electrical apparatus in the country, but preferred to remain with the Brush company. His association and work with Professor Brackett of Princeton and Mr. Brush of Cleveland, together with his practical experience in the work, have more than ordinarily fitted him for the position of superintendent of the Brush Electric company. Mr. Black's successor as assistant superintendent will probably be appointed from some of the men in the works.

## TELEPHONE.

Testimony by telephone was taken in Wayne, Mich., in the case of Goldsmith against Clark. Samuel Goldsmith claimed Joseph Clark agreed to sell him a house and two lots in Wayne village. Goldsmith says he placed the requisite money in the Wayne Savings Bank, but Clark refused either to take the money or turn over the property. In the resultant suit the testimony of Cashier George H. Stellwagen was valuable, but on account of sickness in the family he could not go to the court room thirty miles away, so he was sworn over the telephone, examined and cross-examined and his testimony, taken down by a stenographer, was entered in the court records.

## TRADE NEWS.

General Manager C. F. Shaw of the Law Telephone company of New York, states that his company has outgrown its present quarters and that about May 1st it will move to Cranford, N. J., where it will have a new factory. The concern will have a New York office at 39 Cortlandt street.

By May 1st the enterprising firm of S. F. B. Morse & Co., general western agents for Kerite wires and cables, will be installed in its new quarters at 1014 and 1015 Marquette building, Adams and Dearborn streets, Chicago. A handsomely equipped office, with ample storeroom in the basement, has been secured in this fine new building.

The Western Telephone Construction company of 250 South Clinton street, Chicago, has just shipped a 150 telephone exchange equipment, including switchboards and instruments, to Mattoon, Ill. The exchange was started up this week. The same company has just completed a 300 telephone exchange equipment, which has been put into operation at Winona, Minn. This is said to be the finest telephone exchange west of Chicago. Other recent installations

by this company are: Mt. Vernon, O., 200 instruments; Armour & Co., Union Stock Yards, Chicago, 50 instruments; Johnstown, Pa., 200 instruments; Marysville, O., 100 instruments.

The Standard Thermometer company of Peabody, Mass., makes announcement to the electrical trade that it is introducing a new arc lamp which will be known as the Upton lamp, and be made to work upon all circuits, direct current, constant potential, alternating and series. This concern has had a long experience in the manufacture of arc lamps, its first production being an arc lamp for use upon incandescent circuits. In 1888 it began the manufacture of the well-known "Simplex," following soon after with the "Ward" and "Knight" lamps, which were manufactured for the Electrical Construction & Supply company of New York. The Standard Thermometer company has a large factory in which expense has not been spared to thoroughly equip its four floors and basement with the best and most improved machinery that could be purchased for use upon a line of instrument work. In fact it is stated that the apparatus in use at this factory is of such a kind that the manufacture of watches could be taken up at short notice, and it is especially adapted in turning out the required fine work for arc lamps. The company claims that the Upton lamp is one of marked improvement over the well-known "Ward" lamp, being more simple in construction, cheaper in price, and costing much less to maintain. The lamps are so constructed that they are waterproof without the use of hoods, and meet all the requirements of the fire underwriters. They consume four, five, six, seven, eight and 10 amperes at proper voltage. The factory and main offices of the company are located at Peabody, Mass., and are under the direct supervision of Henry G. Rice, president, a gentleman of extended personal acquaintance in official circles at Washington, D. C., where the Standard instruments have been adopted in various branches of the government service; and through his careful management this concern has grown from a small firm to its present large proportions. The New York office will be located at 39 Cortlandt street, and will be in charge of Charles A. Bramhall, who for a long time was prominently connected with the Electrical Construction & Supply company at New York. Mr. Bramhall enjoys a large personal acquaintance in the electrical trade and is known as a man of push; he will see that the Upton lamp has a position well in the front.

## BUSINESS.

The Proctor-Raymood Electric company of Rochester, N. Y., manufacturer of "annunciators that never fail to annunciate," has issued a new and attractive price-list of its gravity drop annunciator.

"The neatest, strongest and best insulation" is the claim made for the Medbery overhead material for electric railways by the Mason Electric Equipment company of 24 Plymouth place, Chicago, the selling agent.

Roth & Eck, manufacturers of dynamos and motors, 34 Market street, Chicago, have been unusually busy of late. They have received more orders for their "special" dynamo than they can conveniently handle and are working overtime in order to keep up with the demand for their machines.

The Electric Appliance company is opening the spring campaign on the Meston alternating current fan motor with considerable success. A number of improvements have been made in this season's machine, which, added to the great merits the Meston has always possessed, makes a hard combination to beat.

The Hogan Boiler company of Middletown, N. Y., does much credit to itself by its handsome periodical, the *Boiler Review*, "a publication issued for the perusal of those interested in steam boilers, in which are technically reviewed theory and practice relating to the design, construction and operation of stationary, marine and locomotive boilers, with the view of helping those connected with their use or purchase to form an opinion as to the merits and demerits of all boilers unbiased by certain prejudices due to erroneous assertions and claims made in behalf of many constructions."

The Julius Andrae & Sons company, 225 West Water street, Milwaukee, in describing its $35 improved telephone outfit, says: "This outfit can be operated successfully on short lines, or on circuits over 100 miles long. A dozen or more telephones can be connected on the same line with satisfactory results. Only one battery is employed for operating the transmitter, which is similar to the Blake pattern, the patents on which expired January 20, 1893, through limitation on foreign patents. Signal bells, receivers and switching device are of the latest and improved patterns, making this the most complete, best and cheapest telephone outfit ever offered. The outfit is made in oak."

The Beacon Vacuum Pump & Electrical company of Boston is making an especial "drive" on high candle power lamps of from 50 to 300 candle power. In advocating the use of the larger lamps the company says: "It frequently happens that a large lamp is more desirable than an equivalent number of small ones. There are many effects obtainable with large lamps which cannot be had from small ones. The larger the lamp the more impressive and attractive it is. Three small apples may furnish as much nutriment as one very large one equal in weight to the entire three. But who would not prefer the large apple? So the large lamp attracts attention and pleases the eye. For the artistic lighting of store windows, in hallways and in numberless other places, large lamps are advantageous. No cluster of small lamps can match in brilliancy the effulgence of one fine high candle power lamp of an equal current consumption. The clusters appear very tame by comparison. One of our large lamps of 100 candle power or upward, hung in the doorway or window of your store, will advertise your goods through the attention it will attract." Prices have been reduced on the larger lamps, so that the company is enabled to adopt the trade cry: "A penny a candle."

The Mather Electric company of Manchester, Conn., under date of April 10th, reports a continuation of the large amount of new business which has been secured. The following sales were made last week: The C. Weyand Brewing company, Buffalo, N. Y., one 40 kilowatt direct-connected generator; Robert Walker, M. D., Warnerville, Pa., one 100 light and one 250 light ring type dynamo; G. H. Angier & Co., Boston, Mass., one 3 horse power Manchester motor and one 250 light ring type dynamo; William Oswald, New Orleans, La., three 5 horse power, one 10 horse power, one 15 horse power and one 30 horse power Manchester type motors; through J. Holt Gates of Chicago, western contractor, one 60 kilowatt 220 volt multipolar generator to be directly connected to Ideal engine, Westville Coal company, Danville, Ill.; also one 60 kilowatt 220 volt multipolar generator and one 85 kilowatt 220 volt for other electric coal mining works, of which class of work the Mather company is making a specialty; also one 30 kilowatt and one 45 kilowatt multipolar generator for isolated lighting works; B. F. Sturtevant & Co., Chicago, two 20 horse power Manchester type motors; and Burtis & Howard, Minneapolis, Minn., one 250 light ring type dynamo, third order.

The S. Freeman & Sons Manufacturing company, manufacturer of boilers, Racine, Wis., has issued a fine catalogue and price-list illustrating and describing its products. Of its material the company says: "Nothing but flange steel is used in the construction of our standard steel boilers. The manufacturers guarantee that any sheet will bend down cold without fracture after heating to a cherry red and plunging in cold water. We buy our stock exclusively from responsible mills with a reputation for a strictly high grade product." As to methods of construction this information is given: "A girth seam is stronger than a longitudinal seam. The area of the head of a boiler exposed to pressure is many times less than the area of the shell. Consequently the less longitudinal seam the better the boiler. Unfortunately some longitudinal seam is necessary and to make the evil as small as possible, all of our boilers are made of two courses of one sheet each, each plate making the entire circumference and giving one girth seam beside the heads. Many advantages attach to this method of construction, among which are the ability to bring the longitudinal seam well up on the side of the boiler out of the fire, and a ready access for good repair work in case it should prove necessary. This method also brings the girth seam well back of the bridge wall out of the fire and gives but one place on the bottom of the boiler for the accumulation of sediment due to the use of impure water."

The Walker Manufacturing company, Cleveland, Ohio, announces the closing of the following contracts since April 1, 1895, all for speedy deliveries. These orders show the popularity which its improved generators and motors are gaining: St Charles Street Railroad company, New Orleans, La., three 200 kilowatt direct-coupled generators; Corning & Painted Post Street Railway company, Corning, N. Y., two 125 kilowatt direct-coupled generators; Messrs. Channon & Wheeler, Quincy, Ill., one 75 kilowatt belted power generator; Manhattan Beach Hotel & Land company, New York city, one 60 kilowatt belted lighting generator; Norfolk & Ocean View Railroad company, Norfolk, Va., two 250 kilowatt belted generators, three double car equipments, six 50 horse power steel motors, two double car equipments, four 30 horse power steel motors; E. A. Darling, superintendent Columbia College, New York city, one 50 kilowatt belted lighting generator; Buffalo, Kenmore & Tonawanda Electric Railway company, Buffalo, N. Y., two double car equipments, four 25 horse power steel motors; Stern & Silverman, Philadelphia, Pa., for Rapid Railway company, Detroit, Mich., two 200 kilowatt belted generators, eight double car equipments, sixteen 50 horse power steel motors; Dunkirk & Fredonia Railroad company, Fredonia, N. Y., one double car equipment, two 25 horse power steel motors; Scheneley Park & Highlands Railway company, Pittsburg, Pa., three double car equipments and six 30 horse power steel motors.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued April 9, 1895.*

536,996. Electrode. Harry T. Barnett, London, England. Application filed December 27, 1893.

There is a combination of carbon in the form of filaments, with a conducting support, from which the filaments are projecting, and with which they are connected electrically and mechanically, the conducting support being provided with guards extending beyond the free ends of the filaments.

537,004. Electric Metal Heating Process. George D. Burton, Boston, Mass. Application filed December 11, 1893.

The process of working metal, as illustrated, consists in immersing or partially immersing a metal to be worked in a bath of an aqueous solution of carbonate of soda and borax, and subjecting the metal while so immersed to the action of an electric current until it is raised to the desired working heat, and then subjecting the heated and softened metal to a metal working operation.

537,005. Art of and Apparatus for Electrically Smelting Ore. George D. Burton, Boston, Mass. Application filed April 26, 1894.

The last claim is for the combination of a tank, an inclined hearth therein provided with a perforated receptacle at its lower end, a raceway at its upper end for discharging the liquid onto the hearth, means for elevating the liquid from the tank to the raceway, and means for connecting the liquid and the hearth with opposite electric poles.

537,006. Electric Bath Metal Heating Apparatus. George D. Burton, Boston, Mass. Application filed August 24, 1893.

A receptacle for containing a resistance bath, an automatic clamp mounted thereon and comprising a stationary member provided with an eye flared at its upper outer edge and also at its lower inner edge, and a weighted pin sliding in the eye, and conductors connecting the solution and clamp with opposite electric poles.

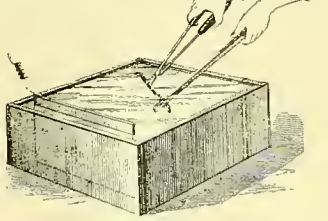
537,007. Method of and Apparatus for Electrically Heating Metal. George D. Burton, Boston, Mass. Application filed January 23, 1895.

The art of heating metal, described in the claims, consists in supporting the metal upon the surface of a non-conductive bed above the surface of an electrolytic bath, then shifting vertically the horizontal plane of one of the surfaces and bringing the bath and metal into electrical connection, and passing an electric current through the metal and bath, the current forming an electric arc between the metal and the liquid of the bath

537,008. Electric Metal Heating Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass. Application filed October 11, 1894.

In an electric metal heating apparatus, the combination is claimed of two main conductors, a resistance tank, where the positive and negative plates are connected with the conductors, a second resistance tank, connected with the negative main conductor, a working circuit through which the conductors are connected with the positive plates of the tanks, and a working circuit where the conductors are connected directly with the main conductors.

537,009. Method of and Apparatus for Electric Metal Heating. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass. Application filed August 30, 1892.



NO. 537,004.

In an electric forge, a receptacle provided with an electrode set in the wall and having an inwardly flaring eye or socket, and an electrode set in an opposite wall and provided with an outwardly flaring eye or socket are the chief features.

537,010. Ventilating Apparatus for Dynamo-electric Machines. George C. Burton, Boston, and Edwin E. Angell, Somerville, Mass. Application filed December 7, 1892.

There is the combination with a dynamo-electric machine of a flaring or bell shaped nozzle having an annular mouth disposed opposite the space between the field magnets and armature and adapted to direct a current of air between the armature and magnets in a plane parallel with their adjacent faces, and means for supplying air to the nozzle.

537,011. Electric Bath Metal Heating Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass. Application filed December 7, 1892.

In an electric metal heating apparatus, there is the combination of a tank containing a conductive watery liquid connected with one electric pole, an arm extending over the tank, a work-holder supported by the arm and connected with the other electric pole, and mechanism for adjusting the arm, whereby the metal to be heated is adjusted in the liquid in relation to the surface thereof to increase, diminish or vary the current passing through the work.

537,012. Electrical Welding Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass. Application filed March 3, 1893.

Claim 1 reads: The combination of the clamp, the sliding bar carrying the clamp and attached to one terminal of the converter, the clamp, the sliding bar carrying the clamp and attached to the other terminal of the converter, and the bell crank levers, arranged to have their upright arms bear upon the sliding bars, respectively, and move the same toward each other by pressure exerted upon the horizontal arms of the levers.

537,013. Apparatus for Brazing Metals by Electricity. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass. Application filed April 17, 1893.

The features of this invention are the combination of two shafts provided with electrodes of opposite polarity, means for adjusting one of the shafts, a spring for pressing one of the electrodes toward the other, and means for rotating the shafts.

537,032. Electric Clock. Fred L. Gregory, Chicago, Ill. Application filed January 30, 1894.

In an electro-mechanical clock, the combination with the time-train thereof and with the electrically-propelled time-train-actuator, of a time-train-stopping device carried by the actuator and adapted for engaging and stopping the time-train at each end of the stroke of the actuator and for positively locking the time-train against forward or backward movement.

537,058. Incandescent Lamp. Charles A. Merritt, Birmingham, Ala. Application filed September 17, 1894.

The special claims for the lamp illustrated in the cut are the combination of a series of conducting wires to connect to carbons the wires connected at their upper ends to contact posts embedded in the insulating filling of the lamp bead, a series of conducting wires from the carbons having their upper ends connected to the metallic casing of the lamp head, an electric contact plate having a base embedded in the insulating filling

of the lamp head, the contact plate provided with a head attached to the base by screw-threads, a switch journaled to the contact plate, the switch provided on one side with a finger to make an electric connection to the contact posts singly and on the opposite side with a plate to make an electric connection with one or more posts as desired.

537,078. Means for Increasing Locomotive Traction. Charles Selden, Baltimore, Md. Application filed October 4, 1890.

The cut shows a locomotive drive wheel having an iron rim, a series of electro-magnets having separate poles magnetically separated or insulated from one another and from the rim and arranged in the circumference of a circle and moving in succession into contact or immediate proximity with the rail.

537,118. Electrical Indicator. Edward H. Johnson, New York, N. Y. Application filed October 1, 1891.

An indicating device, electro-magnetic means for moving the indicating device, and a retarding device, comprising an elongated dash-pot, an elongated hollow plunger open at its inner end, and a mechanical connection from both sides of the plunger to the indicating device, whereby the plunger is moved positively in both directions.

537,124. Electrical Steering Gear. Rodolphe Noury, Nouveau Phalère, Greece. Application filed March 12, 1894.

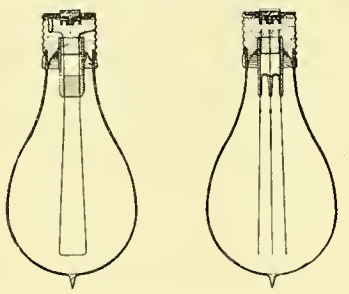
In a compass for the automatic steering of vessels there is provided a magnetically controlled compass card and an alidade adjustably mounted on the card to swing therewith, a holder for the alidade, a gearing for shifting the compass card and a circuit controller moved by the alidade.

537,130. Arc-rupturing Device. Elmer A. Sperry, Cleveland, Ohio. Application filed October 16, 1894.

In this device there are a crescent-shaped magnet, one of the poles of which is at or near one of its ends and an electrode also at this end, the magnetic field of the magnet in the region near the electrode consisting of lines of force having a certain predetermined direction, in combination with a co-operating electrode, a line connecting the nearest points of approach between the free discharge-surfaces of the electrodes being at an angle to the direction of the lines of force.

537,133. Electric Railway Signal Apparatus. George L. Thomas, Brooklyn, N. Y. Application filed April 23, 1894.

A plurality of reciprocating semaphore arms mounted at different elevations, an actuating wheel for swinging the arms, means for bringing the arms under the control of the actuating wheel to hold them in position and for releasing them from the actuating wheel to permit them to operate under gravity, at predetermined intervals during the rotary movement of the actuating wheel, means for applying motive power to the actuating wheel and electric devices under the control of a moving train to release the actuating wheel to operate the arms.



NO. 537,058.

537,149. Demagnetizer, Edward F. Gooding and George W. Scovil, Elgin, Ill. Application filed December 29, 1894.

In a demagnetizing apparatus the electro-magnet in combination with the plug, adapted to hold the ends of magnet coil wires insulated from each other and to fit a lamp socket to connect the wires of a lighting or other circuit, an independent lamp socket normally holding the coil wires insulated from each other, a lamp and a circuit closer to close the circuit in the socket at will and automatically maintain the circuit as long as desired adapted to fit the socket.

537,161. Police Signaling Apparatus. William H. Kirnan, Bayonne, N. J. Application filed December 28, 1892.

In a police signaling apparatus there is the combination with an alarm bell at the receiving station, of a relay controlling the circuit of such bell a spring-dog which drops back of the armature of the relay and holds the bell circuit closed, and a hand pull for withdrawing the spring-dog.

537,179. Electrolysis. Henry Blumenberg, Jr., Mount Vernon, N. Y. Application filed March 30, 1894.

The improvement in the art described consists in placing an electrolyte containing a haloid salt in a vat, electrolyzing the same, thereby setting free the halogen under pressure in the positive compartment and the base without pressure in the negative compartment, leading the halogen into a gas holder and applying additional fluid pressure therein, and the base into a tank, and bringing the halogen from the gas holder to the tank containing the base.

537,194. Conduit Electric Railway. John H. Guest, Boston, Mass. Application filed June 18, 1894.

A suspended conductor movable laterally throughout its length, a current collector for engagment therewith, and a magnet associated with the collector for attracting the conductor and insuring perfect electrical contact between collector and conductor.

537,195. Conduit Electric Railway. John H. Guest, Boston, Mass. Application filed April 14, 1894.

The combination described consists in an electric railway having normally insulated working conductors, two actuating magnets carried by the vehicle, one to close and the other to open the connections for the sections of working conductor, a collector mounted between the magnets, and means for changing the relative positions of the magnets and collector longitudinally of the vehicle.

537,196. Supply System for Electric Railways. John H. Guest, Boston, Mass. Application filed June 18, 1894.

In an electric railway system, the combination, substantially as described, of two lines of working conductor beneath the car, exposed at the street surface and divided into sections and forming respectively the positive and negative sides of the system, the sections on one side of the system being arranged to break joint with the sections on the other, and automatic switches for closing the connection between the sections of working conductor and the power circuit and disconnecting a section to the rear of the car.

537,197. Supply System for Electric Railways. John H. Guest, Boston, Mass. Application filed November 3, 1893.

The combination in an electric railway system, of a sectional working contact or conductor, an electric switch for each section, an actuating magnet or magnets carried by a vehicle, an armature connected to each switch, whereby the switch may be actuated by a magnet on the car as the latter enters a section, a polarizing coil for the armature in the circuit closed by the operation of the switch, and a mass of iron for holding the switch armature in circuit closing position after the influence of the actuating magnet has ceased.

537,198. Electric Railway. John H. Guest, Boston, Mass. Application filed August 9, 1894.

A laterally movable working circuit conductor divided into sections one or more of which are connected to other sections, and a circuit breaker in these connections operated by the movement of the conductor.

537,199. Electric Railway Supply System. John H. Guest, Boston, Mass. Application filed February 20, 1894.

A section of working conductor and a polarized circuit closer, an actuating magnet on the vehicle for setting the circuit closer, and an unsetting magnet connected with sections at both sides thereof, are the features claimed.

537,200. Closed Conduit Electric Railway. John H. Guest, Boston, Mass. Application filed April 10, 1894.

In an electric railway system, a section of iron tubing is provided, sealed at its ends and containing a switch controlling the connection of the tubing with a supply source, the tube being arranged parallel to the track and forming a part of the working conductor.

537,238. Method of and Apparatus for Making Conduit Sections. Alexander Segade and Dennis J. O'Regan, Detroit, Mich. Application filed February 10, 1894.

This method of forming conduit sections consists in introducing an insulated material in a semi-fluid or plastic state into a casing around a mandrel, allowing the material to harden, removing the mandrel, treating the section with oil, and finally introducing a duct into the space from which the mandrel was removed.

537,242. Pyrometer. Alvin A. Simonds, Dayton, Ohio. Application filed December 13, 1894.

The first claim follows: In an electrical pyrometer, the combination with thermo-electrical elements and an indicator of electrical connections between said elements and the indicator and means for maintaining the connections at a low temperature from a point near the elements to a point substantially without the influence of the source of heat which it is desired to measure, whereby the connections are maintained at their normal conductive efficiency.

537,259. Non-arcing Switch. Alexander Wurts, Pittsburg, Pa. Application filed April 14, 1893.

A stationary contact, a movable contact and a series of extinguisher bars in proximity to these contacts, composed of non-arcing metal, are the features of this invention.

537,268. Railway Signal. Horace E. Boothby, Chicago, Ill. Application filed November 30, 1892.

In this device there are two registering apertures in front and back for a night signal, and two for a day signal arranged to normally present a stationary disk to give one positive character of indication. A day signal disk and a separate night signal disk are fixed upon a pivoted arm provided with wing armatures and a magnet is also provided for operating the armature so as to enable the signal disks to move in and out of register with their apertures.

537,271. Incandescent Lamp Base. Waldo C. Bryant, Bridgeport, Conn. Application filed December 20, 1894.

An incandescent lamp base having a porcelain disk with a central opening and a surrounding polygonal recess on one side in combination with a sheet metal screw-threaded terminal adapted to be flanged onto the base, and having a second flange or polygonal outline to fit the recess is described.

537,282. Telephony. Ellis F. Frost, Washington, D. C. Application filed December 20, 1894.

In a telephone system embracing a microphone transmitter, there is the combination therewith of an extra-current spark coil.

537,283. Trolley. Zachry T. Furbish and George A. Staples, Augusta, Me. Application filed September 25, 1894.

A removable cap having ears, a socket pivoted to the ears, a trolley wheel supported by the socket and a connection between the socket and the pole platform.

537,321. Insulating Compound. Alexander C. Thompson, St. Louis, Mo. Application filed July 30, 1894.

The composition of matter to be used for insulating purposes, consists of alcohol, gum shellac, pulverized asbestos, pulverized French chalk, balsam tolu gum, and ground mica.

537,343. Electrical Measuring Instrument. Eugen Hartmann and Wunibald Braun, Bockenheim, Germany. Application filed November 27, 1891.

A flexible body of conducting material extending between abutments, a second flexible body connected to a point on the first body and to an abutment and disposed at an angle to the first body, a means of applying strain at an angle to the second body to a point thereon between its abutment and its place of connection to the first body, and an indicating device showing the displacement of the point on the second body due to the strain when the first body is subjected to the action of electricity.

537,354. Traversing Apparatus for Commutators. John Pease, Apperley Bridge, England. Application filed July 28, 1894.

In apparatus for traversing the commutator relatively to the brushes, or vice versa, of dynamos and electric motors, the combination is claimed with a worm shaft, supported in bearings on frame and worm-wheel mounted on shaft, slotted slide formed with an arm adapted to be connected to the commutator shaft or to the brush-carrier, suitable gearing between the worm-wheel and the slide including slides, slotted and adjustable crank plate, and crank pin which engages with the slot in the slide.

537,358. Electric Battery System. Adoniram J. Powell and William H. Hall, Brooklyn, N. Y. Application filed November 13, 1894.

An electric motor and suitable electrical and mechanical connections, a main battery, a supplemental battery, an electric switch comprising two pairs of switch-bars, movable independently of each other, normally connecting the batteries in a feeding-circuit, means for automatically reversing one pair of the switch-bars to open the circuit when the main battery is connected with the motor, and means for reversing the other switch-bars at will independently of the first pair.

537,396. Trolley Support and Guide for Step-ladders, etc. William J. Sumner, Holyoke, Mass. Application filed October 17, 1894.

In a trolley, a horizontal longitudinal member and the horizontal cross-bars, having their middle portions jointed to the extremities of the longitudinal member for horizontal swinging movements, and each bar having the axially vertical rollers journaled in opposition thereon.

537,402. Electric Bath Metal Heating Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass. Application filed September 5, 1892.

A portable tank for heating metals provided with a porous partition and with a bracket at one side serving as a rest for the work or work-holder.

537,403. Art of Extracting Grease from Wool. George D. Burton, Boston, Mass. Application filed October 31, 1894.

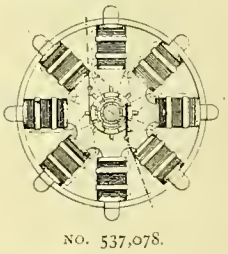
The process of extracting grease from a fibrous substance consists in immersing the fibrous substance in a watery solution of bichromate of potash, and passing an electric current therethrough during the immersion.

537,404. Apparatus for Electrically Heating Metal. George D. Burton, Boston, Mass. Application filed November 6, 1894.

In an electric bath metal heating apparatus, the combination of a vessel for containing an electrolytic bath and having an electrode of comparatively large area, a traveling carriage supported on the vessel and adapted to hold the metal to be heated, a receiving vessel disposed on a plane below the vessel containing the electrolytic bath, a reservoir vessel disposed above the electrolytic vessel, pipes connecting the vessels, a pump for elevating the liquid from the receiving vessel to the reservoir vessel, means for regulating the flow of the liquid, and conductors connecting the electrolytic bath and the metal to be heated with opposite electric poles.

537,405. Apparatus for Electrically Heating Metal. George D. Burton, Boston, Mass. Application filed March 16, 1895.

In an electrolytic heating apparatus, the combination of a vessel for containing an electrolytic solution, a hearth for supporting the material to be heated provided with perforations, and electric conductors for connecting the solution and material with opposite electric poles.



NO. 537,078.

537,412. Rheostat. John C. Fyfe, Chicago, Ill. Application filed January 24, 1895.

In a rheostat, the combination with suitable resistance, of a contact arm adapted to close or open the resistance circuit a switch operated by the arm for throwing the switch into circuit with the mains, together with an interlocking connection between the arm and the switch for limiting the outward movement of the same.

537,414. Closed Conduit Electric Railway. John H. Guest, Brooklyn, N. Y. Application filed February 17, 1893.

The combination with the insulated sections of working or contact conductor and their corresponding feed wires, of normally open connections between the feed wires at a central station or station common to them, and means for including a telephone, telegraph or other electric communicating apparatus in the connection.

537,415. Supply System for Electric Railways. John H. Guest, Boston, Mass. Application filed July 6, 1893.

The combination described consists of a main rail, a special contact rail, insulated from the former, a support wheel carried on the main rail, and a contact roller supported by the wheel and having its axis of rotation at an angle to the horizontal axis of the support wheel.

537,416. Supply System for Electric Railways. John H. Guest, Boston, Mass. Application filed October 12, 1894.

The combination with the sealed conduit containing the switch-boxes, of the sectional working conductor formed of contact rails supported upon the conduit edge.

537,423. Apparatus for Recovering Precious Metals from Their Ores. Frederic H. Long and Delos Car Skaden, Chicago, Ill. Application filed April 16, 1894.

An apparatus for recovering precious metals is described, comprising a revoluble drum, a perforated metal tube opening from the drum and provided with a fabric jacket, and a series of plates secured to the inner surface of the drum and having inwardly extending blades or flanges, and electric connections to the plates and tube for rendering the same of opposite polarity.

537,426. Safety Patrol Box. Joseph F. Brogly, Denver, Colo. Application filed January 28, 1895.

The first claim is as follows: In a safety patrol box, the combination of the outer casing, the inner cage provided with a sliding door, contacts attached to the cage but insulated therefrom, an electrical circuit, conductors leading to the contacts on the cage, signaling mechanism located in the circuit, and springs attached directly to the cage and adapted to engage the contacts, the springs being located in the path of the door, whereby the circuit is opened and closed by the movement of the door.

Western Electrician.

EVERY SATURDAY.

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## Electric Plant in the New Planters' Hotel, St. Louis.

The New Planters' Hotel of St. Louis is located on the site of the famous hotel of the same name which was made historic by Charles Dickens in his "American Notes." The New Planters' occupies half a block, having a frontage of 230 feet on Fourth street and a depth of 122 feet on both Pine and Chestnut streets. The building, real estate and furnishings have cost $2,000,000.

The power plant is located in the rear basement. In the boiler room are two Heine water-tube safety boilers, each of 350 horse power capacity. The Hawley down-draft furnace is used. These boilers supply power for the electric light plant, hydraulic elevators, cold storage system, heating, hot water, filtered water, and all other miscellaneous purposes throughout the building.

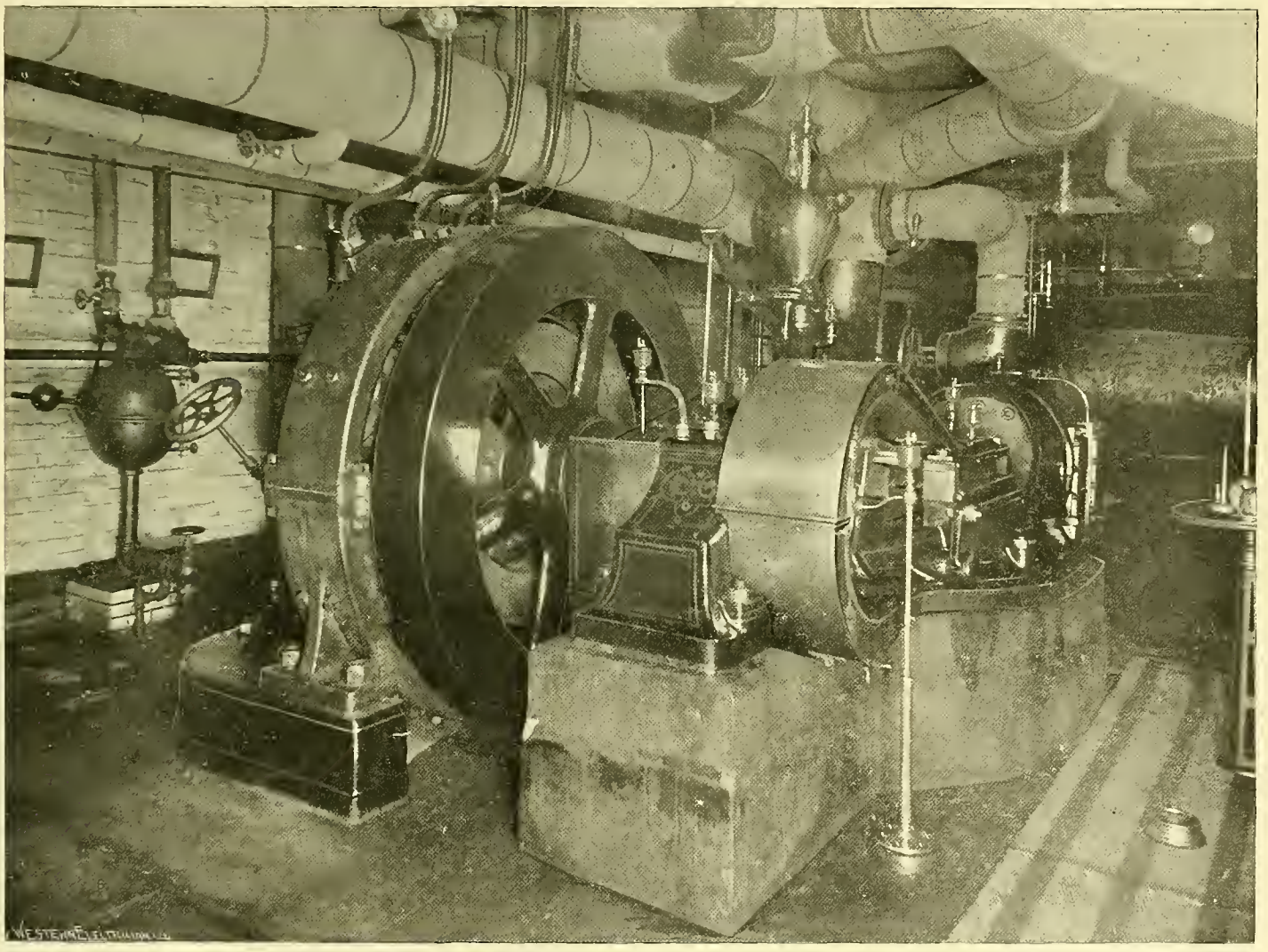

FIG. 1. ELECTRIC PLANT IN THE NEW PLANTERS' HOTEL, ST. LOUIS. 100 KILOWATT ENGINE-DYNAMO.

The combined steam and electric plant is composed of four direct-connected units. The largest unit, Fig. 1, which has just been installed, consists of a Southwark Foundry engine of 160 horse power directly connected to a 100 kilowatt eight-pole General Electric direct current generator running at 275 revolutions per minute. The two intermediate units consist of two Fitchburg engines, each of 135 horse power capacity, directly connected to two 75 kilowatt General Electric multipolar direct current generators, running at 275 revolutions per minute and having a normal output of 650 amperes each. A small engine-dynamo for carrying the light day load is provided. This unit consists of a 45 horse power Fitchburg engine directly connected to a 25 kilowatt General Electric multipolar direct current generator running at 300 revolutions per minute. The building is wired for 4,000 110 volt incandescent lights.

The switchboard is of white marble, 12 feet wide and seven feet high, set in an oak frame. On the ceiling and extending forward from the switchboard is an oak canopy, on which are mounted the equalizer and lead bars of polished copper, which connect the generators with the switchboard. On the switchboard are mounted the usual instruments, ammeters, voltmeters and potential galvanometer and main switches. The bus-bars, which extend the entire length of the board, are of polished copper two inches by one inch in section. The whole forms a very handsome and compact arrangement. A view of the switchboard and glimpses of the 75 kilowatt machines are shown in Fig. 2.

On the twelfth floor—the attic—are two 12 kilowatt General Electric motors, driving two Sturtevant fans, which are used for ventilating the building. Two air shafts lead from these blowers to the various parts of the building. There is also a 15 kilowatt motor in the laundry and a 12 kilowatt motor in the kitchen for running the ice crusher, ice cream freezer, coffee and spice mills, emery wheel and grindstone.

The building is carefully wired throughout with rubber covered wire. The main and auxilliary leads are placed in open boxes and all concealed wiring is placed in interior conduit. General Electric fixtures of solid brass are used throughout.

The annunciator system is supplied with an answer-back device, and each floor is provided with an annunciator. All calls are answered by call boys on each floor. The main annunciator in the office serves as a check to the service on each floor.

The entire electrical contract, including the annunciator system, was carried out by the General Electric company. The plant was designed by and erected under the supervision of Geo. J. Percival, electrical engineer. D. R. Williams, formerly of Chicago, is chief engineer of the electrical and mechanical department of the building.

## Telegraphic Historical Society.

The first regular annual meeting of the Telegraphic Historical Society of North America will be held on May 1st, in the Board of Trade rooms, No. 1410 G street, N. W., Washington, D. C. The first session will open at 10 A. M., when the routine business will be transacted. At a later session, in the afternoon or evening, formal papers will be read and discussed. Officers will be elected for the ensuing year and other important business will be transacted. An address will be delivered by President Cornell, and papers on interesting subjects will be presented by members of the society. An exhibit of telegraphic relics, rare books, portraits, etc., will be made. Members are requested to notify the secretary whether they will be present, and they are at liberty to invite persons interested in the objects of the society to attend this meeting. It is proposed to mark with a bronze tablet the site of the old station of the Baltimore & Ohio railroad in Pratt street, Baltimore, opposite the Maltby House, whence the first official telegraphic message was sent over a wire, on May 24, 1844, its destination being Washington. The site is now occupied by a

factory. There is said to be only one man alive to-day who assisted in building the first telegraph line. His name is Samuel Lee, and he is living in Baltimore in nearly destitute circumstances. Mr. Lee is really a part of the history of the telegraph. He is the last link that connects its birth with the present.

## A Remarkable Electrolytic Phenomenon.[1]

By C. J. Reed.

Most metals, when used as positive electrodes in electrolysis, are either dissolved or corroded, producing metallic salts or oxides; but when used as negative electrodes, metals do not generally undergo such corrosion. They are seldom affected in any way, chemically, by the action of the current, and are never dissolved.

It is to what appears to be an exception to this rule that I wish to call your attention this evening.

While experimenting, some time ago, on the oxidizing effect of various electrolytes upon lead electrodes, I noticed, accidentally, that under certain circumstances, lead behaves toward some electrolytes in a very peculiar manner. The only conditions required are that the electromotive force and current density shall be very high.

On passing an electric current through a solution of di-sodium-hydrogen phosphate, between electrodes of sheet lead, I noticed nothing unusual during the experiment. The solution had a very high resistance and very little current pass d even with a high electromotive force. At the close of the experiment, there being no switch in the circuit, the current was interrupted by lifting one of the electrodes out of the solution. It happened to be the negative electrode.

At the instant of final contact between the electrolyte and the lowest point of the electrode, as it left the solution, I noticed what appeared to be a cloud of black smoke, or precipitate, which had suddenly formed in the solution. On examining the cloud more particularly, and repeating the experiment several times, I found that by exposing only a very small surface of the negative electrode to the solution, there was produced a voluminous cloud of dark blue or lead-colored precipitate, which rapidly sank in the solution and rendered it entirely opaque.

It was then observed that the lead cathode was being rapidly eaten away, and that the precipitate was being produced at the expense of the lead. The precipitate was collected on a filter, washed with water and alcohol, and dried. It was found to be an impalpable powder resembling lead, and permanent in the air at ordinary temperatures. When rubbed in an agate mortar, it was reduced to a lusterless gummy mass, but did not assume a metallic appearance. Heated to the melting point of lead in the open air, it suddenly absorbed oxygen and formed yellow plumbic oxide, with incandescence. Heated in a glass tube in absence of oxygen, it melted to a globule of metallic lead.

In this bottle I show you a sample of this product that has been preserved more than two years without any apparent change.

The surface of the lead cathode, after the experiment, exhibited a peculiar appearance. It was reduced to a point at the end, and presented a smooth, shiny surface, like polished lead. It was of the form we should expect to find a positive electrode of copper or other soluble metal.

Other electrolytes were tried and it was found that the lead precipitate could be produced in the following solutions:

| | |
|---|---|
| Potassic sulphate, | Potassium sulpho yanide, |
| " hydric sulphate, | " ferrocyanide, |
| Sodium orthophosphate, | " ferricyanide, |
| Di-sodic-hydric phosphate, | " iodide, |
| Sodic-di-hydric phosphate, | " bromide, |
| Magnesic sulphate, | " carbonate, |
| Calcic sulphate, | Calcic chloride (with difficulty), |
| Aluminic sulphate, | Strontium sulphate, |
| Ammonic oxalate, | Manganous chloride, |
| Sodium hypophosphite, | Sodium borate, |
| " sulphide, | Potassium acetate, |
| " thiosulphate, | Ammonium hydrate, |
| " sulphite, | Hydric phosphate, |
| " chloride, | Ammonic sulphide, |
| Potassic chlorate. | |

The precipitate could not be produced in solutions of the following substances:

| | |
|---|---|
| Barium hydrate, | Hydric acetate, |
| " chloride, | " oxalate, |
| Calcium hydrate, | Ammonic acetate, |
| Ammonium carbonate, | " nitrate, |
| Strontium nitrate, | " chloride, |
| " chloride, | Potassium bi-chromate, |
| Hydric sulphate, | " nitrate. |

The precipitate could not be formed in solutions of metallic salts from which a metal can be deposited by electrolysis. It cannot be formed in strong acids having a great affinity for lead.

With ammonium oxalate and a positive electrode of platinum, there was formed on the platinum wire what appeared to be a deposit of lead peroxide, although no lead was originally in the solution. In a recent experiment I failed to produce this result.

Similar experiments were made with negative electrodes of iron, zinc, cobalt, nickel, manganese, magnesium, aluminum, copper, cadmium, silver, gold, platinum, bismuth, arsenic, antimony and tin. Of these, arsenic alone acted in a manner somewhat similar to lead, being rapidly disintegrated as a negative electrode. The surface of the metal where the acton took place was smooth, bright and rounded, apparently polished. A film of brown, solid arsenic hydride was formed, which, instead of sinking, floated away from the electrode in straight lines on the surface of the solution. This hydride was also produced electrolytically by Sir Humphrey Davy.

With lead electrodes, in a solution of sodium phosphate, some hydrogen phosphide was produced along with the lead precipitate.

With borax and lead electrodes, the lead precipitate was formed very rapidly; and when the negative electrode was held close to the side of the glass beaker, a bright reddish-brown stratum of liquid was seen to be continually formed at the surface of the electrode. This disappeared almost instantly after moving away from the electrode, but was continually formed as long as the current was strong enough to produce the lead precipitate. The addition of acetic acid did not prevent this formation.

Sodium thiosulphate gave a deposit of sulphur at the positive pole, confirming the theory that in the thiosulphates one atom of sulphur is electro-negative, and takes the place of an atom of oxygen in the sulphates.

With sodium sulphite, sulphur dioxide was liberated at the positive plate.

Strontium nitrate, instead of giving the lead powder, gave a blue flame around the point of the lead cathode.

These results seem to indicate the possibility of obtaining, by the use of high electromotive force and high current density in electrolysis, products of an entirely different nature from those of ordinary electrolysis.

[1] Read at the meeting of the Electrical Section, Franklin Institute, February 27, 1895.

## American Institute of Electrical Engineers.

At the regular meeting of the Institute on April 17th the following named associate members were elected: Jas. C. T. Baldwin, Chicago, Ill; Francis Elliott Cabot, Boston; S. B. Fortenbaugh, Madison, Wis.; W. C. Harris, Jr., Birmingham, Ala.; G. H. Jones, Santiago, Chili; Charles LeBlanc, Paris, France; Wm. E. Lindsay, East St. Louis, Ill.; Paul N. Nunn, Telluride, Colo.; George Herbert Winslow, Pittsburg, Pa.

The following named associate members were transferred to full membership: Albert Schmid, Pittsburg, Pa.; Omenzo G. Dodge, Washington, D. C.; Charles Ashley Carus-Wilson, Montreal, Can.; James A. Lightbipe, San Francisco, Cal.; Arthur Edward Childs, Philadelphia, Pa.; John Waring, Ovid, N. Y.; W. L. Pufler, Boston, Mass., and H. J. Ryan, Ithaca, N. Y.

A paper by Prof. E. J. Houston and A. E. Kennelly upon "Resonance in Alternating Current Lines" was read by Mr. Kennelly and discussed by Mr. Bradley, Dr. M. I. Pupin and Prof. A. G. Webster. A paper was also read by Prof. W. A. Anthony on "Underwriters' Rules," which was discussed by Messrs. Hammer, Leonard, Woodbury, Jenks, Holmes, Mailloux, Ayers and Hamblet.

## Storage Batteries for Electroplating.

The use of storage batteries in connection with electroplating work is something of a novelty in Chicago. The recent installation of a number of cells for this purpose by Barnhart Bros. & Spindler of this city is therefore of especial interest. During the daytime they employ a dynamo for this purpose, but it was seen that a gain of about 14 hours each night could be had if the work were continued by means of the batteries. For this purpose the firm has installed a number of cells of the chloride type, of 200 ampere hours each. These cells are charged during the daytime in series, and discharged each night in parallel, two volts being required for their work. The connecting of the cells from series to parallel is accomplished with one movement of a ten-bladed double-throw switch. The batteries have also capacity to continue the work from Saturday noon until Monday morning, if this service is desired. Other electroplating firms in Chicago have the same application under consideration, and it will probably soon come into more extended use.

## The Heat of the Electric Light.

By C. C. Haskins.

Capt. Exler of the Austrian army has shown that an electric lamp of 16 candle power develops a maximum temperature of 94° C., and a lamp of 25 candle power a temperature of 101° C. Two lamps placed in a cavity in wood developed a temperature of 215° C., decomposed cannon powder and other explosives, but without detonation. The cavity was filled with water, which was set to boiling in about 15 minutes.—*Exchange.*

The amount of heat developed by an incandescent lamp may be made to do a deal of harm by careless handling, and on the other hand it may be arranged so that it will be perfectly innocent of heat danger. There is little doubt that conflagrations have been caused by the heat of such illuminants, but it is usually the fault of the consumer, rather than of the constructor or the company furnishing the current. There are two sources of danger, or perhaps two genera of cases where an incandescent light may work harm to property.

The first of these has its origin in a "spigot and bung" spirit, when the purchaser is contracting for the fixtures of a plant or installation. The purchaser says mentally: "I find that it will cost a considerable amount of money to fit my offices with shaded lamps. I will save that, and the boys and girls can keep books," or set type, or run their machines, as the case may be, "with shades they can make for themselves if they want them." When the current is turned on, after the first grand applause, and the ah! and oh! chorus has died away, there is an echo of wails which is made up of ah! and oh! as before, but this time carrying a very different signification. Now, it is "Ah! my eyes," "Oh! my sight," and at once there is a rush for something of which to manufacture a shade, and it is always, except in a tin-shop, of paper.

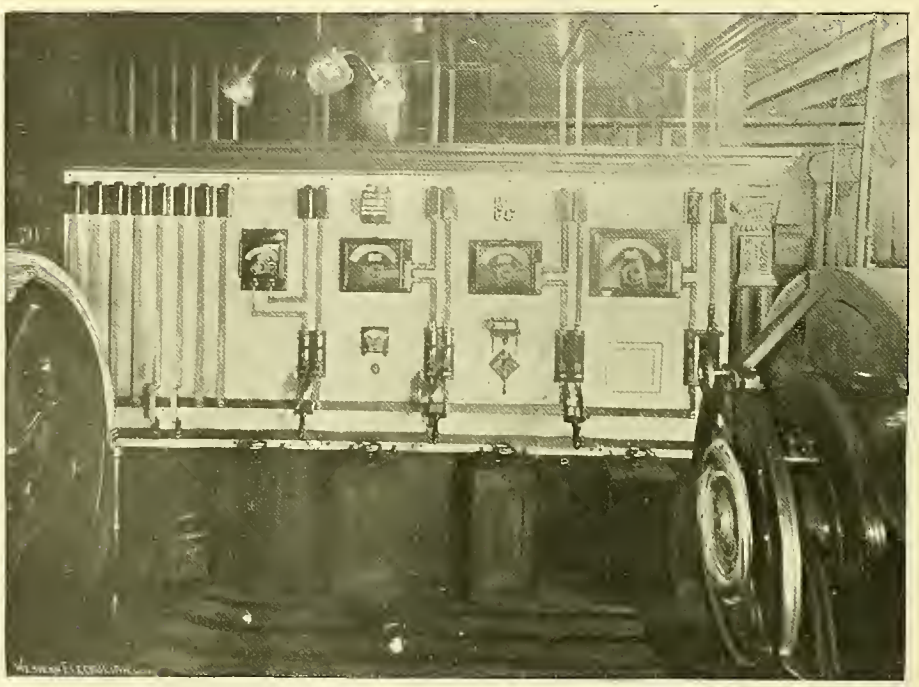

FIG. 2. ELECTRIC PLANT IN THE NEW PLANTERS' HOTEL, ST. LOUIS.—SWITCHBOARD AND 75 KILOWATT MACHINES.

There are more fashions in paper shades than there are in ladies' hats. There is the plain, square, stiff style like a fruit-stand "two for 5 cents" sign. There are cornucopias with gilt edges and funnels with no decorations, capacious enough to hive a swarm of bees, and others hardly large enough to hold a dime's worth of candy or popcorn. There is taste in color, and there is great lack of taste as well as of judgment in the means employed in attaching these to gas and other pipes—and, worst of all, there is danger in all of them, or at least the majority of the home-made shades for electric lights.

The cumulative effect of heat is little understood by the majority of people. There are those who deny, in the face of almost daily proof, that a steam pipe can cause a fire. The skeptic says: "Why, you can't set wood on fire under about 400° Fahrenheit, and water boils at 212°, so how can you set fire when you lack at the least seventy-five or a hundred degrees of heat in your coils?"

The trouble with that proposition is that it is not wood you set on fire—it is partly carbonized wood which doesn't require, after arriving at that condition by a long process of

daily heating, as high a heat as it originally required to break into flame.

Now, what is true of wood is as true of paper—and for that matter, nearly all paper to-day is the greater part wood. The constant application of heat to paper, although that heat is not up to the ignition point, will bring down the critical point of the paper by gradually charring it, until it will burn with the heat of an incandescent lamp. Experiment has shown that an incandescent lamp globe closely wrapped with paper, so that no air can pass between it and the glass, will set fire in a very few minutes. This is one form of danger.

The second source of danger from the lamp globe is developed by the window trimmer. Desirous of making as light and fluffy a display as possible, he winds loose and highly inflammable material around the butts of his lamps, and occasionally is bold enough to envelop the bulb itself with tarleton, canton flannel, cotton lace, or similar light material. That is in the dry goods window. In the notions houses a celluloid comb—made of gum camphor and gun-cotton—or other innocent fabric of a similar nature, is placed where the light will best show it off to the outside spectator, or perhaps a semi-transparent sheet of a like material is placed close to a lamp to show it to better advantage.

When through some such ignorant or careless disposition of electric lights, or when the window trimmer or the milliner's apprentice sticks a pin through a flexible cord to hang a bonnet or a flower, which, when evening comes, sets fire to the window, and perhaps the store, it doesn't seem exactly the right thing for the blame to fall upon the illuminant. If through wilfulness, or carelessness, or ignorance, I pull the trigger without knowing if it is loaded, I cannot see how the gun, or the powder, or the lead even, should be held responsible. Experience runs a very expensive high-school, but its curriculum is comprehensive and thorough, and graduates will all know by and by that sources of light are sources of heat, and are not the best hangers in the world from which to suspend or on which to support highly combustible merchandise.

## Trolley in the South.

Complaints are made by travelers in the South that the roads are bad and that very little improvement has been made of late. A correspondent of the New York *Sun* offers the following explanation of the present condition of affairs, and suggests that in view of the extension of the trolley system the necessity of good roads will not be so generally felt:

Perhaps the prospect of road improvement is not now so good as it would be were it not for the extensive introduction of the trolley system. Trolley cars are running in every considerable town, and the lines are oftentimes stretched far into the outlying districts, and eventually will be extended much further. Whatever may be said against the trolley in large and crowded towns, it is unquestionably an agent for the advancement of civilization in the country of inestimable value; and the use now made of it there is only the beginning of the service it is destined to render in the development of the agricultural regions. The electricity which furnishes its motor is generated by water power at a marvelously cheap rate of expense, and once the lines are laid down they can be run at a cost so trifling that their extension in all directions seems to be inevitable both for the purpose of transporting passengers and for conveying freight. In western North Carolina such a road through the rich tobacco growing country is projected for the special service of the planters, and generally may be made useful and profitable in affording facilities for rapid and cheap transportation in districts removed from steam railways, from which now the agricultural products must be carted at great labor and expense and much loss of valuable time. If it be so employed it will assist importantly in opening up new regions to cultivation, and it will help to lessen the expenses of the farmer generally, and thus enable him to sustain himself in a period of declining prices for his products. This development of the trolley system or of the use of electricity as a motor is manifestly in its very beginning only, and as time goes on it will be carried to lengths that will change the whole face of agriculture. It already has had the consequence of reducing notably the number of horses employed in the villages, the bicycle also assisting to the same end. With the roads as heavy as they are now, riding in a trolley is a positive luxury. Where the best and strongest of teams can move only slowly and laboriously through the clinging sand, the trolley car runs along at ten and twelve and even fifteen miles an hour, up hill and down hill, with tireless energy and complete ease. Around about Asheville and western North Carolina, where the country is hilly, these lines are laid in every direction, even up the sides of spurs of the Blue mountains, and in a few minutes a journey of three, five and six miles is accomplished where animal traction would consume from a half to a full hour.

It is obvious, therefore, that the use of electricity as a means of locomotion and the cheapening of it will bring about very radical changes in country life. It will relieve the lonesomeness and monotony of the isolation of farming regions from which people escape to the towns in order to obtain the social friction essential to enjoyment, and even to moral health; for it will bring the detached farmhouses into close connection with town and village activity, and give opportunity for introducing variety into many now stagnant towns. Here in the South especially this new development will tend to transform social conditions which have existed since colonial days, and it will thus pave the way for the increase of the population and the utilization of the untouched natural resources in which this region is so incomparably rich. Such a change must occur before the ambitious men who are now seeking to build up a new South can obtain their desire. The climate of nearly all the South is agreeable for white people generally, and in the central South, more especially in the higher regions of the interior, it is in all respects inviting.

## Col. W. S. Rogers.

It is a noticeable fact that in every successful institution, no matter what may be its character or form, there are some men who through their close application and devotion to the interests of the concern with which they are connected have come to be identified in the public mind with the enterprise. An instance of this kind is found in the case of Col. W. S. Rogers of the Brush Electric company of Cleveland, whose portrait is herewith presented. Col. Rogers has been connected with the Brush Electric company as special agent since 1891. He has general oversight of the local electric light companies in which the Brush company is interested, devotes a great deal of time to the disposition of bonds and stocks which they have in their treasury, and

COL. W. S. ROGERS.

in addition has made some of the largest sales in the history of the company. Throughout his career Col. Rogers has always maintained a uniformly high standard in his dealings of every kind and this has commended him alike to his competitors and associates. He is particularly proud of his record in private and public life as well as in his business career. His interest in public affairs became manifest at an early date. When only 15 years of age he entered the Union Army as a volunteer and served throughout the war. This was not his only public service, for in 1884 he was elected to the Illinois Legislature and was a member of that body when it elected John A. Logan to the United States Senate, after one of the most remarkable legislative senatorial contests in the record of the country. He was a brother-in-law of General Logan and was very closely associated with him in many ways. General Oglesby appointed him a member of his staff with the title of "colonel." Early in the 80's he was a large contractor for two years with the United States government in the improvement of the Mississippi river and employed from three to five hundred men. Subsequently he became attracted by the great developments in electric lighting, and going to St. Louis, became very prominent in all the earliest developments in electric lighting in that city. The Municipal Electric Lighting company of St. Louis, which was the outcome of the Electric Accumulator companies established in St. Louis by Colonel Rogers, is probably the largest electric light plant in the world and was started by him. He devoted a great deal of time to the development of other electrical industries in and around St. Louis and subsequently moved to New York, where he became interested in the construction of electric railways. He personally constructed Grand View Beach railroad at Charlotte, N. Y., near Rochester, which runs for some eight miles along the shores of Lake Ontario, partially through very swampy land, which necessitated the construction of over four thousand feet of trestle work, which at the time attracted a great deal of interest in the street railway world and was considered a remarkable achievement. The Brush Electric company secured Mr. Rogers' services in '91 and he is still with it. His portrait indicates that he is a well proportioned and handsome man. It is the general verdict of the electrical fraternity that he is a keen business man and strictly loyal to high-toned business methods.

## Electricity on the Pennsylvania Railroad System.

Contracts have been awarded by the Pennsylvania Railroad company for equipping with the trolley system the Burlington branch of the Amboy division, which connects Mt. Holly and Burlington, N. J. Preparations for installing electric motive power on this branch have been going on some time, and the contracts have been awarded under the supervision of F. W. Darlington, consulting engineer. It is understood that the Pennsylvania Railroad company is to put a trolley equipment on the Burlington branch, which is six or seven miles long, of a first-class character, from which can be secured all the data for the reconstruction of any length of its present steam lines into electric lines if it is deemed advisable.

The Westinghouse company will furnish the engine and generator, which will be of 300 horse power, and a Climax boiler will be installed.

Three motor cars 43 feet long will be built by the Jackson & Sharp company of Wilmington. They will be combination cars, for baggage and passengers, and will be equipped with Westinghouse motors and car equipments. Two of these cars will be provided with two motors of 75 horse power each, making 150 horse power to a car, and these motors are to drive the cars at a rate of 45 to 60 miles an hour. The third car will have four motors of 50 horse power each, a total of 200 horse power. These cars are intended to draw one, two or three Pennsylvania railroad coaches, such as are used in suburban traffic.

The railroad company is to do the track and electrical line work under the supervision of Mr. Darlington. All light rails are to be taken up and the entire roadbed will be laid with seventy-pound rails. Freight trains and through passenger trains will be run over the road with steam locomotives attached as usual, as the trolley cars are intended for local traffic alone. It is expected that the road will be ready for the operation of trolley cars not later than June 1st.

There are several short stretches of steam road in different parts of the East that are being provided with electrical equipment, and the outcome is awaited with interest by the managers of steam railroads and by electrical engineers everywhere. Besides the Pennsylvania railroad's experimental line between Burlington and Mount Holly, the New York, New Haven & Hartford Railroad company is equipping its Nantasket Beach branch with the trolley system, and intends, it is said, to use electricity on its Old Colony line also. It has recently been announced that the New York Central has determined to equip its Niagara Falls branch with the trolley system, and the latest announcement is that the Pennsylvania company is contemplating the use of electricity on one of the branches running out of St. Louis.

The General Electric company is now building 100 horse power motors for the New York, New Haven & Hartford's proposed electric road. Two of these motors are to be used on each car, and the intention is to adapt the present passenger cars to the purpose by putting new trucks under them.

## A Flock of French Ducks.

*La Revue Scientifique* of Paris has a good nose for news. In a recent number two late applications of electricity are mentioned as having originated in Chicago. In one of these it is reported a current of air passing over plates heated by electricity is used to dry grain. In the second, a similarly heated plate is placed inside of a public clock which had a habit of stopping because of the frost and moisture which accumulated within the works.

And the *Journal Universal d'Electricité* tells an anecdote which it gets, so it says, from a New York journal, in which the relator tells how he had seen and liked the Auer (which is the same as the Welsbach, inasmuch as the full name of the inventor is Dr. Carl Auer Von Welsbach) and had a burner, unknown to his family, placed over a lounge which he often napped upon, and was discovered asleep, with the lamp burning, by his family. His wife was horror-stricken, and thought his appearance indicated an advanced stage of decomposition, so she fainted and "fell down in it," while his daughter, "believing him dead, ran for a doctor." The row kicked up raised the dead; laughter chased the tears away, and the Auer Von Welsbach burner will cause no more ghostly rumpuses; but when the mains reach his premises the gentleman says he will have the electric light to read by.

## A Swiss Electric Railway.

According to the *Journal Universal d'Electricité*, the Compagnie Générale des Tramways Suisses will construct at Geneva an electric railway about six kilometers in length, connecting the Bastions, the Place Neuve and other points, as seen in the accompanying profile of the line, Fig. 1, which shows the grades, levels and relative inclines, as well as distances. Rousseau's Island is the lowest point.

The cars will accommodate 16 seated passengers (there is no hanging on or standing up on European street cars),

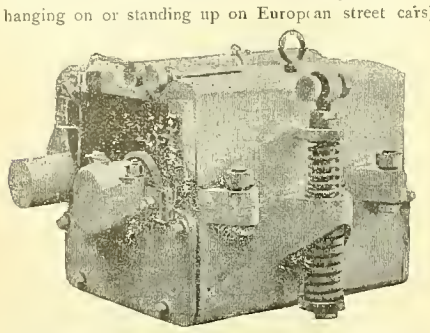

FIG. 2. A SWISS ELECTRIC RAILWAY.—THURY MOTOR.

and they will be run at 12 kilometers per hour. Each car will be provided with a Thury slow speed electric motor of 15 to 20 horse power, with single reduction gearing. The motor, Fig. 2, is completely inclosed in a steel case, which forms the magnetic circuit, and it is thus thoroughly dust and water-proof, while the arrangement is such that all parts, Fig. 3, are readily accessible. It is furnished with carbon brushes and the latest approved ring lubricators.

The power house is in one of the municipal basements, where two separately excited dynamos are directly coupled by the Raffard system to two horizontal turbines. These are run by high pressure water power, a chute of 134 meters being utilized, and they furnish, at a speed of 325 revolutions, 225 horse power. A Picard regulator is attached. The dynamos are of the six-pole Thury pattern of 150 kilowatts capacity. The armatures are drum wound, arranged for the best ventilation. The brushes are held by a special contrivance of the inventor, Thury, and run without sparking, despite the great variations of load. The frames are insulated with porcelain sealed in sulphur and bedded in the bitumen of the foundation. A spare turbine is held in reserve for cases of accident. The current produced has a pressure of 550 volts. This passes through the necessary instruments, meters, switchboards, etc., and thence by a double subterranean cable to la Place Bel-Air, which is the center of distribution. Here the feeder line is bifurcated, one-half going by cable to la Place Champel, and the other toward the Cornavin depot. In several places these are connected to the contact wire, and at each of these points a lightning arrester is placed.

Connection with the motors is made by overhead trolley wires, and the return is made by the rails. The overhead wire is of galvanized steel within the central portion of the city, and is seven millimeters in diameter. The rest of the line is of phosphor bronze. The insulation of the trolley line is similar to that in common practice in America. The earth return is assured by a copper bond wire connecting

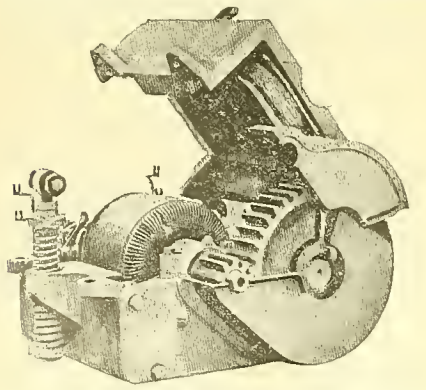

FIG. 3. A SWISS ELECTRIC RAILWAY.—THURY MOTOR (WITH PARTS EXPOSED).

the ends of the rails and a ground wire running the entire length of the line and attached frequently to the bond wires.

The double track line of 1,380 meters connects the Place Neuve to the passenger depot at La Cluse, near Carouge. The total rail line is 5,460 meters with 55 millimeters per meter maximum grade, and 25 meters minimum curve radius.

The running time between terminals, 5,460 meters, is 35 minutes, including regular and occasional stops—the latter far outnumbering the former, as the conductor will stop the car anywhere on notification. A car leaves either terminal every 10 minutes, and there are now six cars in service. An additional service is rendered over the section between Place Neuve and Cornavin depot.

## Shall a Street Railway Company be Allowed to Use the Existing Tracks of a Competitor?

The question put in the above form was brought very forcibly to the attention of the public on April 4th in Chicago by the action of the Chicago General Railway company in attempting to drive one of its cars over the Twenty-second street tracks of the Chicago City Railway company, with the result that Superintendent Bowen, of the latter company, at the head of a large force of men, demolished the car of the rival company, considering the act a trespass. The collision was exciting and was described in an illustrated article in the WESTERN ELECTRICIAN of April 13th. Of course, the Chicago General Railway company pursued the course it did merely to test the question, and the wrecking of its car was promptly followed by a suit in chancery brought in the Circuit Court of Cook county, the papers being filed about two weeks ago. The complaint in this action makes very interesting reading. The action is brought in the name of the Chicago General Railway company and the West & South Towns Street Railway company against the Chicago City Railway company, the solicitors for the complainants being Peck, Miller & Starr, C. C. and C. L. Bonney and Lyman M. Paine. The complaint recites the organization of the plaintiff companies and states that by an ordinance granted to the West & South Towns company on February 8, 1892, it was provided that "said company shall have the right to connect its tracks with those of the Chicago City Railway company, on Twenty second street, at or near Grove street, but shall have no right to construct any

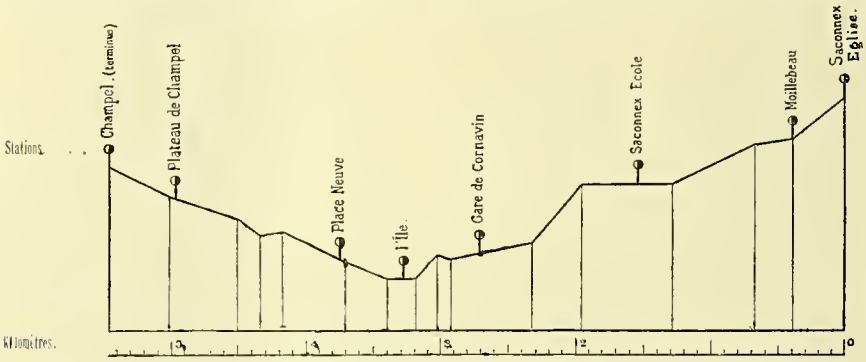


FIG. 1. A SWISS ELECTRIC RAILWAY.—PROFILE OF LINE.

tracks east of the Chicago river on said street, without the consent in writing of the said Chicago City Railway company. And that said company shall also have the right to operate its cars over tracks not owned by it, upon such terms and conditions of lease or contract as may be agreed upon between the companies owning said respective tracks, or othe wise, not in conflict with any of the conditions of said ordinance, or the general ordinances of the said city." The dealings of the two companies are then detailed at some length, and it is asserted, in effect, that the Chicago City company sought to harrass and impede the younger company at every point. That portion of the complaint immediately bearing on the important question in point is as follows:

And your orators further show unto your honors that the obvious natural effect of the extension of the operation of your orators' said lines of railway over and beyond said Twenty-second street bridge would be to increase the number of passengers who would seek passage on the various lines of railway of the said Chicago City Railway company; and would thereby afford ample compensation to said Chicago City Railway company for any use by your orators of the railway tracks laid by said Chicago City Railway company; but your orators do not admit any legal or equitable right of compensation in said Chicago City Railway company for any use which may be made of said railway tracks or of any other part of the said public highway, Twenty-second street, by any other person or persons, vehicle or carriage in passing along the same, forasmuch as the said Chicago City Railway company has not, nor can have, under the constitution and laws of this state and the ordinances of said city, any exclusive right to said street or any part thereof, but the same is and must at all times be free to the public, subject to such regulations as the public authorities may from time to time prescribe.

And your orators further charge that under section twelve (12) of article eleven (11) of the constitution of this state, all railways in this state are and must be public highways, and free to all persons for the transportation of their persons and property thereon, under such regulations as may be prescribed by law; and that under this provision, until such regulations shall have been made by lawful authority, all such railways must be free like other public highways; and that no exclusive right in any public street can be obtained by any railway company, but that such companies must conduct their business in such a manner as not to seriously to interfere with or exclude the general public therefrom.

And your orators further charge that the General Assembly of this state has delegated to the said city of Chicago the power to regulate the use of streets, and to regulate the traffic thereon, and to regulate the laying of railroad tracks; and that the ordinances so as aforesaid passed in favor of your orators are such lawful regulations of the matters aforesaid; and that your orators are duly authorized thereby to connect their tracks with those of the said Chicago City Railway company, and to operate their cars over the tracks laid down upon said streets as aforesaid, without unnecessary interference with the cars of said Chicago City Railway company, and subject to the limitation that no more than five cents shall be charged for one continuous ride for any distance within the present or future limits of said city of Chicago.

And your orators further show unto your honors that on or about April fourth, A. D. eighteen hundred and ninety-five (April 4, 1895), having previously given public notice of their intention so to do, your orators undertook to run one of their cars from said Jefferson street to said Grove street, along the railway tracks and across the bridge aforesaid, and the defendant then and there had full previous notice and knowledge that such undertaking would be made. Said undertaking and attempt was made with what is commonly known as a horse car drawn by animal power, that is to say, by a team of horses. And for the better understanding of this matter by your honors, your orators further show that the west spproach to said Twenty-second street begins at said Jefferson street and extends easterly for a distance of about three hundred feet, and said Twenty-second street bridge extends easterly therefrom for a further distance of about two hundred feet, and the easterly approach to said bridge extends from said bridge to said Grove street for a further distance of about three hundred feet, so that the distance from said Jefferson street to said Grove street has a total extent of about eight hundred feet. The east line of said Grove street is about three thousand four hundred (3,400) feet west of said State street, and your orators have in operation for the transportation of passengers to the eastern terminus of their said lines of railway on said Twenty-second street a total of about sixteen miles of railway track.

And your orators further show unto your honors that although public notice had been given as aforesaid of the intention of your orators to run their cars over said Twenty-second street bridge, and along their right of way easterly therefrom, and although the defendant had full notice, knowledge and information thereof, no notice or information of any objection thereto on the part of said Chicago City Railway company was ever received by your orators, or either of them, prior to the actual making of said undertaking and attempt as hereinafter set forth.

And your orators further show that on the morning of said April fourth, A. D. eighteen hundred and ninety-five, having theretofore invited representatives of the public press and many persons interested in the extension of your orators' railway transportation along said Twenty-second street to attend for the purpose of participating in that event, your orators thereupon took their said car, which was numbered 306, and departed from their electric power plant at Thirtieth street and Kedzie avenue, in said city of Chicago, at or before the hour of ten o'clock in the forenoon, and ran said car by electric power, as a trail car to an electric motor car, from the said power plant along the Kedzie avenue tracks of your orators to said Twenty-second street, and thence along the same eastwardly to said Jefferson street. And that at said Jefferson street said car, No. 306, was detached from said electric motor car and a team of horses was attached thereto. The said car, which then and there contained a number of passengers, proceeded under the direction of W. F. Brennan, general superintendent of said railways of your orators, eastwardly from said Jefferson street along said Twenty-second street, upon the rails so as aforesaid laid by your orators across said bridge. When said car came upon said bridge your orators' said superintendent and the employes of your orators, in charge of said car, perceived a large body of people east of said bridge, along the line of said Twenty-second street, and immediately thereafter discovered that the said Chicago City Railway company, under the personal charge and direction of M. K. Bowen, general superintendent of said last named company, had organized a feudal force of about three hundred (300) men, for the purpose of preventing your orators from carrying out their lawful and laudable endeavor to extend their transportation of passengers along the said Twenty-second street, as authorized by said city council.

Your orators also discovered and learned that, in organizing said force for the purpose of levying war upon your orators and preventing them from carrying out their purpose aforesaid, said Chicago City Railway company had obstructed said Twenty-second street by placing upon the same street a car, without any means of moving the same and without any passengers therein; and had further obstructed said street by placing thereon a wagon loaded with large pieces of iron, weighing, as is estimated, about four thousand (4,000) pounds, and had fur-

ther obstructed said street by another wagon, similarly loaded with pieces of iron; and to render the removal of said wagons difficult and impracticable had removed one wheel from each of said wagons, and taken away the horses by which the same had been drawn into the places then occupied by them. The said Chicago City Railway company had also placed upon said street three wagons, commonly known as wrecking wagons, which said wagons were provided with crews of men, axes, crowbars, hoisting jacks, sledge hammers, ropes with iron hooks at the end and other similar instruments of obstruction and destruction.

FIG. 1. TRANSFORMER VAULTS.

While said car, No. 306, was still upon the said bridge, said M. K. Bowen, superintendent as aforesaid, came to the center of said street in front of said car, and commanded the driver thereof to stop his progress. Said driver did thereupon stop said car, and said W. F. Brennan, general superintendent of your orators' said railway lines, inquired if said Bowen were an officer of the law, and whether he had any legal papers or process forbidding the running of said car upon said street.

Said Bowen replied that he was not such an officer and had no such papers or process, and said Brennan then directed the driver of said car to proceed with the same. When said car had proceeded accordingly to a place about one hundred feet (100) west of the east line of said Grove street, and while the same was clearly within the limits within which your orators had been authorized by said city council to operate their said railway, the said Chicago City Railway company, by said Bowen, its said superintendent, willfully and maliciously, and without any lawful warrant or authority, ordered and caused the organized force aforesaid to give battle against your orators and their said car and the persons in charge of the same, and thereupon about forty (40) of the servants and employes of said Chicago City Railway company, under the immediate direction of said Superintendent Bowen, with force and arms violently assaulted said car and the horses by which the same was drawn, and the persons in charge thereof, and thereupon, under the direction of said Bowen, wantonly, maliciously, violently and with excessive force overthrew said car, and by means of said wrecking wagons and the various instruments of obstruction and destruction aforesaid, assailed, tore in pieces, broke up and totally destroyed said car, breaking the wheels thereof with sledge hammers, and otherwise showing great and riotous malice and disorder in such destruction.

And your orators further show unto your honors that while so engaged as aforesaid in obstructing said public street and destroying said car the said Chicago City Railway company, by the said superintendent Bowen, repeatedly threatened that they would in like manner, break up and destroy all or any other cars which your orators might at any future time or times attempt to run or operate upon said railway tracks east of said bridge.

And your orators further show unto your honors, that their cars, upon their lines of railway aforesaid, are running at intervals of about eight (8) minutes, and that many thousands of persons are transported every day along said lines of railway, many of whom desire to be transported over said bridge and along said Twenty-second street.

And your orators furthur show unto your honors that the obstruction of said street as aforesaid and the destruction of said car were not a mere trespass for which an action for damages would afford any substantial or adequate remedy, but were a serious obstruction of the business of your orators; and if the same should be continued, as threatened and intended by the said Chicago City Railway company, great and irreparable wrong and injury would be inflicted on your orators by destroying their property and in depriving them of a large amount of gains and profits which could not be definitely ascertained; and that if your orators should attempt to continue the business which they have been incorporated to conduct for the service of the public, by running their cars to said Grove street and the said Chicago City Railway company should carry into effect, as your orators fear it would do, its threats to destroy any other cars of your orators which might be run upon said tracks east of said bridge, all the cars of your orators would, in like manner, be destroyed, giving rise to a great multiplicity of actions, in which however your orators could obtain no substantial or adequate redress for the injuries which they would thereby suffer; and the operation of your orators' said railway, both as to said short line of track east of said bridge and to the west thereof would be paralyzed by said destruction, and the franchises, licenses, and privileges of your orators be thereby put in great peril and your orators irreparably injured and damaged.

And your orators further show unto your honors that in neglecting and refusing to resort to the courts of justice for a remedy for any supposed wrongs or injuries suffered or feared by said Chicago City Railway company, from your orators or either of them, and in organizing a private armed force for the destruction of the property of your orators and the obstruction of their lawful business, as aforesaid, and in actually waging war against your orators, their property and employes, said Chicago City Railway company has been and is guilty of a great and scandalous abuse of its corporate powers and privileges, and has incurred a forfeiture of the same which ought to be tried and adjudged against them at the instance of the public authorities, whose duty it is to act in that behalf. And to enable your honors the better to understand the action of said Chicago City Railway company and the charges against the same made by your orators, your orators further show that the said Chicago City Railway company and its lessees have constructed about three hundred and eighty (380) miles of railway tracks within the public streets of said city of Chicago and employ a great number, to-wit, several thousand persons in the maintenance and operation of their said railway lines; and thus have the physical power, if permitted to use the same, of opposing and preventing by force and violence any attempt to enter into competition with them in the transportation of persons through said city of Chicago.

And your orators further show unto your honors that they

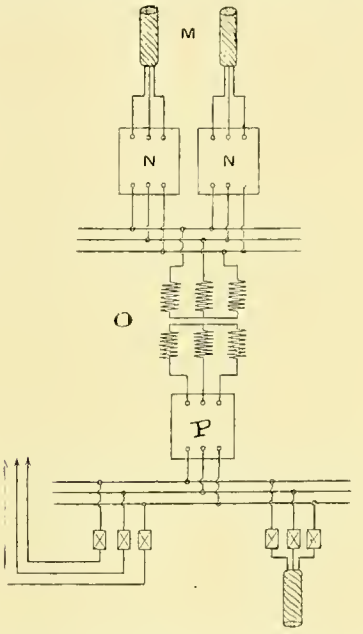


FIG 3. TRANSFORMER VAULTS.

have decided to use electric power as a means of transporting their said cars to said Grove street and to that end have obtained a permit from the city of Chicago to your orator, the said Chicago General Railway company, to erect poles and string wires necessary to electrically equip said line of railway along said Twenty-second street, between Jefferson street and Grove street. But your orators fear that unless prevented by the order and writ of injunction of this honorable court, the said Chicago City Railway company, its officers, agents, employes and servants, in case your orators should attempt to erect such poles and string such wires, and thereafter to run any of their cars along said Twenty-second street east of said bridge, will thereupon with force and arms, assail, destroy and break up the same as in the former case above set forth.

Wherefore, and forasmuch as your orators are without remedy by the strict rules of the common law, and can only have relief in this honorable court of equity, where such matters are cognizable, your orators pray that the said Chicago City Railway company may be made party defendant to this bill of complaint; and that said company may be required to answer all and singular the matters and things in this bill of complaint contained, but not under oath, the oath of said defendant and of its officers to said answer being hereby expressly waived; and that your orators' cause may, with all convenient speed, be heard and tried, and that upon the hearing thereof, it may be ordered, adjudged and decreed by the court that your orators have a full and perfect right to operate their said cars over and along said railway tracks, upon said Twenty-second street, from said Jefferson street to said Grove street, in said city of Chicago, as authorized in said ordinances in their behalf, without any interference or prevention, or hindrance or obstruction, by and on the part of the said defendant, its officers, servants, agents, employes or confederates.

And that in the meantime your orators may, upon the proper motion therefor, at any time, have the proper temporary order and writ of injunction, strictly enjoining and commanding the said Chicago City Railway company, its officers, agents, employes, attorneys, solicitors and confederates of every sort, strictly and absolutely to desist and abstain from all and any interference with or injury to your orators, or either of them, or their cars or other equipment, or their officers, agents, employes or servants, in the operation of their said railway and cars over the said railway tracks, between the said Jefferson street and the said Grove street, in the said city of Chicago; and particularly to desist and abstain from all and any interference with or injury to or destruction of any of the cars or equipment of your orators while in use upon said tracks between the streets aforesaid.

And that upon the hearing of this cause a perpetual injunction may be granted against said defendant, strictly commanding and enjoining it, as is above prayed in relation to said temporary injunction.

The same question—the right of one company to compel a rival to allow it the use of existing tracks at proper rental—recently came up in the Michigan Legislature. On April 18th the House devoted the day to arguments on the bill granting the new Detroit Street Railway company the right to use the Citizens' company's tracks with the half-mile limit. The bill failed by a vote of 51 to 40, and by a tie vote a motion to reconsider was lost, thus in the opinion of a majority burying it beyond resurrection.

## Transformer Vaults.

In the new rules of the Board of Underwriters and of the city of Chicago as well, stringent regulations govern the placing of converters for use with alternate currents, it being well known that this form of apparatus generates no inconsiderable amount of heat. Apropos of these rules—which require this class of apparatus to be placed in "a room or vault constructed of or lined with fire-resisting material, and used only for that purpose"—where the transformers cannot be placed outside the building, possibly consumers might fancy the style of converter box which is represented herewith, and which is described by the *Elektrotechnische Zeitschrift*. These boxes are in use by the central station (Siemens & Halske system) of Chemnitz.

Fig. 1 represents a general view of the column or box, for the transformers or converters, standing out-of-doors, instead, as Prof. George Forbes said in his address before the Electrical Congress of the Fair, "of being stuck up like flies on the houses." It is divided into two compartments, as shown in Fig. 2. These columns, placed on the public street, are four meters in height and 1.2 in diameter, and round. In the upper portion at *D* is the transformer on the platform *C*. A diagram of the circuits is given in Fig. 3. *M* shows the high pressure mains, *N* the cut-outs, *O* the transformer, and *P* the secondary switches and cut-outs. Fig. 2 gives a section of the transformer column. The lower portion incloses the distribution table for the secondary current, mounted on porcelain. In the bottom a raised portion keeps all away from dampness and the earth.

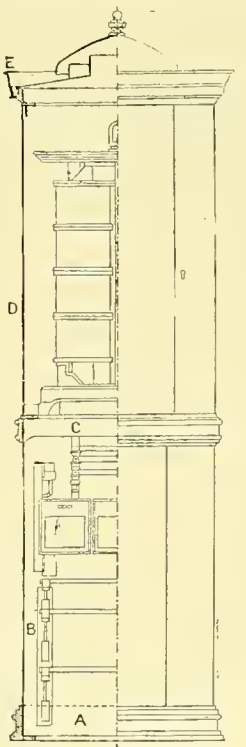


FIG. 2. TRANSFORMER VAULTS.

Doors permit of examining the inside at will. All necessary work can be carried on at ease in the interior, as the size is sufficient for all purposes. While the transformers are constructed so as not to heat above 50° C., the ventilation of the column is assured by openings under the eaves, while these latter protect all within from outside moisture.

Gen. E. S. Greeley has made a gift of a fine electrical equipment to the Boardman Manual Training School of New Haven, Conn.

Western Electrician.

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## HIGH WATER MARK

CIRCULATION, 16,630.

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AN effort will be made to place the responsibility for trolley accidents in Brooklyn by prosecuting the men in charge of the cars which cause death or damage of any kind. Motormen have been indicted and it is proposed to vigorously enforce the law in every case where the responsibility can be fixed. It is hoped that this will make the men exercise more care in the operation of their cars.

MR. HASKINS' remarks on "The Heat of the Electric Light," which are presented in another column, are timely and valuable, and they should receive careful consideration from persons using incandescent lamps in offices, factories and stores where the dangers referred to are particularly prevalent. In this contribution Mr. Haskins presents the result of his observation as an inspector of electric plants, and everyone who has had experience in this line, or who has given the subject consideration, will readily see that his position is absolutely correct. The mistaken idea of entire absence of danger under all conditions in the use of incandescent lamps is no doubt largely due to the fact that there is no flame to come in contact with surroundings. It is true that when incandescent lamps are used danger is greatly reduced, and that with proper attention it is absolutely obviated, but persons using incandescent lamps must understand these conditions, and they should exercise judgment in handling the lamps if they wish to escape the penalty that will surely follow violation of the rules referred to. To be secure, paper shades should be tabooed, and the use of fluffy stuff in combination with lamps in decorating show windows abandoned. There are other suggestions in the article that are worthy of careful attention, and their perusal should be convincing.

ALTHOUGH supported by an unusually strong combination of political and commercial interests, and urged by the people of all parts of the state, the bill providing for the regulation of telephone charges in New York has failed to become a law. It had been hoped that decisive action would be taken by the present Legislature, as the telephone rate question had been made an issue in the last election, and many of the defeated members of the preceding Legislature who had opposed a similar measure attributed their retirement to their action on this question. Early in the year this bill was introduced in the Assembly by Mr. Gerst and in the Senate by Mr. Persons, representatives of Erie county. This action was taken in response to the general demand for some measure of relief from the exactions of the monopoly. Very strong arguments in favor of the bill were made by representatives of many organizations of telephone subscribers in all parts of the state. New York city and Brooklyn sent many distinguished men to Albany to put the committee on electricity, gas and water supply, to which the proposed law had been referred, in possession of all the facts bearing upon the telephone question; Buffalo and other cities did the same, and very strong arguments in favor of reporting the bill were presented. At one of the public hearings fifty organizations of business men from all parts of the state were represented and numerous petitions were presented from subscribers asking for relief from the exorbitant charges that were required. The Bell company claimed that the rates proposed in the original bill were too low and the advocates of the measure at once met this claim by agreeing to an amendment, providing for higher rates, thus showing their willingness to treat the company fairly. But these concessions did not satisfy the telephone people and they continued their opposition. The Assembly committee refused to act. It would not report the bill, either favorably or unfavorably, and so give the house itself the chance to pass upon the merits of the measure. The refusal of this committee to report the bill to the house was very gratifying to the telephone people, but it was a surprise and disappointment to the Republican leaders of the Assembly. Last week these leaders revolved to bring the matter to an issue. A motion was made that the committee be discharged from further consideration of the bill. This motion was beaten, 49 to 60. The motion to take the bill from the committee and consider it was supported by nearly all the leaders of the Assembly. Speaker Fish voted for it; so did the chairmen of all the principal committees, showing conclusively that the leaders in the house recognized the importance of bringing the matter to a decisive vote. In argaing for the motion the leader of the Republicans on the floor said he was not in favor of the particular bill pending before the committee, but undoubtedly great evils existed, and a bill of some sort should be passed. He did not want the newspapers to say that the Republican Legislature was under the control of the telephone monopoly. He was in favor of taking the bill from the committee, amending it and passing it. A telephone bill had been before the House for years; the issue should be met squarely. Let the bill be considered and disposed of on its merits. A glance at the names of the assemblymen favoring the measure disposes of the insinuation that it was their intention to blackmail the company. On the other hand, no less authority than the *New York Herald* charges that lobbyists invaded the Assembly chamber when the bill was called up and openly solicited votes in opposition to the measure. Such a statement should not be allowed to pass unchallenged, and it is to be hoped that the Bell company will meet the issue and disprove the charge. While the failure of the bill will insure the telephone companies of the state from interference for another year, it will not remove the feeling of opposition to the Bell policy that is steadily gaining ground. Competing companies will undoubtedly take advantage of this fact to advance their own interests, and thus the question of securing reduced rates may be solved without the intervention of the Legislature.

The friends of the telephone bill, however, announce that they do not propose to let the measure rest where the Bell people evidently want it—in the clutches of the Assembly committee on electricity—but will endeavor to bring it up in the Senate and pass it there. It must be admitted that this is not a promising programme as the Senate is supposed to be even more in sympathy with monopolies and corporations than the Assembly.

IN the complaint presented to the court by the Chicago General Railway company, in its action against the Chicago City Railway company to compel the latter to allow it to operate its cars over a portion of the Chicago City company's tracks on Twenty-second street, the position taken by those who hold that a street railway corporation has no exclusive proprietary rights to the rails which it lays in a public street is clearly outlined. A comprehensive abstract of this complaint is given on a preceding page under the title "Shall a Street Railway Company be Allowed to Use the Existing Tracks of a Competitor?" but the question at issue might as well be expressed in the form: "Who Owns the Street Railway Tracks in Public Highways?" Are these tracks under the exclusive control of the municipal corporation granting the franchise, or are they the private property of the railway company as much as the power house? This is the question that is now being pressed to a settlement, and it is one that demands a very nice adjudication of public and private rights.

The complainants in this important suit assert that the company owning the existing tracks "has not, nor can have, under the constitution and laws of this state and the ordinances of said city, any exclusive right to said street or any part thereof, but the same is and must at all times be free to the public, subject to such regulations as the public authorities may from time to time prescribe." This is said to be so, because, under the state constitution, "all railways in this state are and must be public highways, and free to all persons for the transportation of their persons and property thereon, under such regulations as may be prescribed by law; and that under this provision, until such regulations shall have been made by lawful authority, all such railways must be free like other public highways; and that no exclusive right in any public street can be obtained by any railway company, but that such companies must conduct their business in such a manner as not to seriously interfere with or exclude the general public therefrom." It is further claimed that the city of Chicago has the express right to regulate the use of the streets and the laying of railway tracks within its limits, and that in pursuance of such right the city gave the Chicago General company the privilege of running its cars over the existing tracks in a portion of Twenty-second street.

The position of the Chicago City Railway company has not been officially stated. It undoubtedly holds, however, that under its prior franchises and by long existing rights it has the right to resist what it regards as trespassing on its property.

To show to street railway men, not alone in Chicago, but elsewhere—for this is more than a local question—the temper of the press and a large portion of the public of Chicago, we quote from two recent editorials in the conservative and influential *Record:*

If the lawless outrage in Twenty-second street is to be passed without rebuke it would be well to set aside the pretense of government and go back to the simple but direct methods of Patagonian savages. The company which committed the violence in this case seems to have been inspired by the idea that its own sacred possessions are of more importance than public safety or the common law. It needs to be taught a lesson.

The wanton destruction of a competitor's property by the Chicago City Railway company's men makes pertinent the inquiry: To what extent do the streets of Chicago belong to the street railway monopolies? "I will wreck every car that touches our rails," said the captain of the attacking force. Will the City Railway company rest content with smashing the cars of its most dangerous rivals, or will it go further and destroy also such omnibuses, cabs and private conveyances as happen to run upon its tracks?

* * * * * * * *

It seems that the question as to who owns the streets of this town is still undecided. The pleasing fiction that they belong to the public and that the public has a right to say what shall be done with them seems, however, to have been disproved. So has the theory which maintains that in cases of doubt or dispute questions pertaining to streets franchises should be settled by adjudication in a court of law. The methods actually employed are much more primitive and simple.

The question is now fairly in the courts, and we may at least hope that the final decision will clear away much of the confusion existing in relation to the rights conferred on private corporations by municipal street franchises. Street railway men will do well to watch the case carefully, and the American Street Railway association might find a fruitful topic for discussion at the coming Montreal convention in a thoughtful consideration of this subject.

## Underwriters' Rules.[1]

By William A. Anthony.

A recent controversy, in relation to inside wiring for incandescent lighting, has suggested to me the importance of bringing out a full and free expression upon the subject from those whose experience gives them the best right to speak, and I venture to bring the matter before the Institute in the hope that it may provoke such an expression as may have some influence in determining the character of any changes in the rules for construction that may be proposed, or in fixing the interpretation to the rules now in force. The present rules are, of course, the result of a process of evolution, and I think everyone will admit that the process has been one of progress. In early days of electric lighting, the desire to conceal the wires led to fishing them in between floor and ceiling and between plastered walls, as had been done with electric bell and burglar alarm wires. Fires occurred, and were ascribed to the electric wires, sometimes rightfully, but no doubt sometimes wrongfully.

Insurance companies took up the matter, passed rules and appointed inspectors. Many of the rules were good, some were only an annoyance to the construction companies. Different boards adopted different rules, and often the inspector was a law unto himself.

Wishing to assist in securing uniformity, and feeling that electrical engineers, who have to do with the practical work of electrical installation, are best qualified to frame rules for electrical construction, the National Electric Light association, in 1890, appointed a committee to take the matter in hand, and upon the report of this committee, in 1891, adopted a series of rules, which, with some amendments adopted at later meetings, may be assumed to represent fairly well the consensus of opinions among the electrical fraternity, as to what constitutes a safe electrical installation.

Rules, substantially the same as those, have been adopted by the National Board, and various local boards of fire underwriters, and are the recognized rules in force at the present time.

The object of all rules is, first, to secure a safe and permanent installation; second, to provide for the repair or renewal of conductors in case of failure. It may be said that from the standpoint of the insurance companies, the first is the only object, but surely conductors so installed that they can be easily overhauled and replaced in case leakage is discovered, are safer for the very reason that a fault is likely to be repaired before any serious damage has occurred.

When highly insulated wires, whose insulation resistance was measured in megohms per mile after immersion in water for weeks, came into use for electric lighting plants, it was natural to suppose that they could be put anywhere, and would last indefinitely. They were put in all sorts of inaccessible places; on the beams before floors were laid, in partitions before plastering, on the lath with iron staples to be covered with mortar. Some such circuits are no doubt in existence to-day as perfect in insulation as when first put up; but numberless cases of failures of insulation occurred, and experience shows that such a construction is entirely unreliable. Then came the interior conduit, which it was assumed would serve both as a mechanical protection and an insulator, but it was found not to be entirely reliable in either capacity. It was not impervious to moisture, it was subject to damage by nails, saws and chisels. It was found necessary to prescribe that wire of the highest insulation should be used in it, and that it should not be drawn in until all danger from mechanical injury was passed. Then came the brass armored conduit; but that was not nail proof. Now we have the iron armored conduit, and it remains to be seen whether this will fulfill all requirements.

It has come to be pretty well recognized that no mode of electrical construction is absolutely proof against failure at some point, and that form of construction is best which affords the smallest chance for injury or depreciation, and offers the greatest facilities for repair or renewal in case of failure.

There has been a uniform progress in the direction of greater safety and better facilities for repair, from the time when wires were put anywhere, to be covered by floors, or mortar, or built into brick walls, to the iron armored conduit which is offered to-day. To be sure, the cost of the installation has advanced, and the iron armored conduit presents difficulties when alternating currents are employed. To me it seems that the advantages gained are worth the cost, and the difficulty with alternating currents disappears, if the two conductors are placed in one conduit. To this I can see no possible objection when the conduit is iron armored.

In view of the fact that we cannot be absolutely certain that failures in insulation will not occur in any given installation, it seems to me that the foundation principle of all rules for the placing of conductors should be accessibility. Further, no conductor should be placed where its position or its relation to other conductors in any part of its length is unknown. This means that raceways must be provided, into which conductors may be drawn and from which they may be removed at pleasure, such raceways to serve as adequate protection from mechanical injury; or the conductors must be placed in mouldings which are themselves accessible, or they must be supported by cleats or insulators in plain sight.

I believe that past experience would warrant the adoption of a rule that would require the use, for concealed work in buildings of fireproof construction, where conductors must be carried up steel columns, over steel floor beams, in brick partitions, or in plastered walls, of a raceway or conduit, equal in its ability to afford mechanical protection to that known as iron armored conduit, so installed that conductors could be drawn in or out at any time.

And now a word as to the controversy that suggested this paper:

A conductor has been put upon the market, which consists of a standard Habirshaw wire with its covering of rubber and braid, having woven upon it two additional coverings of extra heavy braid. This additional covering, which is tightly woven on, and from which the wire can no more be removed than from its original covering of rubber and braid, the maker, by an extraordinary stretch of language, calls a tube, and claims for it the advantages of the conduit tube prescribed in the insurance rules. It goes without saying that this wire affords no means of replacing a damaged conductor, and, therefore, has not that advantage of the conduit. As to mechanical protection, it certainly is not superior to the unarmored conduit, and it has not the advantage that the conductor can be left out until the danger of injury is passed. As to insulation against moisture, the added coverings do not improve it; the insulation being entirely due to the rubber covering which is inside of all the braids.

And yet I have just learned that the New York Board of Fire Underwriters, on March 20th, passed the following resolution:

*Resolved*, That the superintendent be authorized, until further notice, to approve the use of the Attix tube and wire, when equal in quality and insulation to the samples submitted to this board and tested, under the same conditions where tubing would be permitted; provided that there is no splicing or tapping of the wire, but that its introduction shall be in all cases by the loop system; that in new buildings, when necessary to carry it between floors and plastering, it shall be through holes bored in the beams, not less than two inches apart, a single conductor in each hole, out of the reach of nails; and in old buildings where necessary to carry it within the reach of nails, it shall be protected by some device from perforation; and provided further that the wire and tube be carried intact into the cut-out boxes, and that in no case shall the outer covering be removed before introducing the core wire into the cut-out box.

It will be noticed that the wire is called a "tube and wire," when it is no more a tube and wire than the Habirshaw which forms its basis. The tests referred to show that, after immersion in water or being imbedded in plaster, the insulation resistance was 20 megohms per mile. But the Habirshaw wire, without the Attix covering, would have shown the same. What then is the propriety of confining the operation of this resolution to the Attix wire? Why not permit the use of any good highly insulated wire under the same conditions?

It seems to me that this resolution is one of those reversions to an ancestral type which we find in all evolutionary development, which is off the general line of progress, and which is destined soon to become extinct.

1. Read before the American Institute of Electrical Engineers, April 17, 1895.

## In Memory of Mr. Phelps.

At the regular meeting of the American Institute of Electrical Engineers on April 17th, President Houston officially announced the death of Treasurer Phelps, with fitting remarks regarding Mr. Phelps' services in behalf of the Institute. William J. Hammer, James Hamblet and R. W. Pope were appointed a committee by the council to bring in a suitable memorial. The report of this committee, which was adopted by a rising vote, is as follows:

The council of the American Institute of Electrical Engineers, desiring to express its sense of the loss to the Institute in the death of George May Phelps, at its meeting held Wednesday afternoon, April 17, 1895, at the Institute headquarters, appointed a special committee of three to draft suitable resolutions which the undersigned as committee respectfully present herewith.

*Resolved*, That in the death of George May Phelps the council has suffered the loss of an energetic, faithful and capable member, and the Institute a most efficient officer—one who was constantly striving to uphold the standard of its work, one who was ever watchful of its welfare. In his disinterested efforts to serve the Institute, he brought to bear upon its deliberations his keen perceptions, intellectual ability and eminent force of character.

*Resolved*, That a copy of this resolution be suitably engrossed and framed and presented to Mrs. George W. Graham, his daughter and the sole surviving member of his family.

George A. Hamilton was elected treasurer for the unexpired term of Mr. Phelps.

## A California Opinion.

Giovanni Girandi, a dishwasher in a San Jose, Cal., restaurant, was sent to the roof of his employer's house one stormy night in 1891 to secure some signs. While on the roof he ran into some electric wires and was badly burned. He sued the Electric Improvement company of San Jose for damages and obtained judgment. Then the company took an appeal. The Supreme Court has now affirmed the decision of the lower court. The Supreme Court says: "It is the duty of those making a profit from the use of so dangerous an elemeat as electricity to use the utmost care to prevent injury to any class of people composing the public. They must protect those possessing less than ordinary knowledge of the character of the commodity."

## Important if True.

Under recent date the daily papers print this information in a dispatch from New Haven, Conn.:

B. J. Hogan, electrician and head of the mechanical department of the Yale psychological laboratory, has invented a device which reduces the voltage of an electric wire without impairing the current. Hogan believes that it will entirely supplant the motor-dynamos used by telegraph and telephone companies. The Edison machine now in use costs $100, and Hogan says his machine can be made to sell for $5. Hogan says that a strong electrical current can be so reduced that it can be used either for propelling cars or for ringing door bells.

The trolley line on Van Buren street, Chicago, connecting with the Halsted street cable road, is now in operation.

## No Relief for New York Telephone Subscribers.

Once more the American Bell Telephone company has demonstrated its great power in the Legislature at Albany, and despite the wishes of the people of the state of New York and the efforts of the leaders of both parties in the Assembly, the bill providing for the reduction of telephone rates was hung up last week. On Thursday, April 18th, a test of the relative strength of the friends and opponents of the measure was made, when there was an effort to discharge the committee on electricity, gas and water supply from the further consideration of the bill of the Board of Trade and Transportation of New York city providing for lower telephone rates. By a vote of 60 to 49 the motion was defeated, six members refusing to vote. The reason ascribed by the *New York Herald* for the defeat of this bill is the alleged fact that "the telephone companies make large contributions to political state committees." The same paper is authority for the following report of the proceedings:

The most formidable lobby which has invaded the capitol this session was active during all the time of the session preceding the making of the motion. Some of them were at work on the floor of the Assembly openly soliciting members to vote against bringing the bill out. Mr. Gerst of Erie, who introduced the bill, moved to discharge the committee, saying that two weeks had passed since the last hearing.

Mr. Lounsberry, chairman of the committee, opposed the motion, because the bill had not been reprinted and was not upon the files in its last form. He thought the original bill had been withdrawn.

"It has not," Mr. Gerst replied.

Mr. Hennessy declared that the committee had had plenty of time to consider the bill. "Let us get the bill before the House," said he, "and if it is a good bill we will pass it. If it is a bad bill we can kill it. The people, as well as the corporations, have rights involved in this question. In the last two Houses these bills were smothered."

Mr. Cutler of Rockland said that the Gerst bill was full of defects, and that it still would be inequitable after Mr. Gerst had offered the amendments which the backers of the bill had agreed to.

Mr. Abell of Kings offered a substitute motion requesting the committee to report on the bill with amendments. Mr. Gerst objected, as did Alfred Conkling of New York. The latter said the committee had three months in which to report, and that was time enough. Mr. Hennessy said that a mere request of the committee might be ignored. He would direct the committee to report before April 23d.

Speaker Fish reminded the House that to-morrow would be the last day for reports from committees. Mr. Ainsworth thought that no one suspected the committee of holding up the telephone bill for ulterior motives. The bill ought to be passed in some form, backed by some one who is responsible to his conscience and his constituents. He doubted if some of the men who are backing the bill here from year to year really wanted to pass it. But he would vote to discharge the committee.

This motion Mr. Stanchfield of Elmira thought an insult to the committee. Mr. Foley of New York, while realizing that the merchants and manufacturers of New York and Brooklyn were paying too high rates for telephones as compared with other cities, believed that the passage of this bill was feared more by some of the men who are working for it every year than by the telephone companies themselves. He said there are men back of the bill who are getting a harvest of dollars every year from deluded subscribers.

This probably closes for the present at least the most determined fight that has ever been made upon the Bell company. The result is a disappointment to the people of the state, and is very annoying to the Republican leaders of the Assembly, who will be held responsible for this failure. Not only the Republican speaker of the House, but the chairmen of all the important committees, who were, of course, in sympathy with him, voted for the measure, but they were not powerful enough to control a majority of the members. The result was a very interesting though a disagreeable surprise to them.

## Bell Company's Plan of Campaign in Iowa.

The Iowa Union Telephone company announces that it has decided to make an adjustment of its rates, and with this plan in view officers of the company have been canvassing the territory. In an interview published in the Sioux City *Journal* the plan of campaign is thus outlined:

I am taking this trip over the state, said the general manager, to see the subscribers and consult with them in regard to the best means to reduce our rates. Sioux City is the first town I have visited.

When asked if the company had any plan under consideration whereby the reduction was to be accomplished, the general manager said: I do not mind telling you that the company has three schemes in mind. Which one of them will be adopted I cannot say. They are these:

1. To reduce the residence rate materially, and, instead of reducing the business rate, give the subscribers free use of our toll lines.

2. To reduce the exchange rates all through, both business and residence, leaving the toll rates as they are now.

3. To reduce the exchange rates a certain percentage and extend the service a certain radius—say a hundred miles.

It will be left to our subscribers which one of the plans shall be followed. Whatever amount is saved to our company on royalties we propose giving to our subscribers, but

we want to give it in such a way that it will satisfy the greatest number. Of course, we first must satisfy the officers and stockholders of the company.

We do not care for competition. That will make no difference to us. We are in the business to stay. Our lines form a network all over Iowa. We have our money in the business, and if any other company thinks it can can come in and pay dividends, let it come on. Let it put its money in and see how quickly it would be dropped.

We have a big settlement to make with the American Bell company. You see, the hand telephones and transmitters used by us belong to the Bell company. Now we either will have to manufacture them or pay a small rental for their use.

We are preparing to put in a metallic circuit between Sioux City and Le Mars. That will be the first thing we do in this territory. When that line is in operation we shall be in shape to offer our subscribers long-distance transmitters, the same as used between New York and Chicago.

## Competition in Newark, Ohio.

At a meeting of representatives of the Newark, Ohio, Telephone company and Judge James Thomas of Chillicothe, L. P. Lewis and W. P. Evans of Delaware, Jerome Penn and J. F. McLain of Washington Court House, steps toward forming an organization of all local telephone exchanges in Ohio to oppose the Central Union Telephone company were taken. It was decided to call a state meeting of representatives from every local company in Ohio. The meeting will be held in Columbus, April 29th, when a permanent organization will be formed. The question of establishing long-distance lines will also be considered.

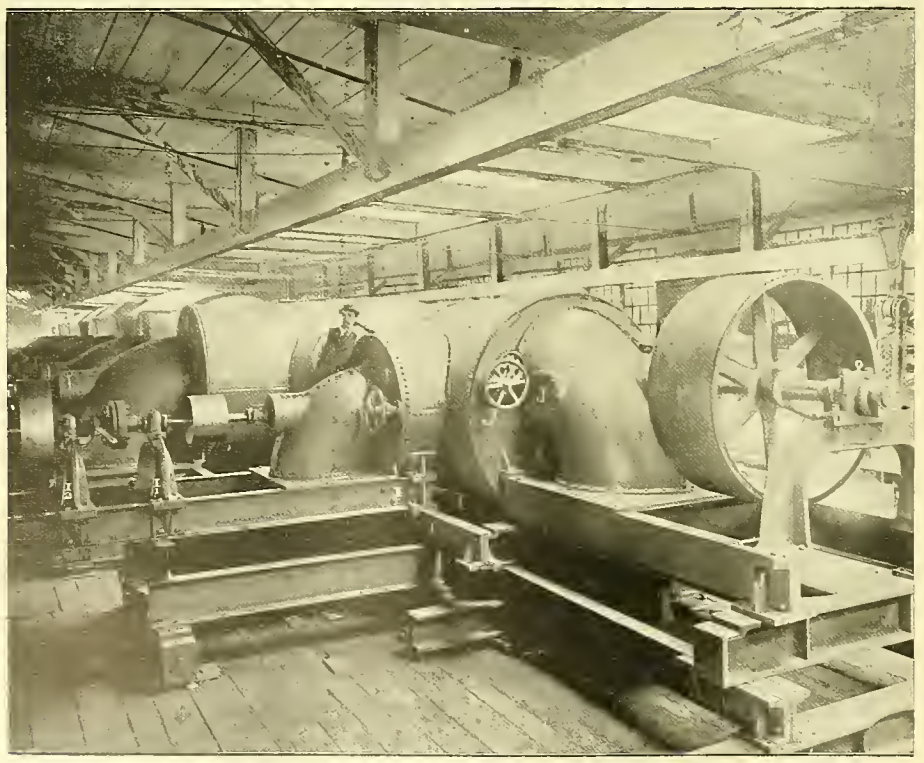
## Rates Cut in Connecticut.

A big reduction in telephone rates has been announced by the Southern New England Telephone company. The cut was made, the managers say, because of a demand for lower rates and the guarantee of a large number of new subscribers. The cut affects the second and third-class exchanges, including the smaller towns of the state, where the reduction amounts to more than 50 per cent. The rates for New Haven, Norwich, Bridgeport and Waterbury have not yet been adjusted, but will be reduced in proportion.

## Delays Will Be Unavoidable.

[From the Keokuk, Ia., *Standard*.]

We are in receipt of a communication from W. H. Dolbear, manager of the Central Union Telephone company in this city, enclosing schedule of rates now in force here. The figures for one subscriber on a line have already been given in these columns. Mr. Dolbear calls attention to the fact that the rates are materially lower where two or more subscribers use the same line. It is furthest from our intention to be captious in this matter. The new rates, as Mr. Dolbear points out, are quite reasonable where several subscribers consent to use the same wire. There are inconveniences attending such an arrangement, however, that preclude the probability that it will ever become generally popular. Only one subscriber can use the wire at a time, and delays are unavoidable. Again, when one patron is called by Central all the telephone bells on the line ring, and only by a pre-arranged system of signals can it be known which subscriber is intended. Nevertheless, the "party" line arrangement deserves recognition for the concession in rates it affords. Those who have little need for telephone service can avail themselves of it at a moderate cost.



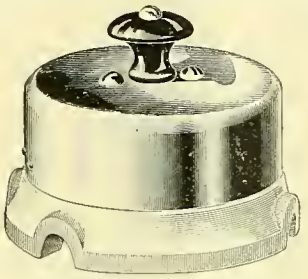
LARGE WATER POWER PLANT.

# COMMUNICATION.

## Ownership of the Bonta Telephone Patents.

*To the Editor of the* WESTERN ELECTRICIAN:

Under date of April 13th one of your contemporaries [the *Electrical World*] published an article on the Standard Telephone company of New York, in which it is announced that among other patents owned or controlled by that company are the well-known Bonta patents, which include his method (patent No. 361,124) on the make-and break system.



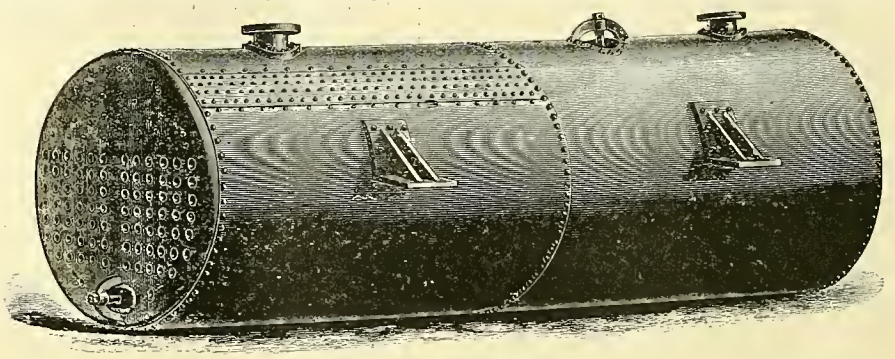
BRYANT DOUBLE-POLE SWITCH.

We must take exception to this statement, as each and all of these patents—some sixteen in number—are owned absolutely by the M. & B. Telephone company of Philadelphia. We do not think for a moment that the Standard Telephone company intimated in any way that they owned the control of these patents, but we feel that the journalistic enterprise displayed by your contemporary should be in a measure checked.

Where they got this information (?) we of course do not know, but as we consider that these patents, together with the new construction patents, which are pending or allowed, give us a complete non-infringing system, we naturally desire that the erroneous impression—that the patents are owned by others—should be corrected.

In this before mentioned article an interesting description of some of the Bonta patents is made, and, among others, a description of the Bonta receiver is given.

It may not be out of place to tell something of the history of these patents. It was only after a long and crucial test of the apparatus that the patent examiner acknowledged that Bonta had a make-and-break telephone and granted a broad method patent, which was the only one ever granted to anyone but Bell, and would have made Mr. Bonta and his associates very healthy competitors of the Bell company had it not been that the Bell receiver was



FREEMAN'S HIGH PRESSURE BOILER.

the only instrument of its kind. The trouble with the Bonta receiver seemed to be that it would not receive; and although Bonta's transmitter was above reproach and excelled anything made by the Bell company at that time, yet as long as the only receiver was owned by the Bell company, it held the key to the situation. In 1892 all of these patents were purchased by some Philadelphia gentlemen, who foresaw their value, and who have lately organized the M. & B. Telephone company of Philadelphia.

Wonderful improvements have been made since the first crude instruments were turned out years ago, and new forms, on which broad construction patents are pending or allowed, give them an instrument which is superior to anything else on the market.

In connection with these non-infringing telephones, the M. & B. Telephone company has arranged to handle what is considered the only non-infringing switchboard manufactured, and so is prepared to put in a complete system. You will therefore understand that the M. & B. company objects to having it stated that its patents are the property of some one else.

M. & B. TELEPHONE COMPANY.

Philadelphia, April 19, 1895.

## Bryant Double-pole Switch.

The World's Fair did much for the electric interests, and the Bryant double-pole switch received its share, with 8,000 scattered through the buildings and grounds. The Bryant Electric company has recently placed a new style of base upon the Bryant double-pole switch. This is a slotted base, as can be seen by the illustration. The switches are made either with or without the slotted base. The wireman can easily see wherein one base may be preferable to the other, and order according to the needs of the work he is doing. Grier Bros., managers of the western office, expect to have a stock of the switches with slotted bases within a few weeks.

## Large Water Power Plant.

In view of the interest manifested by the electrical fraternity in the development of water powers and their utilization in transmission schemes there is no doubt that the accompanying illustration will attract attention. It gives an excellent idea of the turbine water wheel plant furnished by the Stillwell-Bierce & Smith-Vaile company of Dayton, Ohio, for driving the new pulp mill of the Freydenburgh Falls Pulp company, Plattsburg, N. Y. The plant consists of eight 33-inch, one 30-inch and one 15-inch cylinder gate Victor turbines all on horizontal shafts and all supplied from one feeder 13 feet in diameter at its large end. The photograph was taken in the water wheel erecting shop, where the apparatus was set up complete before shipment. The total capacity of the plant is 4,660 horse power.

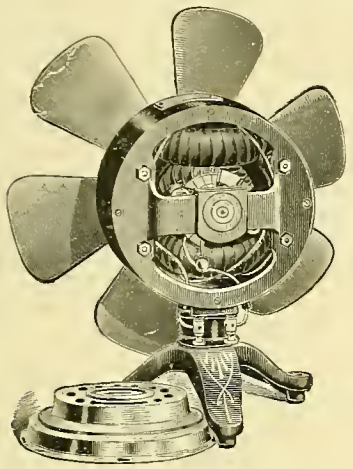
## Freeman's High Pressure Boiler.

The accompanying cut illustrates the high pressure boiler of the S. Freeman & Sons Manufacturing company of Racine, Wis., which is especially adapted for electric railway or lighting stations using compound or triple expansion engines or for other uses requiring steam up to 150 pounds working pressure. The boiler is of the horizontal return tubular type. In a general way it differs from the standard boilers of the same manufacture in having heavier shells and heads; in having the longitudinal seams, butt joint and double strap riveted; in being braced strictly up to government requirements (no brace of one square inch of sectional area is required to carry more than 6,000 pounds strain); in having pressed steel flanges for all openings. All rivet holes are drilled after the plates are rolled and bolted together, great care being taken in every detail to make them perfect, specially heavy fronts and castings are used, as well as pop safety valves, high-class ganges, large water barrels and

special valves and trimmings which will be thoroughly reliable under the heavy pressure they are called upon to carry. The company uses either flange or fire box steel, but recommends fire box steel as being of greater density and stiffness.

## Wagner Fan Motor.

The neat type of fan motor put out by the Wagner Electric Manufacturing company of St. Louis is illustrated in the accompanying cut, the rear cap being removed to show

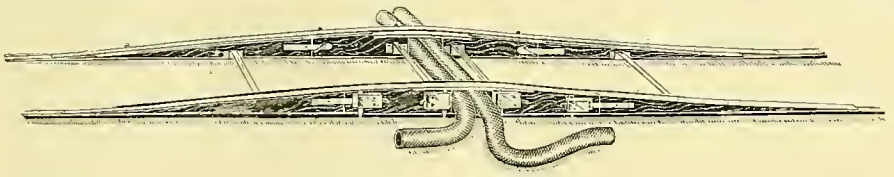


WAGNER FAN MOTOR.

the armature and brushes. This motor is made for both direct and alternating currents and is exceptionally neat and compact in design. It is claimed that these motors are of marked economy in operation and that they always work up to rated capacity.

## Portable Bridge for Fire Hose

The accompanying cut tells at a glance the story of what indeed appears to be "a necessity to every street railway company in America." A description of it is superfluous, but these claims of excellence may be noted: It is made of the best steel and second-growth oak; it is easily placed in



PORTABLE BRIDGE FOR FIRE HOSE.

position ready for work inside of three minutes; strongly and securely braced and clamped to the rail, it is practically impossible to get out of position; it will carry the heaviest motor cars fully loaded; being but eight inches high at its center and sixteen feet in length, the rise of the car in passing over is almost imperceptible; weight of the bridge but 400 pounds; it is in three sections to each side and easily carried on a car or "hurry up" wagon; two lines of four-inch hose can pass under each bridge; every bridge is guaranteed for ten years. The Metropolitan Electric company of Chicago handles this time-saving device.

## Phœnix Transformer.

This being the season when almost each day the load upon the central station becomes lighter, it should also be the season when the station manager should begin to look around and find how he can reduce his operating expenses during the next season of heavy loads through the medium of improved and superior apparatus. In placing upon the market the new Phœnix transformer, the Louisville Electrical Works of Louisville, Ky., claim to be exploiting an apparatus which will be well worth a thorough examination and test upon the part of the central station manager.

In Fig. 1 the Phœnix transformer is shown with the cover

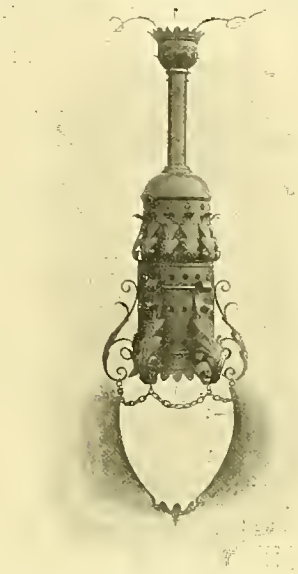
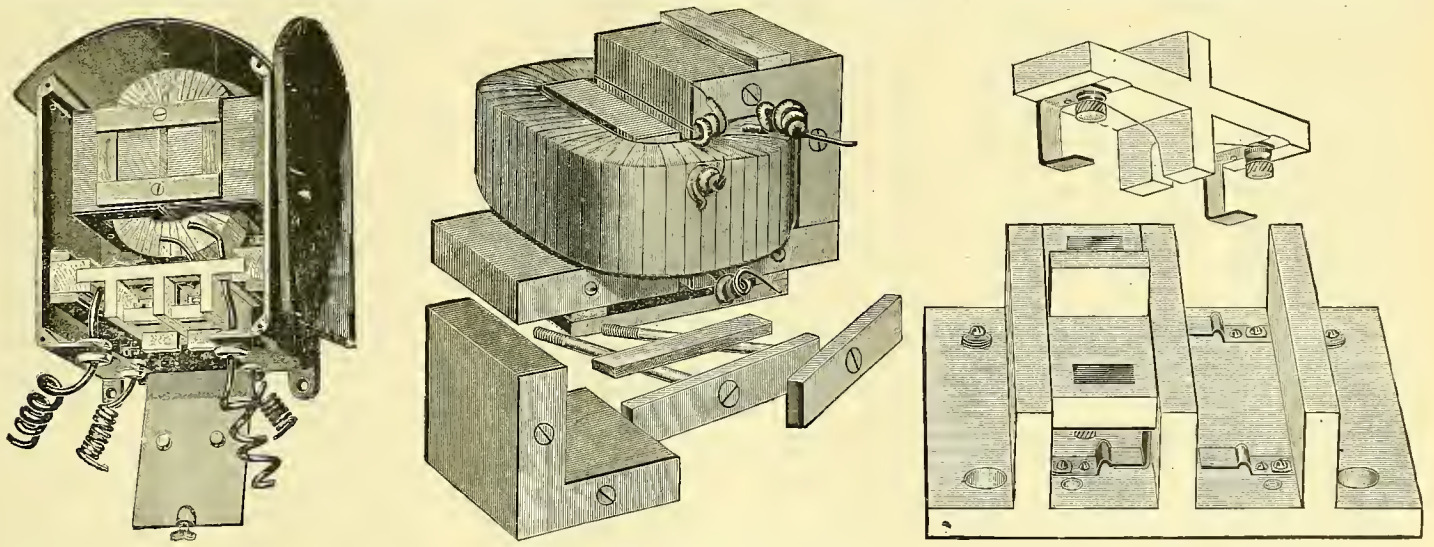


FIG. 1. FORT WAYNE ELECTRIC CORPORATION'S NEW ORNAMENTAL ARC LAMPS.

removed and door opened. This view shows the core, coil, terminal block and fuse plug in their positions, while at the same time it shows a form of case more attractive in appearance than usual in transformers. Fig. 2 gives a clear idea of the form of the core and the method of forming it about the coil, while Fig. 3 explains the construction of the terminal block and fuse device.

The cases are strong, durable and well ventilated, beside being thoroughly waterproof. At the bottom of the case is a small hinged door, fastened by a thumb-screw. The fuse plugs are readily and safely reached, while at the bottom of the case, adjoining the door, are four slots in which are freely and loosely placed the porcelain insulators through which the leading-in wires are run. The use of a porcelain insulator in this position and for this purpose is a vast improvement upon the usual form of hard rubber screw insulator,



FIGS. 1, 2 AND 3. PHOENIX TRANSFORMER.

which is so easily broken. The core is formed of L-shaped laminæ, tightly bolted together into four interchangeable blocks or sections. The four core sections after having been placed about the coil are rigidly and securely bolted together by means of two or more long screws running through wrought iron clamp pieces, placed above and below the core, which are throughly insulated from the core. Through special means of punching and treating these laminæ and pressing the core together the very best possible magnetic joints are obtained. To withdraw a coil requires but the removal of two screws, making it a truly removable coil transformer. The core and coil are secured in position in the case in a very simple and effective manner, and they can be removed by taking out two cap screws. The porcelain terminal block and fuse device are secured in the case between blocks or mouldings of treated wood, held between projections on the inside of the case. The fuse plugs are all alike and interchangeable and are fitted with blades between ample contact pieces placed upon the lower side of the block, the plug sliding between the walls formed on the block. The fuse is secured under two thumb nuts and passes through a slot in a bridge of porcelain, formed upon the upper side of the fuse plug, which effects the immediate destruction of the most serious arc. The construction of the fuse plug makes it as effective as a jack-knife switch as a circuit breaker, and it is not only absolutely safe for a lineman to handle, but the blowing of a fuse, it is said, can not possibly break the plug, since both ends show an open space ample for the rapid escape of the gases which are generated. When the door of the case is closed, the two lugs formed on the

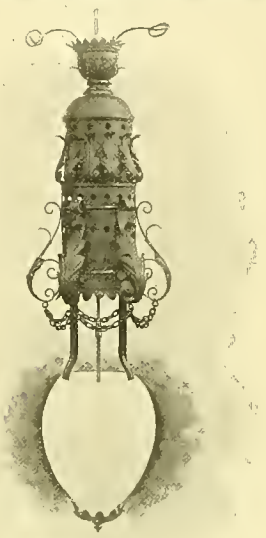


FIG. 2. FORT WAYNE ELECTRIC CORPORATION'S NEW ORNAMENTAL ARC LAMPS.

inside, move into position ahead of the thumb pieces, preventing the possibility of the plugs changing their positions or decreasing the contacts.

Through the use of the very best and highest grade of material, the proper proportioning thereof, and the peculiar method of forming and securing together the core, the Louisville Electrical Works are enabled to guarantee for this transformer the very closest regulation, the highest efficiency and the least loss from leakage attainable, and are willing for anyone to put them to a thorough and complete test for the purpose of determining the correctness of the statements upon these points. They are prepared to furnish these transformers in all sizes ranging from five to 500 lights in capacity and wound for any voltage.

## Fort Wayne Electric Corporation's New Ornamental Arc Lamps.

The accompanying cuts, illustrating Mr. Wood's ornamental lamps, manufactured by the Fort Wayne Electric corporation, deserve more than passing notice, as they contain a feature which facilitates trimming. Fig. 1 shows

lamp ready for burning, while Fig. 2 shows the ornamental casing raised exposing the feed rods and carbon holders for trimming, completely obviating the difficulty so common in ornamental lamps in keeping the feed rod clean and adjusting the carbons in line. This casing is held up in position by a bayonet joint at the top of the suspending tube, where it in no way interferes with the attendant during the act of cleaning the globe or trimming the lamp. When it is lowered into place, as in Fig. 1, it acts as a most effective spark arrester. The design of these lamps, from an artistic point of view, leaves absolutely nothing to be desired. They are manufactured either single or double, of any candle power, and wound for constant current, constant potential or street railway circuits, while the cases are finished either in brass or old iron to suit the requirements of the purchaser.

## Mr. Johnston Acquires the "Street Railway Gazette."

The following announcement by W. J. Johnston, proprietor of the *Electrical World*, conveys an interesting bit of news:

The *Street Railway Gazette* has been purchased by W. J. Johnston, and will hereafter be issued each week from 253 Broadway, New York. Clarence E. Stump, general manager, and J. W. Dickerson, editor, will still be connected with it. The *Gazette* is the only weekly street railway journal in the world. It was established in 1886, and for six years was published monthly, but has been a weekly since 1892. The size of page will be slightly reduced and the number of pages considerably increased. Reading articles will be by practical men for practical men, and, while technically accurate, will be written in plain and simple language. More illustrations will be used than formerly, and the effort will be to make the paper in every way a worthy representative of the activity and enterprise and progressiveness characteristic of the street railway business.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, April 20.—There is considerable activity in electric railway circles along the New Jersey coast. At Darlington a large force of laborers is at work on the grading for the electric railroad from Asbury Park to Pleasure Bay. The contractor is under bonds to complete the road by June 27th. J. C. Shaffer, president of the Seashore Electric Railway company in Asbury Park, is the chief promoter of the enterprise. The road will connect at Branchport with the boats from New York, and will do both freight and passenger business. The route is through Darlington, Elberon, West End and Long Branch. Another company has been incorporated, which will build an electric line from Long Branch to Atlantic Highlands, passing through Red Bank. The horse car line from Asbury Park to Belmar will be changed into an electric railroad this summer. Projects are also said to be taking shape for the building of trolley roads from Belmar to Point Pleasant, and from Point Pleasant to Lakewood.

The air is full of projects for long-distance electric railways in the eastern and middle states. One of these is for a line to connect Philadelphia and Williamsport, Pa. Such a road would pass through Port Clinton and Tamaqua to Lakeside, and over the proposed Lakeside line to Mahanoy City, where connection would be made with the Schuylkill Traction road for Ashland. A link would be built to Centralia, which would continue the road to Shamokin. The Centralia connection would start at Nineteenth street, Ashland, and take a long and circuitous route to Centralia, in order to avoid heavy grades. The route to Shamokin westward would be through Lewisburg and the farming country. In the farming districts the company would depend largely on the daily milk shipment and the carriage of produce. The trolley cars would have advantage in their ability to stop at any farm along the line on signal and take in a basket of eggs or a barrel of potatoes and drop them off in town, and at rates that would make small shipments possible. The cars used would be much larger than those now operated, and some of them would be provided with a compartment for freight. The freight cars would probably run at intervals of two hours. Mail would, of course, be carried, when it could be secured.

One of the remarkable trolley car accidents for which Brooklyn has acquired such an unenviable notoriety occurred early Thursday morning at Driggs avenue and Leonard street. Trolley car No. 1,931, of the Flushing avenue line, jumped the switch and ran upon the sidewalk, breaking the flagging and crashing into the liquor store of John P. Rohr, which was somewhat damaged. The car was wrecked, and the four passengers aboard were badly shaken up. The motorman, eye-witnesses said, seemed to have lost his senses when the accident occurred, for, instead of turning the current off, he turned it on. As the trolley was still on the wire, this increased its momentum. A crowd of some 500 or 600 persons witnessed the performance. Mr. Rohr, the proprietor of the liquor store, when seen yesterday, said that he was in bed at the time, but his sons, William and Charles, were in the store. He had been awakened by the crash, which caused the building, a frame structure, to tremble. Jumping out of bed, he ran to the window and saw the car upon the sidewalk. A heavy iron bar in front of the windows of the store was broken, the woodwork of the front of the store was torn off and the glass was shattered. The crash awakened the people living in the neighborhood, and considerable excitement prevailed.

W. F. O.

## New England News.

BOSTON, April 19.—A bill is pending in the Legislature to incorporate the Boston, Lynn & Beverly Street Railroad company and authorizing the construction and operation of either an elevated or a surface railroad under the Boynton bicycle railway patent. The road is to be elevated within cities, with one or more tracks, as may be required. It is to begin at Quincy Market, Boston, and will pass through the towns of Everett, Malden, Revere, Lynn, Salem to Beverly. The company will undoubtedly use electricity for power transmission.

A favorable report has been received in the Legislature from the committee on mercantile affairs on a bill to permit companies engaged in the transmission of electricity—railway companies excepted—to sell electricity for heating and cooking purposes.

The West End Railroad company has won its fight on the question of free transfers, and the eight-cent fare will not be abolished.

The Portland Street Railroad company of Portland, Me., has awarded contracts for equipping its line with electricity as follows: Tracklaying, Arthur Hodges & Co., Boston; line work, M. K. Kendall & Co., Boston; cars, J. G. Brill company, Philadelphia; rails, Pennsylvania Steel company, Philadelphia; wire, American Electrical Works, Providence; electrical apparatus, General Electric company, Schenectady, N. Y.; supervising engineers of power station, Sheaff & Jaastad, Boston; supervising engineers of track work, Hodges & Harrington, Boston; engines, the E. P. Allis company, Milwaukee, Wis.; boilers, Babcock & Wilcox company, New York.

The preliminary survey for the electric railway between Williamstown and North Adams, Mass., has been made, and work is to begin when the bill granting the right of way is passed by the Legislature and receives the governor's signature.

The Canton, Sharon & Boston Street Railroad company is another electric railroad which is to be operated in southeastern Massachusetts. The capital stock of $110,000 has all been paid in, and the route will require about ten miles of track. The organization is as follows: Raymond S. Byam, president; Edward H. Galligan, treasurer; Francis D. Dunbar, clerk; Thomas E. Grover, George W. Mantle, William O'Connell, Edward I. Garfield, Edward H. Galligan, Raymond S. Byam, Francis D. Dunbar, directors.

C. S. G.

## Milwaukee, Wis.

MILWAUKEE, April 20.—There is a great deal of discussion in official circles over the question of permitting the Milwaukee Street Railway company to build a line across the new Holton street viaduct. All sorts of demands are being made upon the company, some of the aldermen and city officials going so far as to insist that the company pay one-half of the cost of building the viaduct, which cost the taxpayers $125,000. Commissioner Brockman of the Board of Public Works is one of the city officials who favor the proposition of requiring the company to pay half of the cost of the viaduct. "The company refused to help the city build the viaduct," he states, "and now it wants to step in and use it." Commissioner Schneider thinks that one-half of the cost is an excessive demand to make upon the street railway people, while Commissioner Schnengel points out the fact that the company heretofore has only offered to furnish the power for swinging the bridges, and ascribes that offer to the desire to have the bridges opened and closed more quickly, so that cars will not be delayed. Alderman Devos of the railroad committee of the Common Council is of the opinion that the city ought to be satisfied if the company will pay $20,000 for the franchise and agree to furnish the power for swinging and lighting the structure. The citizens of the Sixth and Thirteenth wards took up the matter and made a number of additional demands of a minor character. In reply to all these demands Vice-president Henry C. Payne of the Milwaukee Street Railway company has sent a communication to the railroad committee stating just what the company would do and just what it would not do. In his communication Mr. Payne states that the present route of the Holton street cars is by way of Pleasant street and Island and Garfield avenues, to which route both the company and its patrons object on the grounds that it is circuitous and that the cars have to pass up and down a very steep hill, at the middle of which it crosses the tracks of the St. Paul Railway company at an angle, a condition that menaces the lives of passengers. A line over the viaduct would save the people from eight to ten minutes each trip. The people themselves, Mr. Payne states, have asked the company to change its Holton street line so that the cars will pass over the Holton street viaduct. Mr. Payne then goes on to state that the company will accede to the demands made by some of the citizens that the tracks over the viaduct shall be so constructed as to allow a 6 inch paving block between the tracks; that the company pave between the tracks and for 12 inches on each side of the tracks and maintain such pavement; that it provide electric power for swinging the bridge and that it furnish enough arc lights to light the bridge. The company refuses to pay the salaries of the bridgetenders. The question of granting the franchise has come up before the committee a number of times and has been continued without definite action, generally at the request of the company.

Alderman George Thuering of the Fifteenth ward is one of the most determined opponents of the street car company. He has threatened to introduce a resolution in the council calling for an examination of the company's books by a committee, assisted by an expert, in order to demonstrate the truth of the claim that the company is not making money. He states that at the present time, when the wages of workingmen are lower than they have been for years, the company is charging laborers 25 per cent. more for fare than they have ever had to pay. He thinks that Cincinnati, which requires the street car companies to pay five per cent. of their gross earnings to the city and a license fee of from $40 to $60 for each car, is a shining example of how cities should treat railway companies. He states that State street cars, which do not cost more than $10 a day to operate, each take in from $22 to $23 a day; that the Wells street cars take in from $25 to $30 and the Farwell avenue and Third street cars in proportion. He is of the opinion that the company is making all the money that it ought to make.

City Engineer George H. Benzenberg is at work preparing plans and estimates for a municipal lighting plant, as requested by the Common Council, although that body has not decided definitely to embark in the enterprise. He has about decided what kind of plant shall be—or rather, ought to be—erected on Jones Island, but the distribution of the wires is giving him some trouble. All the wires must be underground and underground conduits are costly. One system costs $8,000 a mile and another system costs $4,000. The city engineer does not want to make the cost of conduits too high, yet he wants good conduits, such as will not get out of repair too frequently. The fact is that the city, which recently passed an ordinance requiring all electrical wires to be placed underground, is now getting a taste of its own medicine. Mr. Benzenberg will soon visit a number of cities which have first-class electric lighting systems, in order to get ideas. He expects to try a 100-light circuit. His idea is to run main feeders to each section of the city from Jones Island, armoured cables being laid under the river. From the main lines short lines will be extended to the neighboring streets. In the outlying districts overhead wires will be used. The contract between the city and the Badger Illuminating company will expire next fall.

The Milwaukee Street Railway company has decided to try a new kind of car. Two of the cars have been received and they attract a great deal of attention. They are 40 feet long and the front part is closed and the rear part is open, so that they are of a combination pattern. The cars were built by the company, being cars that were formerly used on the Whitefish Bay dummy line. Double trucks are used. The trucks are specially geared and it is claimed that they turn corners more easily than ordinary cars do. The cars are tastefully decorated and in the night are lighted by a row of fifteen incandescent lamps. Each car has two motors of 25 horse power. The closed part is 20 feet long. The platforms are four feet in length and the open part 12 feet long. There will be an aisle in the center and double seats on each side. There will be steps at both sides of the cars and at the ends, as well as between the open and the closed parts. In the open part there will be room for 20 people and in the closed part room for 30 people.

During next month the Milwaukee Street Railway company will test a plan for a general transfer system. At present, even with the recent additions, there are only 17 transfer stations in the city, but 45 more, covering almost every point where one line crosses another, will be used during the next month. The new system will enable one to ride from almost any point in the city to almost any other point for one fare. Before it permanently establishes such a system, the company, it is understood, wants to ascertain just what effect it will have upon the revenues. Should it result in a material decrease it is not likely that the system will be adopted permanently. It is expected by some, however, that the result will be an increase in the earnings of the company.

C.

## PERSONAL.

"Jim" Godfrey, of the India Rubber & Gutta Percha Insulating company of New York, was in Chicago last week.

H. C. Thomson, of the Electric Gas Lighting company of Boston, is in Chicago looking after the interests of his company.

Godfrey G. Luthy, general manager of the Royal Electric company, Peoria, spent several days in Chicago last week. Mr. Luthy has only recently returned from an extensive eastern trip in which he combined pleasure with a great deal of business.

The marriage of Edward R. Grier of Chicago to Miss Lucy Parthenia Bosworth of Lee, Mass., at the bride's home on April 16th, is announced. Mr. Grier is a member of the firm of Grier Bros., western representatives of the Bryant Electric company.

Herbert A. Wagner, known in connection with his work for the Wagner Electric Manufacturing company and the Missouri Electric Light & Power company, described the new monocyclic system before the Electric Circuit of St. Louis on Thursday evening.

R. L. Weitbas, for years an efficient member of the business staff of the *Electrical World*, has acquired an interest in the Bureau of Press Clippings of New York, and after May 1st he will occupy the position of secretary and manager of the concern, with an office in the Western Union building, New York. Mr. Weithas is distinguished alike for his modesty and for his mastery of the practical details of the newspaper business. It is a great pleasure to wish him every success in his new venture.

## NEW INCORPORATIONS.

Taylor Electric Light company, Taylor, Tex.; capital stock, $20,000; Hugh Burns, Taylor, Tex.

Denison Street & Electric Railway company, Denison, Tex.; capital stock, $50,000; G. L. Blackford, Denison, Tex.

Globe Electric Construction company, New York, N. Y.; capital stock, $20,000; to sell and install electric equipment; J. J. Clark, New York, N. Y.

Empire State Electric Forging company, Syracuse, N. Y.; capital stock, $300,000; to manufacture electric welding, forging and smelting apparatus; L. H. Grossbeck, Syracuse, N. Y.

## ELECTRIC LIGHTING.

The electric lighting plant at Pawnee City, Neb., has been purchased by the town authorities.

A press dispatch states that A. A. Foreman, superintendent of the Iron Mountain, Mich., Electric Light & Power company, has disappeared. He is said to be short in his accounts for a large sum, but how much will not be known until a thorough examination of the books have been made.

## ELECTRIC RAILWAYS.

The Middletown-Bloomingsburg Electric Railway company has been incorporated with a capital of $200,000 to operate an electric railway from Middletown, Orange county, to Bloomingsburg, Sullivan county, N. Y., a distance of ten miles. The directors are J. C. Hinchcliffe, John Hinchcliffe, of Paterson, N. J.; W. B. Rockwell, of Scranton, Pa.; E. G. Wightman, F. D. La Bar, C. H. Smith, A. E. McIntyre, W. B. Royce and H. W. Wiggins, Middletown.

The contract for the construction of the electric tramway between Bilbao, Spain, and the suburbs of Las Arenas and Portugalete, and the necessary plant for the same, has been given to the Spanish agents of the Allgemeine Electricitats Gesellschaft of Berlin. The line to Las Arenas will run on both banks of the river Nervion, the power station being situated about midway between the two places on the left bank of the river. In order not to interfere with navigation, the main conductor will be carried over the river at a height of 164 feet, two towers, one on each side, to be erected for the purpose. The tramways when completed will have a total length of about twenty miles.

The Niagara Falls & Lewiston Electric Railway company has let the contract for the construction of its Niagara gorge road to Crage & Fench of Buffalo, and the work will be at once begun and rapidly pushed to completion. It is expected that the line will be constructed, equipped and ready for operation by July 1st. The road will be a double-track one, and the contract let to the Buffalo firm provides for the grading of the roadbed and laying the rails. Aside from this contract the railroad company buys its own materials, and has already contracted for a portion of what will be required. President Brinker says that bids have been received for the construction of the cars from several firms, and that the contract for them will be let during the next few days. Enough men, he says, will be placed at work to insure the completion of the road by July 1st in order to catch the bulk of the season's traffic. The line will run at an average height of 20 feet above the water's edge, and the route will be very picturesque. Cars with a seating capacity of 60 will be used and a 15 minute service given. Each car will have two 50 horse power motors and the round trip from the Falls to Lewiston and return will be made in one hour. The promoters feel certain that the road will be profitable.

## TELEPHONE.

A charter has been granted to the Middlebrook Telephone company to construct a telephone line from Staunton to Lexington, Va., with collateral lines. The principal office of the company is to be at Middlebrook, and the maximum capital $5,000. John H. Bowman is president; J. Frank Clemmer, vice-president; H. A. Shepherd, secretary; W. W. Sproul, treasurer; J. F. Clemmer, W. W. Sproul, H. A. Shepherd, William McComb, H. M. Clemmer; D. S. Condon and W. C. Bosserman, directors.

## MISCELLANEOUS.

The Vaudeville theater of London is electrically heated. Twenty-two wall radiators and four large portable radiators are employed.

A handsome new trade journal, *Deutsche Industrie*, is published monthly in the German language by Eugene A. Sittig & Son of Chicago. The wood and metal working and electrical interests are represented, and the first number is in every way a creditable production.

The telautograph is now in service between the Board of Trade and the Western Union office in Chicago. It is used by the operators on 'change to notify the chief operator at headquarters of wire interruptions and by the superintendent in transmitting messages concerning the handling of the company's forces. The machine has been used nearly a year between the Western Union general headquarters and the supply department, 213 Kinzie street.

The directors of the Rochester, Charlotte & Manitou Railroad company have elected the following officers: President, Michael Doyle; vice-president, Charles W. Briggs; secretary and treasurer, George W. Brown. The managers of the new organization say they will expend $30,000 in improvements. They will supply electric light to the village of Charlotte; also to the Cottage and Ontario hotels and grounds, and will do a general electric lighting business. The electric machinery is now being placed in position.

It is said that a number of Chicago capitalists, headed by A. E. Coy, have completed arrangements for a big water power scheme near Belleville, Mich. While they will not divulge the purposes to which the power is to be applied, yet certain indications show that they purpose to transmit it by electricity to Detroit and use it there for street car and lighting purposes. Their plan is to dam the Huron river at French Landing, two miles below Belleville, where they can easily obtain a head of thirty feet of water and a big area for a reservoir.

The Essen Coal company of Pittsburg has just closed a contract with the Independent Electric company of Chicago for a complete plant for mining and hauling the coal in its No. 2 and No. 3 mines at Hazletine, Pa. This is undoubtedly the largest plant ever constructed for bituminous mines. It will cost between $60,000 and $80,000, and is intended to produce 2,400 tons of mine run coal per day. The shipment consists of 600 horse power in boilers; three 200 horse power engines; three 150 kilowatt dynamos; two 80 horse power locomotives; station equipment and circuits, and sixteen of the "Independent" chain breast machines.

## TRADE NEWS.

F. W. Parker, the well-known specialist in electrical patent law, has removed his offices from the Opera House block to 1410 Marquette building, Chicago.

The success of Collins' compound has been very marked. Lee & Collins, 1325 Monadnock block, Chicago, have recently been making some large shipments of this valuable insulating and preservative paint. After a test covering several weeks, one firm has placed a contract with them aggregating over a carload.

The New Jersey Asbestos company, with offices at 117 Front street, Camden, N. J., manufactures asbestos materials of all kinds. It has just issued an exceptionally handsome catalogue which shows the manifold uses to which asbestos, rubesto, carbo-beston, asbestolio and similar preparations are put. Asbestos is employed to a considerable extent in the electrical trades, and the company's catalogue will be found of much assistance to electrical contractors and manufacturers.

The sal ammoniac, "electric brand," which has been so favorably known to the telephone and battery trade for two or three years, is reported by A. Klipstein & Co., New York, who control its supply, to be in better demand than ever before. The importance of having pure materials especially adapted for their respective uses is becoming more and more generally realized in electrical industries. The efficiency and durability of batteries are very largely dependent upon the purity of the sal ammoniac used in them, or, as a correspondent puts it, "pure sal ammoniac is the life of the battery,"—a fact that will interest increasing numbers of readers as telephones and batteries come into more general use.

Preliminary steps looking to the organization of an association for mutual protection and inter-municipal connection between the new telephone exchanges of Ohio were taken in Newark April 12th. Those who met the Newark Telephone company were Judge James M. Thomas of Chillicothe, W. Z. Evans and L. P. Lewis of Delaware, James F. McLain and Jerome Penn of Washington Court House. After carefully scanning the new telephone exchange the visitors pronounced the construction work done by the Western Telephone Construction company to be strictly first-class, and they declared the operation of the exchange to be very satisfactory. At the meeting it was agreed to hold a state meeting at the Chittenden in Columbus at noon on April 29th. All local telephone companies in the state will be notified of the meeting, at which a permanent organization will be formed.

The annual meeting of the stockholders of the Joseph Dixon Crucible company, Jersey City, N. J., was held Monday, April 15th, at the company's general offices at Jersey City. The minutes of the meeting of 1894 were read and approved. The detailed statement showing the millions of lead pencils, cakes of stove polish, crucibles, etc., manufactured met the hearty approval of stockholders present, which manifested itself later on by the unanimous re-election of the board of directors and officers. Out of a total of 7,345 shares, 6,393 shares were represented in person or by proxy. The full number was cast for each of the following named gentlemen: E. F. C. Young, John A. Walker, Daniel T. Hoag, Richard Butler, William Murray, Alex. T. McGill, Jerome D. Gillett. After the stockholders' meeting had adjourned, the newly elected board organized and unanimously re-elected E. F. C. Young, president; John A. Walker, vice-president and treasurer; George E. Long, secretary. The Joseph Dixon Crucible company, established in 1827, is said to be the most extensive manufacturer of graphite products in the world. Its manufactures comprise plumbago crucibles, graphite facings, retorts and other goods used in foundries and smelting works; lubricating graphite, graphite greases, graphite paints, and Dixon's celebrated American graphite pencils and carburet of iron stove polish. These goods find their way and meet ready sale in all the cities and towns of the civilized world.

## BUSINESS.

E. Wertheim, manufacturer of engineers' and general mill supplies, will remove on May 1st to 55 South Canal street, Chicago. The new quarters are large and convenient and well located for Mr. Wertheim's business.

A handsome engraving of the Warren P. Freeman fan motor (full size) finely executed on heavy paper, with other specialties of the Newton Rubber Works of Newton Upper Falls, Mass., will be sent upon application.

The Electric Appliance company is again out after lightning arrester business with the swinging-ball lightning arrester, which has made such an excellent record during the last five years. Prices have been very much reduced, and a large business is looked for during the present season

A New England office for the Columbia Incandescent Lamp company and the Wagner Electric Manufacturing company of St. Louis has been opened at 620 Atlantic avenue, Boston, with Charles E. Bibber in charge. Mr. Bibber, who is well known to the trade, will carry Columbia lamps and Wagner motors and transformers in stock.

The Independent Electric company of Chicago has registered as a trade-mark a picture of a coil of tested fuse wire. This company's brand of fuse wire is favorably known for its uniformity and also for the convenient and attractive manner in which it is packed. The Independent Electric company says that its recent reduction in the price of the fuse wire and links is having a marked effect on the business in this line.

Stone & Webster, electrical experts and engineers of Boston and Chicago, express their views on the requirements for central station work in a neat pamphlet entitled "A Modern Power Plant," which they are circulating among those interested in the subject. The pamphlet describes in detail the equipment of the plant of the Industrial Improvement company, Boston, at Allentown, Pa., and contains several excellent illustrations, including drawings and views of several departments.

G. W. Conover, western manager of the Perkins Electric Switch Manufacturing company, with offices at 1536 Monadnock block, Chicago, will be located in rooms 1537 and 1538 of the same building after May 1st. This change was found necessary on account of the increasing demand for the well known Perkins specialties, which Mr. Conover has pushed so energetically. The new offices are well adapted to the requirements of the Perkins company, and will enable it to handle its orders with even greater facility than heretofore.

The Fuel Economizer company of Matteawan, N. Y., announces that it considers business improving and at present it is very busy. It has obtained orders for economizers for the New Jersey Consolidated Traction company of 2,500 horse power; for the St. Charles Street Railroad company, New Orleans, of 750 horse power; for Detroit Street Railroad company of 2,000 horse power; for Holyoke Street Railroad company of 800 horse power; for Howland, Crofts & Son, Camden, N. J., for 1,000 horse power; for Crystal Plate Glass company, St. Louis, of 2,400 horse power.

People have no time now-a-days to wade through a long rigmarole to get at the facts of a matter. What they want is the pith and point of an argument. Some have suffered through having had an inferior grade of motor brushes put upon them; some have suffered through delayed shipments and threadbare excuses. For these and other reasons the Partridge Carbon company desires that it be distinctly understood that it has never carried a stock of excuses of any kind, and it confidently asserts that there never has been, and probably never will be in this wide, wide world, a more complete and perfect stock of electric motor and generator brushes than that carried by this same Partridge Carbon company of Sandusky, O. The Partridge "self-lubricating brush" is still in the lead, and it is gratifying to note that the factory is not only working overtime, but that Secretary J. S. Speer reports the company's business as being better now than it has been at any time this year.

Col. S. G. Booker, of the Phœnix Carbon Manufacturing company of St. Louis, visited Chicago last week, and through his usual energetic efforts succeeded in corralling some very desirable contracts, one or two of which will undoubtedly excite the envy of his competitors. Col. Booker displayed at his hotel a line of high-class electric light, battery and telephone specialties, also a special line of carbon motor and generator brushes. These latter specialties were much admired. The Phœnix Carbon Manufacturing company is at the present time paying especial attention to the manufacture of motor brushes, and also is doing an excellent business in high-class carbon telephone specialties. Col. Booker seemed most enthusiastic over the success of his enterprise, and seemed to think that future trade would be of the best. Col. Booker certainly deserves success. His aggressive policy in getting out personally in the field, where his experience as a carbon maker is so well known and highly valued by his many friends, no doubt redounds greatly to the advantage of his company.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued April 16, 1895.*

537,464. Printing Telegraph. Oscar L. Kleber, Pittsburg, Pa. Application filed June 5, 1894.

In this system there is a shaft, upon which is affixed a wheel with alphabetical letters and numeral characters arranged around its periphery. There is suitable means for revolving it in combination with a series of wheels, each of which has an equal number of teeth and intermediate spaces, the teeth of the series being relatively arranged in oblique lines across the faces of the wheels and advancing beyond each other, like a flight of stairs.

537,474. Secondary Battery. William M. McDougall, East Orange, N. J. Application filed January 7, 1893.

The arrangement illustrated comprises a perforated box containing an electrode, provided throughout both its surfaces with laterally projecting lugs bearing against the inside walls of the box for the purpose of maintaining the electrode in a central position, while active material fills the space on each side of the electrode.

537,475. Secondary Battery. William M. McDougall, East Orange, N. J. Application filed August 2, 1894.

NO. 537,474.

A secondary battery electrode and an envelope for it, consisting of elastic material, the normal size of which is smaller than the electrode, so that it will have to be stretched to embrace the electrode.

537,480. Commutator. Gwynne E. Painter, Baltimore, Md. Application filed February 28, 1895.

In the construction, as shown in the accompanying cut, there are a hub, a series of base bars or segments insulated from each other and from the hub, each bar being firmly mounted solidly secured and provided with radial stems for coupling with the armature winding. A series of detachable contact bars or shoes occupying specially prepared seats on the solidly mounted base bars and their stems, and means for clamping the contact bars in or to their seats, are also provided.

537,498. Incandescent Electric Lamp. Elihu Thomson, Swampscott, Mass. Application filed May 23, 1892.

A bulb for an incandescent electric lamp, having a portion of its exhausted chamber formed with external screw threads.

537,499. Electric Measuring Instrument. Elihu Thomson, Swampscott, Mass. Application filed October 26, 1894.

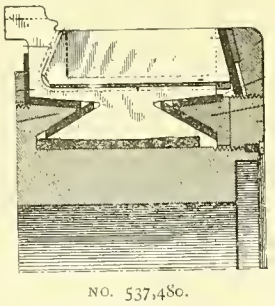
Means are provided for conducting current to the actuating coils of an electric measuring instrument, consisting of insulated conductors, carried by the axle about which the coils revolve, and strips of silver foil connecting the insulated conductors with the external circuit.

537,500. Electric Measuring Instrument. Elihu Thomson, Swampscott, Mass. Application filed October 26, 1894.

The features of this invention are a pair of magnets, having their poles of unlike signs opposed, a non-magnetic bobbin rotating in the magnetic field, coils carried by the bobbin having straight portions adjacent to each other and wound in the same direction, each coil having a hollow space inclosed, a circuit through the coils conveying the current to be measured, and a shunt across this circuit composed of a folding ribbon of conducting material.

537,501. Electric Measuring Instrument. Elihu Thomson, Swampscott, Mass. Application filed October 26, 1894.

In this instrument a pair of magnets has one pair of poles of like sign adjacent. A curved pole piece connects these poles, a second curved pole piece connects the other pair of poles of like sign, and a coil moves in the space between the pole pieces against an opposing force.



NO. 537,480.

537,513. Combined Cut-out and Lightning Arrester. Merle J. Wightman, Scranton, Pa. Application filed January 9, 1895.

A line circuit, cut-out terminals therein, lightning arrester terminals, and an electro-magnet in the line circuit having a pole of the same sign under each of the sets of terminals, the two poles provided with a common armature.

537,515. Electric Switch. James J. Wood, Fort Wayne, Ind. Application filed November 12, 1894.

The device illustrated has an intermittently rotating bridge, a rotative axial spindle and an operating handle, a spring interposed between the bridge and spindle, a stationary ratchet, and a two-armed pawl pivotally connected to the bridge, with its arms projecting to opposite sides of the spindle, and an operating arm projecting from the spindle between the arms of the pawl, and adapted to bear against either of them.

537,533. Electric Switch. Edward M. Hewlett, Schenectady, N. Y. Application filed December 22, 1894.

One switch for automatically reversing the leads of a current indicator and another arrangement to change the circuit from positive to negative, or vice versa.

537,538. Electric Switch. Amandus Metzger, Schenectady, N. Y. Application filed October 5, 1892.

The device comprises a circuit terminal formed of one piece of sheet metal, having vertical spring arms or clips, a horizontal extension projecting from the base, and a vertical projection integral with the circuit terminal and forming a stop for the switch blade.

537,539. Electric Switch. Amandus Metzger, Schenectady, N. Y. Application filed April 15, 1893.

In a knife-blade electrical switch there is a circuit terminal consisting of sheet metal vertical arms or clips formed with oppositely overlapping base portions, the latter being provided with an extension projecting from the base for attachment of the circuit wire.

537,541. Regulator for Dynamo-electric Machines. Walter S. Moody, Lynn, Mass. Application filed August 30, 1893.

An alternating current dynamo-electric machine, separate exciting dynamos, a magnetic device in shunt to the main circuit responsive to changes in the line potential, a switch operated thereby and adapted to vary the field strength of the exciters, and a second magnetic device in series in the main circuit, adapted when the load is increased to oppose the potential reducing effect of the first magnetic device, and thus to compound or over-compound the regulating effect.

537,549. System of Electric Distribution. Edwin W. Rice, Jr., Swampscott, Mass. Application filed February 21, 1894.

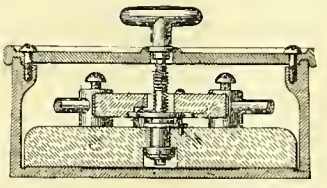
In this system of distribution of electric energy central stations equipped with sources of continuous current and with sources of alternating current, sub-stations adapted to convert alternating current into continuous current, and alternating current feeder lines connecting the main stations and the sub-stations together, in combination with mains adapted to supply translating devices connected to all of the stations, such mains being also interconnected.

537,555. Filament and Carbon for Electric Lamps. Peter Stiens, London, Eng. Application filed February 14, 1895.

The process of treating filaments or carbons in the course of manufacture consists in impregnating them with burned boric acid, and then heating them by the electric current in the presence of carbonaceous vapor or gas.

537,595. Electrical Interrupter. Gustaf J. Andersson, Brooklyn, N. Y. Application filed February 18, 1895.

In an electrical interrupter mounted on a shaft with pulley and run by mechanical power the combination is claimed of a number of insulated segments with a brush through which the current is introduced, metal rings in such a number as allows division of the number of segments, metal screws connecting electrically the metal rings with the segments, and a number of brushes, of which each presses against one metal ring.



NO. 537,515.

537,603. Automatic Telephone Exchange System. Ward Decker, Owego, N. Y. Application filed May 14, 1894.

An automatic switchboard for a central station in a system of electrical intercommunication consists of the combination of stationary conducting bars, terminals connected with the telephone lines for making contact therewith, and independently movable from the sub-stations, and means for automatically bringing two or more of the movable terminals into electric contact with one of the stationary bars.

537,617. Electric Arc Lamp. Charles A. Pfluger, Chicago, Ill. Application filed July 2, 1894.

This lamp comprises a carbon holder with a carbon free to move therein, stops to limit the motion of the carbon, the stops being attached to pivoted arms, the pivoted arms having pivoted washers associated with their ends, so that the distances between the stops are fixed when the washers are in place, but may be varied when the washers are removed.

537,626. Electric Railway Conduit System. Harry A. Belden, Washington, D. C. Application filed January 26, 1895.

In an electric railway conduit system a conductor support comprising a vertically arranged screw threaded support, a bracket on the screw threaded support, the bracket having both vertical and lateral adjustments on the support, and a conductor provided with a lateral flange adapted to rest in a recess in the end-face of the bracket.

537,630. Electric Railway Conduit System. Albert N. Connett, Washington, D. C. Application filed January 26, 1895.

In an electric railway conduit system there is the combination with the slot rail of a frame formed with a chamber adjacent to it, a conductor-holding device, comprising an outer shell seated in the chamber, an insulating holder in the outer shell, and a conductor stem secured in the insulating holder.

537,644. Telegraphy. Robert H. Morris, Roselle, N. J. Application filed August 10, 1894.

In a duplex telegraph system in which signals are transmitted from one end by current reversals, and from the other by changes in line resistance, the combination is claimed in the arrangement illustrated of a differential relay having a single core, two batteries of different polarity at the same station, a key for changing from one battery to the other, a polar relay at the other station, and a rheostat and transmitting key at the same station.

537,665. Electric Switch. Henry P. Ball, Bridgeport, Conn. Application filed October 19, 1894.

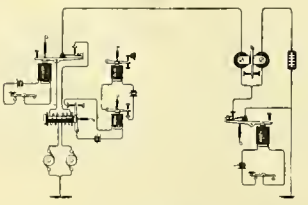
An electric snap switch is described, composed of terminals to be united and disconnected, a pair of hinged blades connected by a spring, and each formed with a pivot bearing in the form of a sector of a circle, and a sector of a circular groove concentric with the latter, a conducting ring located in the sectors of a circular groove, and means for holding the ring in place.

537,672. Electric Railway. Jean Claret and Olivier Wuilleumier, Lyons, France. Application filed September 19, 1894.

Permanent way rails are provided at crossings and junctions with insulating pieces composed of a series of lengths of rail insulated from each other, and connected in such a manner as to form an insulating and rigid section of the line rails.

537,673. Electrically Actuated Vehicle. John B. Clark, St. Paul, Minn. Application filed March 3, 1894.

The cut shows the arrangement, which consists of a framework mounted to run upon tracks, an axle journaled to the framework and having pulleys upon its ends, rims surrounding the pulleys and running upon the tracks, friction rollers supported in a framework and interposed between the rim and pulleys, a constantly running engine upon the framework and adapted to actuate a dynamo, and an electric motor adapted to be energized by the dynamo, and so connected as to actuate one of the friction rollers.



NO. 537,644.

537,679. Oil Guard for Electric Fans. Philip Diehl, Elizabeth, N. J. Application filed May 24, 1893.

In an electric fan a rotating armature is provided with a depending sleeve or journal, an oil cup into which the sleeve or journal extends, and an inverted cup formed non-perforate except at its central open portion, and located on the armature carrier above the sleeve or journal, there being an oil-tight joint between the inverted cup and the horizontal part of the armature carrier, so that the cup will serve to prevent the outward escape of oil from the sleeve or journal when the armature is in rotation.

537,693. Process of Evacuating Incandescent Lamps. Arturo Malignani, Udine, Italy. Application filed August 15, 1894.

A process for producing a vacuum in the bulbs of incandescent lamps is described, consisting in first introducing into a tubular elongation of the bulb suitable substances capable of being gasified by heat and combining with the gases generated by the filament when brought to incandescence to form solid or liquid precipitations then exhausting the bulb by means of a pump and sealing the tubular elongation up, then bringing the filament to intensive incandescence and simultaneously heating the substance in the elongation, and finally sealing off the elongation.

537,696. Electric Arc Lamp. Louis C. H. Mensing, London, Eng. Application filed October 29, 1894.

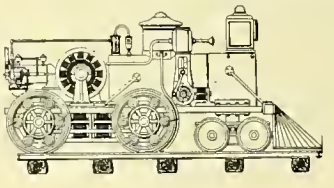
The last claim follows: The combination with a balance or swing frame and the link of a brake lever fulcrumed to said frame for controlling the grip of a wire or band upon the brake wheel under the combined radial movement of the frame and connecting link.

537,706. Sectional Conductor for Electric Railways. James F. McLaughlin, Philadelphia, Pa. Application filed February 5, 1895.

A main or supply conductor and a sectional working conductor, rotary switches for coupling the same, pivoted armatures for actuating the switches, and traveling magnets passing over the armatures in inductive relation thereto.

537,715. Safety Support for Overhead Electrical Conductors. Alexander D. Poole, Boston, Mass. Application filed August 13, 1894.

The claim: A safety support for electrical circuits, comprising a frame of conducting material, two studs mounted



NO. 537,673.

upon the ends of said frame, an insulating sleeve and disks on said studs arms of conducting material mounted upon said sleeves and between said disks, insulating blocks between said studs in the path of a projection on said arms, and a raised portion or web on said arms arranged to form contact with the outer ends of said frame.

537,718. Electric Wire Insulator. Daniel M. Rothenberger, Lancaster, Pa. Application filed January 8, 1895.

An insulator having a tie wire, and its inner end provided with a recess, and a filling of cement within the recess, extending to or slightly beyond the outer surface of the inner end is claimed.

537,757. Railway Block Signal Lock and Register. John Dean, New York, N. Y. Application filed October 26, 1894.

A railway block signal lock is described, comprising a lock bar for the signal lever and formed with shoulders and teeth, an electro-magnet having its armature lever provided with a lug adapted to engage the shoulders to fasten the lock bar in different positions, a shaft under the control of the operator, and a toothed wheel held on the shaft and adapted to engage the lock bar teeth

537,769. Electric Meter. Haydn T. Harrison, London, Eng. Application filed June 14, 1892.

This instrument comprises a pendulum having a constant rate of vibration, a series coil adapted to increase the amplitude of vibration of the pendulum, and a registering device adapted to record the increase of amplitude.

# Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, MAY 4, 1895. No. 18.


## A Typical Chicago Railway Power House.

Reserving for a future article a comprehensive description of the noteworthy transformation of the network of horse railway lines on the North and West Sides of Chicago into electric railways—the task being still in process of accomplishment—the accompanying illustrations show the main features of the first of the three great power houses to be completed and put in operation. This is the plant of the Chicago Electric Transit company, near California avenue and Roscoe boulevard, which is to supply current to the lines in the northwestern portion of the city. The company named is affiliated with the North and West Side street railway companies of Chicago, and, together with other companies covering outlying territory, is controlled by C. T. Yerkes, the prominent street railway financeer. The great extent of territory served by these companies is thus really under one system of street railway management, and, as a matter of fact, the entire electrical transformation has been systematically and consistently carried out under the direction of one man, James R. Chapman, acting for the Yerkes interests. The power houses are planned on the same lines, and thus the one herewith illustrated, the smallest of the three, although of 3,000 horse power capacity, may be regarded as typical. In all respects the station is modern, complete and well built. It was highly praised by the members of the Western Society of Engineers who inspected it on April 27th. A group picture of the visiting party on that day is given in Fig. 5

The building, shown in Fig. 4, is 245 feet long and 134 feet wide. Ground room is ample, and the station is designed with reference to future extension. The exterior walls are 33 feet high and the basement underneath both engine and boiler rooms is 12 feet high. Brick is the material used for the building and largely also for the machinery foundations. For exterior ornamentation pressed brick and cut stone are employed. The octagonal brick stack is particularly massive in appearance. It is 175 feet high with a uniform interior diameter of 11 feet. The building and plant are designed to be absolutely fireproof, and as there is hardly anything that can burn no insurance is carried. The roof is of corrugated iron, the floors of cement or steel plates, the staircases to the switchboard gallery and the basement of iron, and every precaution has been taken to avoid the use of combustible material. Probably no electric power house in the country is more worthy of description as fireproof.

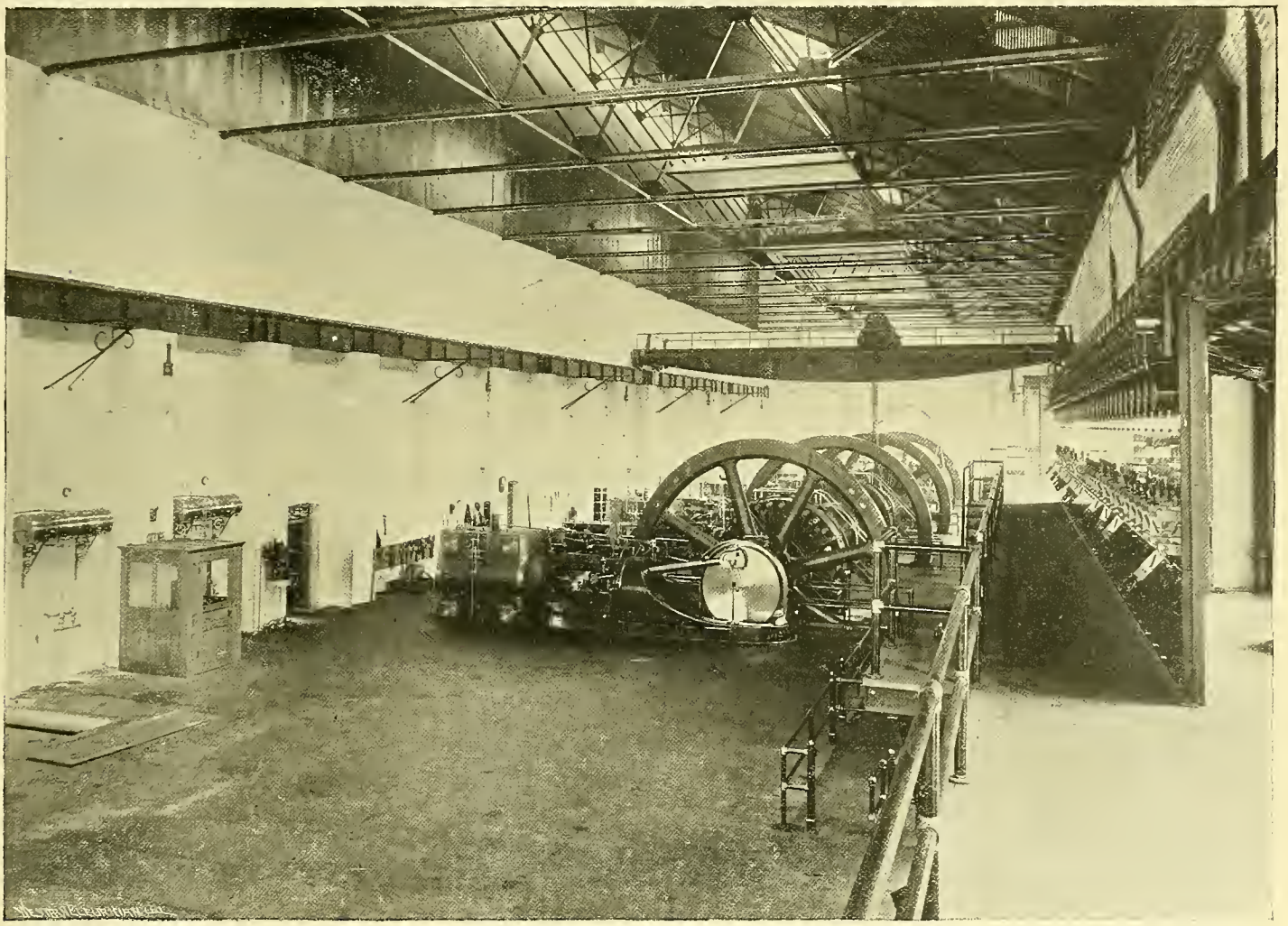


FIG. 1. A TYPICAL CHICAGO RAILWAY POWER HOUSE.—ENGINE AND DYNAMO ROOM OF THE CALIFORNIA AVENUE STATION.

By a longitudinal wall of brick and iron, the station is divided into two large apartments of about equal size. One is devoted to the boilers, feed water heaters and boiler pumps and the other contains the engines, dynamos and switchboard. The imposing array of boilers is shown in Fig. 3. There are ten Campbell & Zell water-tube boilers of 300 horse power each in five batteries. Crude oil is burned in Murphy furnances and is forced through pipes to the points of consumption by the oil pump shown at the left in Fig. 3, which is from the Snow Steam Pump Works of Buffalo. The oil is stored in tanks outside the station. Steam pressure is maintained at 130 pounds, and all steam pipes leading to the engines and smoke flues are laid beneath the floor. Berryman feed-water heaters and boiler pumps and condensers of the Blake admiralty type are used. The injectors are of the Metropolitan double-tube type, from the Hayden & Derby Manufacturing company.

In the engine room, a comprehensive view of which is given in Fig. 1, there are four Fraser & Chalmers cross-compound condensing engines, which develop about 800 horse power each at the most economical rate of operation. On the shaft of each engine is a Siemens & Halske railway generator, with external revolving ring armature and commutator, rated at 620 horse power. The combination is driven at the rate of 85 revolutions per minute, and as both engine and dynamo have demonstrated ability to withstand overload, between 800 and 900 horse power can be obtained from each unit if necessary. So far the load has not exceeded the capacity of one engine, but of course the demand for power is constantly increasing as new lines or extensions are thrown on the station. A view of one unit is shown in Fig. 2.

The engine room is completely equipped. A twenty-ton Walker overhead traveling crane, Fig. 1, will transport all but the heaviest engine and dynamo parts, and as the floor is composed of removable steel plates access to parts desired to be removed can also be had from the basement. The leads from the dynamos to the switchboard are conducted through the basement. Lubricating oil is fed to the engine and dynamo bearings by an automatic oiling system. The two distributing tanks for this system are shown attached to the wall at the left in Fig. 1. A Westinghouse locomotive air pump forces the oil from these tanks—one being for cylinder oil and one for engine oil—through filters and thence to the bearings. One valve controls the oil supply for each engine, and after use the oil is conducted to storage tanks in the basement, refiltered and used again. The compressed air from this air pump is also used for blowing dust from the machinery and switchboard. This system of oiling was supplied by the Wilson Whiting Davis Oiling company of New York.

The large switchboard is shown in Figs. 1 and 2. Like the engine room, it is arranged for ample extension. The board is made up of polished panels of black slate, and is in two parts—a dynamo board of nine panels (four unoccupied) on the floor level and a circuit board of 40 panels in a gallery. The former is 18 feet long and the latter 55 feet long. Each feeder panel is supplied with a General Electric automatic circuit breaker, a Weston shunt ammeter and a knife switch. In the dynamo board, in addition to a panel for each machine, one panel supports a large Thomson recording wattmeter. About half of the feeder cables leave the power house through porcelain wall bushings for the pole line, shown in the exterior view, Fig. 4. These cables can also be seen against the inside of the wall in Fig. 2. The other half is conducted on a rack in the basement to a six foot arched brick tunnel, through which the feeders are conducted underneath the North Branch of the Chicago river.

The lines now operated from this station are: Van Buren street, Milwaukee avenue (electric), Elston avenue, North avenue, Lincoln avenue (electric) and the loops on Garfield, Center, Webster, Fullerton and Racine avenues. It is a noteworthy fact that the nearest point on the Van Buren street line is five and one-half miles from the station, yet it is said that the feeders are heavy enough to provide full 500 volts at the motors on this distant line.

## Death of W. J. Richardson.

The announcement of the death of William J. Richardson at Brooklyn, April 26th, will be a great shock to the street railway men of the entire country. Outside of the immediate circle of friends, it was not known that Mr. Richardson had been seriously ill. The cause of death was spinal meningitis. Since the death of his father, the late William Richardson, president of the Atlantic avenue railroad, a large part of the work of looking out for the estate which was left had devolved upon this son. There had been many complications in business affairs during the last six months, and much of his time had been devoted to caring for the interests intrusted to him. In addition to that the great railroad strike was a source of much worriment to him. As a director of the Atlantic Avenue Railroad company he wanted to do what was for the best interests of that corporation. As president of the Atlantic Avenue Railroad Employes' Mutual Aid association he wished to see the men as kindly treated as possible. The two interests diametrically opposed to each other could not be harmonized, and the result was that Mr. Richardson worried himself sick over the complications. The strike had been settled but a short time when the announcement was made that he was suffering from nervous prostration. That was seven weeks ago. A few days before his death the sickness developed into acute spinal meningitis. Thursday night he was known to be very ill and the members of his family were notified. His five children, three daughters and two sons, his brother, Dr. Richardson, and Dr. Sharpe were present at his bedside when he breathed his last. Up to within a few moments of his death he was conscious, and recognized his relatives as they spoke to him.

William James Richardson was born in the city of Albany, N. Y., October 22d, forty-six years ago. His early education was secured at the state normal school there, and after passing from the lowest to the highest department in the school he went to the principal business college of the city. In 1864 his father was made president of the Dry Dock, East Broadway and Battery railroad in New York city, and with his family moved to New York. His son's education was then continued in the New York branch of the same business college. After that was completed he entered the English hardware importing business, and for a year he received the salary of $10 a month. At the end of two years he had been steadily advanced and was receiving $25 a month. As this work was at that time entirely unnecessary, but done for the purpose of learning the business, it shows what kind of energy there was in the young man. In 1867 William Richardson secured control of the Brooklyn and Jamaica Railroad company and his son gave up the hardware business to assist him. After two years in the railroad business he desired to devote himself for a time to study and attended the Polytechnic Collegiate Institute for three years. Ever since that time he has been an enthusiastic member of the alumni association of the institute, and rarely missed any of their larger meetings and annual reunions. For a year after leaving the institute he superintended for his father a steamboat line which was operated between Brooklyn and Rockaway and Canarsie. Then he again associated himself directly with his father in the business of the railroad, and when the Atlantic Avenue Railroad company was organized to operate the various lines in which Mr. Richardson was interested, William J. Richardson was elected secretary, and filled that position with ability until the reorganization of the company put new men in control, who substituted friends of their own.

FIG. 4. A TYPICAL CHICAGO RAILWAY POWER HOUSE.—THE CALIFORNIA AVENUE STATION OF THE CHICAGO ELECTRIC TRANSIT COMPANY.

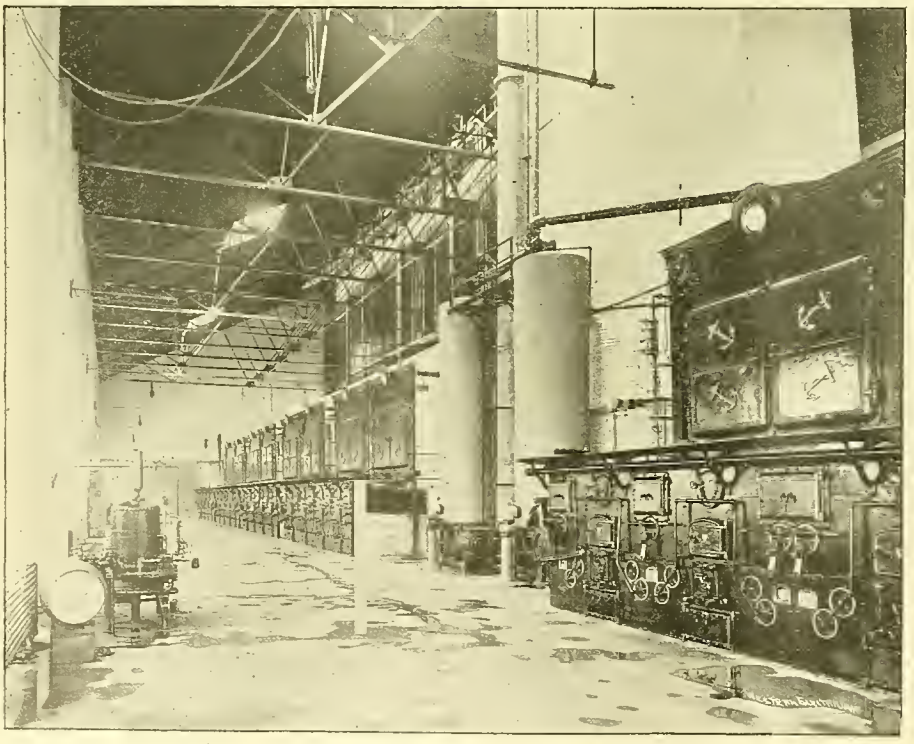


FIG. 3. A TYPICAL CHICAGO RAILWAY POWER HOUSE:—BOILER ROOM.

When the Brooklyn Traction company purchased the control of the Atlantic avenue railroad, Newberry Frost, who was then treasurer, resigned, and William J. Richardson filled for a time both positions. It was said that there was an agreement between the new men and the former president of the company that William J. Richardson should be continued as secretary. After the death of William Richardson, late in December, 1893, there could be found no trace of that agreement, and Benjamin Frick was elected to take the place. Mr. Richardson then opened an office for the American Street Railway association, of which he had been secretary and treasurer since 1882, in the Franklin Trust company building. Mr. Richardson was quite fond of traveling and had been three times to Europe, several times to the Bermudas, and had also traveled extensively in this country.

In 1873 he married Mary Carrington Raymond, the second daughter of John H. Raymond, LL.D., the president of Vassar college, by whom he was the father of six children. One of them has since died. Mr. Richardson has always taken a great interest in the work of the church, attending the meetings, was actively engaged in promoting the interests of the Young People's association and has been a great help to the pastors of the church. His family is known by his friends as a charmingly happy one. Beside the members of his own family, Mr. Richardson had two brothers and a sister. One of his brothers is in Europe at the present time.

## Cheaper Telephones Demanded.

At the annual meeting of the Board of Commerce of Youngstown, O., on April 15th the question of cheaper telephone service was discussed and resolutions adopted providing that unless the Bell Telephone company reduced its rates to $24 per year for residences and $30 for offices, that the board would request the council to grant a franchise to a new company at these rates, to be secured by a five-year contract.

## Five Hundred Subscribers Secured in Lincoln, Neb.

[From the *Lincoln Journal.*]

Promoters of the proposed new telephone system have succeeded in interesting six or eight Lincoln citizens, and articles of incorporation are now being drawn up. The capital stock is to be $50,000; a controlling interest is to be owned by citizens and the balance by eastern men. Persons interested say the new company is now practically formed and that nothing stands in the way. The ordinance

granting a franchise is yet in the hands of City Attorney Abbott, who will probably report at the next meeting of the council. The Harrison system is to be put in and completed in ninety days, but it is not the intention of the company to put up a building. According to agreement resident telephones are to cost $2 a month and office instruments $3 a month. Over 500 bona-fide subscribers are now on the list, enough to warrant the putting in of a system.

## Reorganization of the Mutual Automatic Telephone Company.

Interesting news comes from Philadelphia regarding the reorganization of the Mutual Automatic Telephone company, whose affairs were recently investigated by city officials, owing to the fact that it was charged that considerable stock had been distributed among the aldermen for the purpose of securing a franchise. Readers of this journal will recall the proceedings alluded to in the accompanying sketch of the concern which was published in the Philadelphia *Ledger*:

FIG. 5. A TYPICAL CHICAGO RAILWAY POWER HOUSE.—VISITING PARTY FROM THE WESTERN SOCIETY OF ENGINEERS.

The Mutual Automatic Telephone company was organized with a capital of $10,000, of which only $1,000 was paid in. It had the usual complement of officers, but from the president down to the directors all who could be questioned during the recent investigation denied having any more than the most general knowledge of its affairs. Treasurer Persch was "the head and front of the offending" and he could not be found while the investigating committee was reluctantly pursuing its inquiry. Besides its capital of $1,000 the company was supposed to have the right to use a switchboard, from which the name of the corporation was derived, but eventually it was ascertained that it had no system, no switchboard—nothing whatever with which to begin business. The company was still more remarkable in having no stockholders of importance. The two largest individual stockholders outside of Treasurer Persch and Clerk Gale, who held stock as trustees, testified that their names had been used without their consent or knowledge. Much of the stock had been issued to Gale in blocks of six and twenty shares, the number of blocks of six being sufficient, if properly distributed, to control a two-thirds vote of the Common Council, and the number of blocks of twenty being sufficient to control the Select Council in the same way. There were also a few blocks of 500 shares, of which nothing could be learned. In the course of the inquiry into the company's affairs the fact was developed that one of the blocks of six shares was in the estate of a councilman who had died. In itself that fact might have been of little significance. But another councilman interested himself to buy these six shares acting, he said, on behalf of a client whose name he refused to disclose. At all events this block of six shares and all the other blocks disappeared. All this was disclosed long after the company had been given extraordinary privileges, and after a committee of councils specially selected to smother an investigation had been forced by public opinion and the resolution of its chairman, Mr. Roberts, to call the witnesses who could tell this much. Mr. Persch, the treasurer, and his clerk, Gale, left the city as soon as the investigation was ordered, and they did not return until after the committee had expired by limitation.

These recently ascertained facts about the company, the disclosures made on the witness stand, the strenuous efforts made to prevent an investigation, the refusal of Councilman Simon to reveal the name of his client who wanted to buy up the stock of a dead councilman, and the running away of Persch and Gale from the jurisdiction of our courts should be read in the light of the action of councils on telephone ordinances.

More than a year ago the business community, as represented in trade organizations, demanded reduced telephone rates and competition in the business. Two companies, the Drawbaugh and the Central, with capital and systems to recommend them, applied for the privilege of laying wires in the streets of the city. A committee of councils held their ordinances back, but when the Mutual Automatic company applied for privileges its ordinance was promptly reported. The company was given everything it asked for, and scarcely any provision was made to guard the use of the grant or to secure any return to the city for a most valuable franchise. It is said that when a man begins to go down hill "everything appears to be greased for the occasion." So it was with this ordinance. It was promptly passed by both branches of councils and signed by the mayor.

The ordinance required the filing of plans of work to be done and this company bought a cheap map of the city and ruled off all the streets with red ink to make it serve as a plan of what it intended to do. Perhaps nothing more in the way of a plan could be asked for, as it does not appear that the company intended to do anything more than sell out at a high price the valuable privileges it had been granted for nothing, to one of the companies vainly importuning councils for permission to establish telephone service. The investigation interrupted the deal, and nearly a year after the Drawbaugh and Central ordinances had been introduced public opinion forced the electrical committee to report them to councils. But there was still an opportunity to make the blocks of six and twenty shares of Mutual Automatic stock worth something to their unknown holders, and, accordingly, the Drawbaugh and Central ordinances were amended so as to require heavy payments to the city for the privileges granted. But as they would have been accepted even under these terms, their consideration was postponed by amendments, and they were finally killed by a vote which was short of the required number for final passage. In the meantime the ordinance to repeal the privileges granted to the Mutual Automatic company was also hung up, and the holders of the blocks of six and twenty shares congratulated themselves on still having a marketable commodity, with possible customers in the field.

That is the situation of affairs to-day. But the ordinance to repeal the privileges granted to the Mutual Automatic company has been reintroduced, and the members of the new city councils, if they do not want to rest under the suspicion of being interested in the value of its shares, should pass it promptly. The effrontery of Treasurer Persch in returning to the city to "reorganize" his discredited company, after he had been in hiding to escape examination as to the means employed to get his ordinance through councils, ought to be rebuked, and no self-respecting or politic councilman will fail to administer the rebuke. But whether councils shall pass the repealer or again seek to protect the holders of Mutual Automatic stock, the city solicitor should make it clear that its franchises have been forfeited and are valueless. The terms of the ordinance were not complied with in the time appointed, and, if councils should again prove recreant, the law officers of the city should resist any attempt of Persch to dispose of the franchises granted to his company, or to use them. If the city cannot smoke out the real holders of the blocks of stock issued in the name of Gale, it should at least render those blocks of stock valueless.

## Competition Developing in the South.

[From the Chattanooga, Tenn., *Times*.]

The city council has at last settled the question of granting a franchise to a new telephone company. After a long discussion, merited by the importance of the matter, an ordinance granting a franchise to the Citizens' Telephone company of Chattanooga was passed last night. The important matter was entered into in a deliberate and business-like manner. The company is bound by reasonable restrictions, thus protecting the interests of the city.

President Carswell said after the meeting last night that representatives of the company will to-day begin a canvass of the city for subscribers. They offer to put in telephones at rates of $30 per year for business houses and $24 for residences.

## No Combination Will Prevent Reduction.

[From the *New York Times*.]

Very few persons who are not connected with the Bell company will be depressed in mind by the discomfiture of the organization, or its downfall, if that should be brought about. For many years it has made itself obnoxious not only by its greed and its exactions, but also by the exercise of its great influence in devious ways in the Patent Office. The manifestations of its power have in many instances been so clearly contrary to public policy that a vast majority of the people would be glad to hear of its overthrow. And if the drying up of its great stream of profits is to be accompanied by a great extension of the agencies for telephonic communication and the supplying of telephone service at a cost not exceeding one-half of the Bell rates, their satisfaction will be complete.

The condition of the telephone business will be very interesting for a long time to come. It does not yet clearly appear whether the competing organizations now so vigorously attacking the old exchanges in the West and South

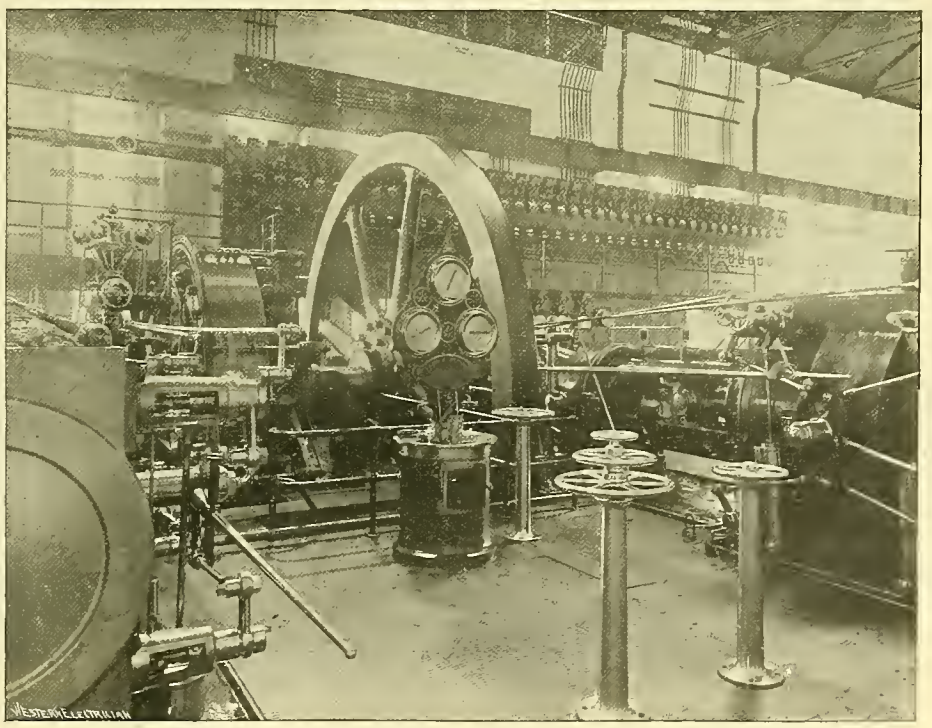


FIG. 2. A TYPICAL CHICAGO RAILWAY POWER HOUSE.—ONE OF THE ENGINE-DYNAMO UNITS.

are connected with the new Standard company or are independent of it. The new company which offers service in Brooklyn, among the officers of which are some of the leading capitalists and men of affairs in this state, seems to be entirely distinct from the Standard. The old contract between the Bell company and the Western Union Telegraph company, by which each was bound to remain in its own field, will expire by limitation before the end of this year. There are in sight possible combinations that would have a marked effect upon both telephonic and telegraphic communication. But it is tolerably plain that no probable combination will prevent a great reduction of the cost of telephone service to the public in the near future, and the simplification and improvement of the means of communication.

## Fighting for Existence.

[From the *Pittsburg Dispatch*.]

The war against extortionate telephone rates that is just starting in Pittsburg has blossomed out in earnest in many other places nearby. In nearly all the larger Ohio towns opposition companies have started in to break the monopoly of the big company which controls all the telephones in this city and it is having a lively time of it to hold its grip there. The following special from Warren, O., shows the situation at that place:

"The many new telephone companies being organized for cheaper rates are to encounter strenuous opposition, it is said, here from the Central company of Pittsburg which occupies about all of the territory in this section. The Pittsburg company is reported as saying that rates will be reduced to fit any emergency arising from competition. Warren and Niles citizens will organize a new company within a few days. They already have a franchise here."

## Gerst Telephone Bill Not a Strike.

[From the Rochester *Post-Express*.]

Newspapers, politicians and lawyers that advocate the interests of corporations and monopolies rather than the interests of the people are trying to prejudice the Legislature against the Gerst telephoee bill by calling it a "strike." They would have the senators and assemblymen believe that the bill is advocated only by "a gang of disreputable individuals" who make a precarious livelihood out of the agitation by levying assessments on telephone subscribers.

The bill, however, is not a "strike," and there is no good reason to question the sincerity or the public spirit of those who are urging the Legislature to pass it.

The bill has been before the Legislature for several years; the telephone company has always opposed it, expending thousands of dollars every year for "counsel fees" and for other purposes, and has always succeeded in defeating it.

This year it was introduced in the Assembly by Mr. Gerst and in the Senate by Mr. Persons, two Buffalo representatives of good character. The bill was formally approved by the Black Rock Business Men's association and the Buffalo Association of Telephone Subscribers, and the action of these organizations was ratified by the Buffalo Real Estate Exchange, South Buffalo Business Men's association, Buffalo Lumber Exchange, Buffalo Produce Exchange, the Common Council of Buffalo, and various other associations of business men. On the last day of January a meeting of representatives of commercial organizations in the city of New York was held, and what is known as the Conference of Commercial Bodies on the Telephone Bill was organized. The organizations then represented in and since acting with the conference number nearly forty. The most important are the New York Board of Trade and Transportation, Cotton Exchange, Lumber Trade association, Building Exchange, Mercantile exchange, Fruit Exchange, Clothing Manufacturers' association, Jewelers' association, Telephone Subscribers' association, and the two Grocers' associations. Various organizations of business men in Brooklyn have also approved of the Gerst bill, and we are assured that it has been approved also by associations of business men in Albany, Cohoes, Binghamton, Lockport, Oswego, Bath, Ilion, Ithaca, Port Jervis, Seneca Falls, Nyack, Utica, Schenectady, Rochester, Cortland, Geneva, Syracuse, and in other cities and villages. Representatives of the conference have attended hearings on the bill at Albany on no less than five different days and have been very active in behalf of the bill. The conference itself has had many public meetings, which have been largely attended. In a statement to the Legislature, its officers say:

"We believe that this discussion has attracted as much attention in the Legislature as any other measure at this session, wholly by reason of the very earnest and persistent efforts that have been made in its behalf and by the unusually large delegations that have appeared before the committees from different parts of the state, and also by the fact that the organizations herein mentioned have steadily endorsed the work done by their representatives and by resolutions formally adopted at regularly called meetings have approved the Persons-Gerst telephone bill.

"The various hearings held by your committees were attended by more than 100 representative men as delegates from their respective bodies which earnestly support the measure. In appearing before your committees all of those men did so at great personal sacrifice of time and convenience and many of them at their own expense for traveling.

"No person connected with the work, either as officer, counsel, delegate, employe, or in any other capacity, of any of the organizations represented, nor of the combined organizations, has at any time been paid, or expects to be paid, for any services in connection with this matter. Their services have been rendered wholly in the public interest. All collections have been made under supervision of our committees and have been confined to the amounts strictly necessary to cover traveling expenses, printing, postage and telegraphing. All disbursements have been made under audit of responsible members of our organization, and our books are open to the inspection of any committee of the Legislature."

The man who calls the telephone bill a "strike" insults the intelligence of his hearers. Few bills have been introduced this year that have so much strength among the business men of the state.

It is not claimed by all that the bill is perfect, though there are many who defend it in every detail, but it is insisted upon all sides that it is the duty of the Legislature to consider it, to improve and perfect it, and to pass a measure that will furnish some relief to the people.

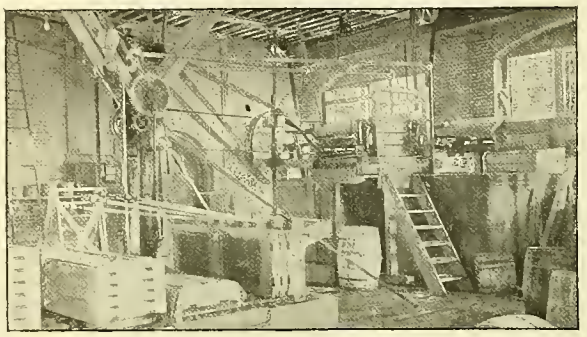


FIG. 1. PORCELAIN FACTORY AT SCHENECTADY.—MIXING ROOM.

FIG. 2. PORCELAIN FACTORY AT SCHENECTADY.—CORNER OF PRESS ROOM.

## Telephone Project in the Lackawanna Region.

[From the Scranton, Pa., *Tribune*.]

A number of prominent Wilkesbarre, Scranton and Carbondale business men have formed themselves into the Interstate Telephone company, with the purpose of stringing telephone wires throughout the Lackawanna region and establishing a telephone system between Carbondale and Wilkesbarre.

The officers of the company are: John Graham of Wilkesbarre, general manager of the Wilkesbarre & Wyoming Valley Traction company, president; Timothy Burke of Scranton, vice-president; Horace E. Hand of Scranton, secretary and treasurer. J. R. Beetem, general manager of the Scranton Traction company, and Robert Reeves, superintendent of the Scranton Gas & Water company, as well as several prominent business men of Scranton, Wilkesbarre and Carbondale, are largely interested in the enterprise.

A month ago the charter was secured, and since then the Interstate company has secured facts and figures concerning the Bell, Drawbaugh and other high grade telephones and have negotiated for the use of poles up and down the valley. Contracts have already been made for the use of several lines of poles already erected in the vicinity of Scranton.

Mr. Hand said that the telephone scheme was more than a speculation on paper. He had no hesitancy in declaring that line work will be started in this city and elsewhere as soon as franchises are secured.

When asked whether the company anticipates being asked to pay for privileges granted by the city, Mr. Hand replied in the negative. He remarked that other electric companies had not been asked to pay for franchises in Scranton and he saw no reason why an exception should be made against the Interstate company.

The detailed plans of the company could not be ascertained last night. It was positively announced that a telephone exchange will be located soon in Scranton and that Wilkesbarre and Carbondale and intervening towns will be connected within a comparatively brief period.

The Interstate company has no connection with the Standard corporation, nor the Drawbaugh company, which is negotiating to establish its manufacturing plant here.

## Competion Welcomed in New Orleans.

[From the New Orleans *Picayune*.]

The prospects of competing telephone companies being granted the privilege of swinging out their shingles to do business in this city are attended by promises and assurances of reductions in the charges for a service, which, although a necessity, has been maintained in the class of a luxury, because of the charges before the expiration of the principal patents.

The present movement is general all over the country, and the prospects are very promising that, via the competition route, the long-hoped-for reduction will be secured. Of course the local lawmakers may intervene and ordain that the present charges are not excessive and refuse to allow any competition, but they have already indicated by their action that such is not their belief nor proposed course. The first ordinance submitted passed through without objection from anyone until it reached the mayor. He stated his objections to the measure, and the projectors caused them to be removed from the ordinance, and thus amended the ordinance was again placed before the council.

The Standard Telephone company is also about to establish itself here. The company has already started to map out its plans, having selected Captain Harry Allen as its general manager.

Colonel A. W. Crandall, president of the Great Southern Telephone & Telegraph company, is at present out of the city on business connected with his company. The reporter, in order to ascertain what the company proposed to do by way of meeting or offsetting the proposed competition, called at the office of the company and there met Joseph J. Fowler, the secretary and general manager. His reply to the query propounded to him was: "You know that the mayor is already in receipt of a communication stating that this company proposed to revise its rates. This revision, understand, is not inspired by this talked-of competition, because we had proposed to do so before this matter was ever spoken of. Now as to details, Mr. Crandall on his return will be able to furnish you with all information, and on that account I should prefer that you would see him."

## Telephone Rates Higher.

[From the *Milwaukee Sentinel*.]

Complaint is made that the new telephone toll rates in Wisconsin which went into effect recently are really higher than the old rates. One old rate for instance was $1 for a five minutes' talk between Milwaukee and Green Bay, while the new rate is 70 cents for three minutes and 25 cents for each additional minute. The old rate to Madison or Oshkosh was 75 cents for five minutes, while the new rate is 50 cents for three minutes and 15 cents for each additional minute. Manager McLeod was absent from Milwaukee yesterday, and Mr. Payne said he knew nothing about these rates.

## Porcelain Factory at Schenectady.

One of the interesting features of the growth of a great manufacturing concern is the manner in which varied and widely differing industries are included as the progress of development advances. At the outset a large dependence is placed upon the outside manufacturer for raw or partly finished material, but as the art progresses and higher standards are required, the outside manufacturer is no longer able to meet the demand. The principal manufacturer is thus thrown upon his own resources, with the result that he generally succeeds in producing something much superior to that which he formerly was obliged to procure elsewhere.

A striking example of this evolution by necessity is furnished by the very complete factory for the manufacture of porcelain for electrical purposes which the General Electric company has established as an integral part of its immense establishment at Schenectady.

An especially perfect porcelain of hard, white, vitreous character, dense in structure, non-absorbent and unaffected by acids, alkalis or gases was demanded, and efforts were made to obtain such porcelain outside, but without avail. Confronted with this difficulty, the company decided to

build its own porcelain factory. This has now been in operation for the last three years with excellent results. It comprises mixing, moulding, drying rooms and kilns, and stands a few yards away from the eastern division of the works, between Kruesi avenue and the New York Central Railway tracks. It is equipped with the latest and most approved machinery, and is operated by a corps of skilled workmen under the careful supervision of an experienced man. Although only a pottery in miniature, it is a complete pottery.

The building is a two story brick structure covering a space of about 14,000 square feet. Through the roof protrude the squat chimneys of the kilns, which are kept in continuous service with the constant rush orders.

Entering by the main door admission is immediately had to the mixing room, where the crude kaolin or china clay, which is the best for the purpose that the market can supply, is brought to be washed, manipulated and mixed. Passing from the mixing machine the clay is placed in bags and is strained through them to remove any material of a hard nature which might interfere with future operations. It comes from the straining press in large lumps and in that condition is partly dried, placed in a pulverizer and reduced to the necessary condition for transmission to the press room, which it reaches in the shape of a moist, grayish, disintegrated clay.

The press room is immediately over the mixing room, and is well lighted and ventilated by large windows on three sides. The presses in which the porcelain is moulded are upright screw presses and stand along the three sides of the room directly under the windows. The operations in this room appear very simple, but it is here that porcelain of the most intricate shapes and fashions is turned out to meet special orders. The moulds used are of special tool steel, which are made in the works themselves by a corps of efficent tool makers. Before cutting these moulds, or dies, the shrinkage of the porcelain in drying and baking is calculated to a nicety in order that when the porcelain in its finished state leaves the kilns the metal parts which have been stamped out in the punch press house a few yards away may fit accurately. The catalogue number of the porcelain appliance is cut in the die, and this appears in relief on the base of the finished device.

The lower part of the die is fixed to a small table, which can be moved up or down by means of a foot lever, and is set in a hollow space in the larger table forming the base of the press. The upper part of the mould is fitted to a sliding bar, which is elevated and depressed by the lever and screw. The die being fixed in position, the pressman takes a portion of the pulverized clay and weighs the proper quantity in a pair of scales. With a small brush the two dies are then thoroughly dampened, the lower mould is lowered to its normal position, and the operator pours in the clay, which he presses evenly down with his hands to give it a preliminary packing. A vigorous twist is given to the lever and the upper die is brought down upon the clay with considerable pressure, which is increased by an additional pull at the lever. Another twist in the reverse direction and the upper mould rises, the lower one being elevated by the foot lever at the same time. Depression of the latter lowers the lower die and leaves the mass of clay, which has assumed the form desired, in the hands of the workman. This, with others, is laid upon a rack in order that the pieces may undergo a process of air drying. The entire space in the center of the press room, as well as a part of the second floor of the main building, is occupied by these racks. They are always full, for the press room is taxed to the utmost to keep up with the orders.

A door in the press room opens into a spacious room, which occupies part of the second floor of the left wing and the whole of the main building. In this room all the pieces are corrected before they are sent to the kilns. The burrs are removed from all the holes through which screws or punchings are to pass, the marks of the dies are cut off, and the pieces put into final condition for baking. Through this room pass the upper parts of the kilns.

FIG. 3. PORCELAIN FACTORY AT SCHENECTADY.—VIEW OF THE KILNS.

Descending from this clay finishing room the kiln room on the ground floor is reached. The pottery kilns are four in number and were constructed by one of the best kiln builders in Trenton. Around the kilns stand piles of yellow "hillers" and "saggers," which are made in one corner of the kiln room. Into these clay pots or pans the moulded pieced are placed. When full a cover is placed over each and hermetically sealed. The kiln is then filled and the doors closed.

FIG. 4. PORCELAIN FACTORY AT SCHENECTADY.—CORNER OF ASSEMBLY ROOM.

After the first baking the porcelain comes out in the form of a hard, white, compact biscuit. For certain insulating purposes, this biscuit is employed as it comes from the kilns. It is non-absorbent to a high degree, and is used for socket bases and other purposes where the porcelain is not exposed. For switch bases, insulators, cut-outs, etc., however, the porcelain is glazed and subjected to another firing. When it leaves the firing kiln it is as nearly perfect as the potter's art can make it. It is beautifully white, compact in texture, extremely hard, is unaffected by moisture and has exceedingly high insulating properties.

From the kilns the porcelain which is to be used in cut-outs, switches, sockets, transformer connecting boards and in many other appliances is taken to the second story of the right wing of the building, where these appliances move along from operation to operation with a rapidity which speaks volumes for the dexterity of the workers. Here the brass punchings are applied to the cut-out, the screw shells fastened to the connections, the screws set and the insulating composition applied where needed. In another part of the room are made the thousands of key and keyless sockets, with porcelain bases and polished brass shells, and millions of glass fuse plugs for the plug cut-outs. At the table where the plugs are made a striking feature is the electric soldering devices, used to solder the fuse metal to the tip and exterior screw shell of the plug.

The assembling of ratchet snap switches occupies a little department by itself, as does the manufacture of the copper terminal fuses for link cut-outs. In sundry other portions of the large room other porcelain appliances of varied character are made ready. The finished appliances are then passed on to the next room, where, each neatly wrapped in tissue paper, they are packed in brown card boxes bearing a label showing their source and giving their description.

The insulators for special work, such as for transmission at very high voltages, are tested in a small room adjoining. During a recent visit an electrician in this room was busily engaged in testing the large double petticoat insulators for the important Folsom-Sacramento power transmission plant. Each insulator is subjected to as severe a test as could be devised, and before being accepted as satisfactory must show its capability of withstanding a pressure of 25,000 volts alternating. In order to test the endurance of these insulators, the testing current was raised as high as 52,000 volts before any of those subjected to the test gave away. The only trace of the enormous pressure then apparent on the outside of the insulator was a pin point hole scarcely perceptible. To such perfection has the manufacture of porcelain for electrical purposes attained.

In the use of porcelain as the most convenient and satisfactory insulating material, the General Electric company claims to have been the pioneer. Long before porcelain was used by other manufacturers, the appliances of this company were widely employed and had earned a high reputation for excellence. Gradually electrical manufacturers came to recognize the merits of porcelain, as the electrical consumer had done already, and porcelain has come into much more general use, until to-day it is used almost universally for insulation purposes.

## No Thought of Retiring.

[From the New York *Sun*.]

Tuesday last was the seventieth birthday of President Thomas T. Eckert of the Western Union Telegraph company. Yet he has not a thought of retiring because of his age, or of asking a pension because of his long years of service for the company. He was on duty as usual at his office on his birthday, and went to work as lively as he went to it a half century ago. He stopped awhile to receive the congratulations of the company's employes and to hear a poem:

Three score and ten, life's autumn year,
Greets you erect and strong, with cheer.

Then he set to work till it was time to go home and take a rest in preparation for the next day. He may keep up that kind of thing for many a long year yet; and any man who dared to talk to him about retiring as a veteran would probably soon be made to wish he had kept still.

There are thousands of men in business life as old and as active as President Eckert. It is only in military life that men are regarded as unfit for further duty when they have got beyond their youth.

## The Regulator Patent.

Judge Robert S. Taylor, who represented the government in the Berliner telephone suit at Boston, was in Chicago on Thursday of last week to file the brief for the Thomson-Houston company in the United States Circuit Court of Appeals in the suit against the Western Electric company upon the regulator patent. Judge Grosscup found the patent void, as detailed in the WESTERN ELECTRICIAN of January 19th last, and, as the Thomson-Houston company has taken an appeal, it is expected that the case will be heard before Judges Woods, Jenkins and Showalter in the Circuit Court of Appeals in the latter part of May.

According to the Newark, Ohio, *Daily Advocate* of April 13th, the new telephone exchange in that place is about completed. There are over two hundred 'phones in operation, and as fast as the instruments arrive an additional one hundred willbe connected up, making the total number of subscribers three hundred. This is said to be the largest exchange in the state operated by a local company. In February the Newark Telephone company made a contract with the Western Telephone Construction company of Chicago, Ill., to construct a two hundred telephone exchange complete. Work was commenced on February 16th, and notwithstanding the fact of three feet of frost in the ground, necessitating the use of dynamite to blow out the holes, the construction company has fulfilled its contract to the letter, which required two hundred telephones to be connected and in operation April 15th.

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CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CIRCULATION, 16,630.

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THE eastern office of the WESTERN ELECTRICIAN has been removed to 108 Times Building, New York.

IN another column is presented an article on the electrical features at the Atlanta Exposition, the preparations that are in progress for lighting the grounds and buildings and providing attractive features for exhibition in the building set aside for electrical apparatus. It may be mentioned that this is the first authoritative statement of the plans of the department of electricity of the exposition company, and Mr. Atkinson, chairman of the committee on electricity, takes this occasion to announce through the WESTERN ELECTRICIAN that every facility will be afforded exhibitors for displaying their specialties to the best advantage. No doubt the electrical fraternity will take advantage of the opportunity.

THERE are few men in the street railway business in this country whose death would come home so closely as a personal loss to such a great number of men identified with similar enterprises as did that of William James Richardson of Brooklyn, whose untimely taking off is noted in another column. Mr. Richardson was an estimable gentleman of engaging manner and gentle disposition, admired by his business associates for his great executive ability, his energy, perseverance and fidelity to principle, and beloved by his subordinates for his consideration and his constant efforts to better their condition and secure at all times recognition of their rights. Aside from his connection with and financial interest in the Brooklyn street railways, he was secretary of the American Street Railway association and secretary of the New York State Street Railway association, and president of the Atlantic Aid association, an organization of employes of the company with the management of which he had so long been identified. An evidence of the implicit confidence which the employes had in Mr. Richardson's sense of fairness and his great personal honor is found in their action in offering to submit their recent differences with the company to his consideration, pledging themselves to abide by his decision. When the fact of Mr. Richardson's financial interest in the company is taken into account and also the position he held in the street railway world, as representing the capital invested throughout the country in similar projects, by reason of his position as secretary of the two leading street railway organizations of the country, an idea can be gained of the estimation in which he was held. The action of the Brooklyn employes was a fitting tribute to a worthy man. He was a powerful friend of the workingmen of Brooklyn, and his death may well be considered by each of them as a personal loss. The lesson of his life was a good one, emphasizing as it did the respective rights and responsibilities of capital and labor, and the influence of his teachings, by precept and example, should long be felt in the community.

IN New Jersey, as in Pennsylvania, Massachusetts and Connecticut, the introduction of the trolley for suburban service is not to be accomplished without a struggle. The steam roads will oppose it vigorously, for they realize that they cannot compete with it in this class of business. The Central Railroad company of New Jersey has already begun a crusade against the establishment of an extensive network of trolley lines contemplated by the New York & Philadelphia Traction company. The latter corporation proposes to connect practically with every steam road in the state and with almost every electric road between the Hudson River and Cape May. As projected the road forms a connection between the Metropolitan Traction company of New York, the Consolidated Traction company of Jersey City and the Philadelphia Traction company of Philadelphia, all of which are practically controlled by the same interests. The establishment of this extensive system would mean serious competition for the steam lines, and the Central Railroad company of New Jersey does not propose to permit the building up of such formidable competition if it can prevent it. Accordingly the Jersey Central has appealed to the courts, and the rights of trolley lines in the state will be passed upon. In this contest the Jersey Central will endeavor to have the courts follow the recent decision of the Supreme Courts of Pennsylvania and Massachusetts to the effect that road commissioners and other public officials cannot give away the public highways to corporations for the use of the trolley roads. Work on the trolley roads has been discontinued under a writ of certiorari obtained by the Jersey Central, which may possibly delay further construction of the trolley roads until the constitutionality of the law which now enables the traction company to secure franchises to construct its road along the public highways is tested in the Supreme Court of the state. The case is one of considerable importance to projectors of similar enterprises in other states, and the decision will undoubtedly greatly influence further developments in trolley roads for suburban service.

SINCE the expiration of the fundamental patents of the Bell company opened the telephone field there has been a growing demand on the part of the public for improved service and reduced rates. In many cases where the Bell interests have failed to accede to this demand competition has sprung up, and in some instances appeals have been made to state legislatures to regulate telephone charges by law. Thus far the latter plan has failed to secure relief for the subscribers, and it is quite generally regarded as an expensive, unsatisfactory and dangerous policy. The Bell interests are represented at state capitols by powerful and experienced agents whenever trouble is anticipated and they seem to possess some very potent means of winning over members of legislatures to their cause. The general argument that legislative interference in the affairs of a corporation is bad public policy serves as an excellent excuse with men of business for opposing such measures. It is unquestionably a dangerous precedent to establish and should only be resorted to in a great emergency. It is therefore gratifying to note the growing tendency of the public to look for relief when dissatisfaction exists to the natural means at its command, namely, competition. At the present time there is evidence on all sides that the Bell interests, which have so long enjoyed immunity from competition, will soon be engaged in the greatest struggle of their history. In every part of the country rival companies are springing up, and they are receiving enthusiastic support from Bell subscribers as well as from those who heretofore have been unable to enjoy the advantages of telephone service owing to the excessive charges made by the Bell company while it monopolized the business. Correspondents of the WESTERN ELECTRICIAN in all parts of the United States report unusual activity in the telephone field, and these accounts are corroborated by the daily papers, which record the growing interest that is manifested everywhere in the great controversy that is just beginning. The West and Northwest seem to be the most inviting field for projecters of these enterprises and already several large exchanges have been begun, while at numerous other points agents are canvassing for subscribers. The Bell company refuses to seriously consider some of these projects in the light of competition, and in other cases it has shown a disposition to crush these rivals. This latter policy can not be followed successfully, of course, for any length of time, even by such a powerful corporation as the American Bell Telephone company, with its vast resources and great influence. No longer protected in a monopoly of the telephone business, it must stand ready to meet competition and conduct its business upon the same footing as other great enterprises, and it can only hope for success in following well established business principles, by giving the best service possible at the lowest rate at which the business can be conducted and pay a fair return on the actual capital invested.

AMONG the bills pending in the Illinois Legislature is one intended to regulate the granting of franchises by city councils and village boards, which will have a salutary effect if enacted and enforced. The measure has already passed the House, the vote being almost unanimous in its favor, and it is not anticipated that serious opposition will be encountered in the Senate. It is provided that city councils and village boards "shall have no power to grant to any person or corporation a franchise authorizing the laying of gas pipes for the distribution of inflammable gas, for fuel or lighting purposes, or to lay in or on the ground or string on poles any wires on, over, or by which electricity for lighting purposes is to be used, conveyed or distributed in any street, alley or public grounds in any such city, village or incorporated town, except upon the petition of the owners of the land representing more than one-half of the frontage of the street or alley of any block along which it is proposed to lay such pipes or wires, or string such wires." An important provision in this bill is that "when the street or alley, or part thereof, sought to be used shall be continuous for more than one block no petition of land-owners shall be valid unless it shall be signed by the owners of the land representing more than one-half of the frontage of each block of the street or the part in which it is sought to lay pipes or wires or string wires." On the face of the bill it appears to be an excellent measure, and if it should become a law it promises to work to the advantage of legitimate enterprises. It is aimed particularly at the policy adopted by the City Council of Chicago to sand-bag established companies by threatening to ruin their business through rival concerns—straw companies – fostered by corrupt politicians. An example of this kind is found in the recent granting of valuable franchises to an alleged electrical corporation without any financial standing whatever. It is known that this company had no real existence and that when the ordinance was adopted it was offered for sale to several companies and individual capitalists who were contemplating engaging in enterprises covered by this ordinance. This outrageous business has been conducted so openly that it became a public disgrace and many of the aldermen who were interested in the deal referred to and who attempted to secure re-election were defeated. The lesson of this rebuke may soon be forgotten and it is therefore proposed to protect the property owners by the enactment of the measure whose chief features are here presented.

It is easy enough for reputable business men to form a company and secure a franchise when there is a demand for a new enterprise, but it is an outrage on legitimate corporations already established as well as upon property owners to permit the council to grant franchises to irresponsible men, by which streets may be torn up and legitimate business enterprises threatened unless the latter submit to blackmail for "protection." If the proposed measure becomes a law it will act as a check upon boodling councils, and existing companies will be more secure in their rights. It will give a majority of the property owners a veto on ordinances for certain classes of franchises. The right of owners of abutting property to say whether a street shall be used for railroad purposes has long been recognized. This bill recognizes the right of the owner of property abutting on a street which he has paid heavy assessments to improve to have a voice in deciding whether the pavement shall be torn up and damaged, possibly for his ultimate benefit, but generally to his immediate and also ultimate detriment. Moreover, it does not prevent honest competition, but rather encourages it, for it gives property owners a voice in the disposition of privileges to corporations.

## Electricity at the Atlanta Exposition.

By H. M. Atkinson.

The department of electricity of the Cotton States and International Exposition company is confronted with two separate and distinct problems: First, the lighting of the grounds and the interiors of the buildings and furnishing such necessary facilities in the way of power as may be required; second, filling the electricity building, comprising 22,750 square feet of floor space, with exhibits which will show as comprehensively as possible the progress made up to the present time in electrical inventions and their application to practical uses.

In making provision for the lighting of the grounds and the furnishing of power where needed, a great deal of study has been made of the arrangement of the grounds and the lay of the land, with the idea of putting to the best use the resources at the disposal of this department, and to aid in every way possible in bringing out the beauties of the landscape design of the grounds and the architectural effects of the buildings, the prevailing idea being that the lighting of the grounds is simply one of the items that will go to make up the picture, and that this lighting in design and location must fit into the picture that will be presented in its proper place, so as to make one harmonious whole. These lights must be applied with the hand of an artist, or the effect that can be produced will be very likely destroyed by accentuation at undesirable spots. The lighting must be applied just as an artist applies the colors to a picture, or else it will be lost or wasted, or actually injure the results attained by the landscape engineer and the architect.

It is the opinion of this department that a great deal of the lighting done at expositions is absolutely wasted because applied at the wrong place and often in the wrong amount. A great glare of light produced at certain spots simply serves to exaggerate those particular localities and to dwarf others, and so distorts the whole. Even if desirable, which in the opinion of this department it is not, it would be out of the question for the Cotton States and International Exposition company to go to any immense expense in the question of lighting, taking into consideration the time the exposition will be open; and it is unquestionably a fact that a moderate amount of money, as compared with the amount spent at recent expositions, expended with the fixed and definite purpose of applying the lights at the proper places and in such a way as to bring out the beauties of the scene and to accentuate the proper localities, will be more satisfactory in result than a great blare and glare of light applied without any intelligent purpose.

It is designed to have the light well diffused throughout the grounds and to aid the effects sought to be produced by the designers of the grounds and buildings, rather than to dwarf and mar the same.

The department is to be congratulated upon securing, as consulting engineer, the services of Luther Stieringer, so well known in connection with all recent expositions and who is now at work on the general plans for the application of the lighting. The experience of this gentleman at Chicago, San Francisco and various other places, and his well-known reputation and ability, are a guarantee of the success of the lighting of the grounds of the Cotton States and International Exposition company and will undoubtedly create a feeling of confidence in the minds of the electrical people who expect to make exhibits or who are in any way interested in the success of the electrical part of the exposition.

In the department of exhibits a great deal of work of a preliminary kind has been done in this line with the idea of bringing to the exposition the exhibits of the various manufacturers of electrical apparatus and supplies, and with quite gratifying results. The great disadvantage this department has worked under has been the recent experiences of the World's Fair, which has rendered electrical manufacturers indisposed to so soon take hold of another exposition. In spite of this, hard work has accomplished a good deal, and the department has convinced the electrical world that it cannot be absent from this exposition. The widespread development of the South in an industrial line, and the indications that the most important developments of the country will be in this section of the country during the next few years, hold out attractions that cannot be withstood. Manufacturers and investors are turning their faces toward the South in numbers, and an era of great growth and prosperity for that section is at hand. There could be no more opportune time than that provided by the exposition to exhibit the important part that electricity and the transmission of power by electricity are destined to play in this development and growth, and exhibits in the electrical line are particularly timely, and will undoubtedly be followed by results far-reaching in their effects. There can be no possible doubt but that this opportunity provided at just the right time will be largely availed of by the electrical world, and the work already done in this department assures a varied and interesting display.

This department has had experts traveling in its interests throughout a large section of the country, explaining the plan and scope of the exposition, and the necessity for representation in one shape or another. This work has developed the fact that the exhibits will be of the most approved and up-to-date pattern, and as rapid strides are being made and will be made in the improvement of apparatus and devices of all kinds, the electrical department must and will awaken new interest and be an important factor at the coming exposition. Liberal terms are offered manufacturers and dealers for the placing of operative exhibits in the machinery hall, and this department has already secured all the apparatus necessary for the providing of the service lighting and power of the exposition. This could hardly be otherwise, taking into consideration the terms offered and the advantages to be attained by such exhibits. It is to the credit of the electrical world that the opportunity has and is being so readily taken advantage of, and is proof of the ability of men in the electrical line.

The electricity building is admirably located for the purpose, and it has the advantage of not being too large, so that it will not be a great bazaar filled with a mass of articles, a large part of which the public will not want to see, and which would necessitate trouble and fatigue in looking over. It is the aim of the department, as far as possible, to make the electricity building an exhibition of select exhibits, showing the most recent developments in the line of manufacturing, and excluding those which are out of date and which have been left behind in the struggle for economy and efficiency.

This article would be incomplete without the announcement that the department has secured the services of Charles F. Foster as engineer, and the fact that the plans of the department will be executed by him is a sufficient guarantee for their intelligent and successful execution. Mr. Foster is well known in connection with his work at the World's Fair, and any reference to his career there or upon his general ability is entirely superfluous. His name will carry a guarantee to those exhibitors who desire to contribute operative exhibits, and will enable them to consign apparatus to the Exposition company for this purpose, with a feeling of perfect confidence that they will be properly cared for and properly operated.

To summarize: The aim of this department in the first place is to light the grounds properly and sufficiently, without any great prodigality of light, but with a true conception of the aims sought in the whole design, and with a desire simply to aid in bringing out the picture; that is, the lighting is simply one of the means to an end and must not be unduly prominent. And the second aim of this department is to make an exhibit in the electricity building which will show the progress of the science up to the present date.

## Action of the Electric Current on Fused Sulphurets.[1]

By Jules Garnier.

After having determined that carbon, heated to redness under the influence of an electric current of feeble voltage, is transported from the positive to the negative electrode, which fact permitted me to indicate a new method of iron cementation, I thought that this acton of an electric current ought not to be limited to carbon. To settle this point I made experiments in the laboratories of M. Hillairet.

I employed the arrangement described heretofore, that is to say, a tube of refractory material placed horizontally in a reverberatory furnace and receiving the material to be electrolized between the two electrodes in the heated part of the tube. The current was furnished by a Gramme machine. I first experimented with a very complex product, a raw nickel matte which I had brought from Sudbury, Canada. I placed a certain quantity of it in the middle of the tube between the two carbons. The spaces between the carbon rods and the walls of the tube were filled with refractory earth mixed with charcoal to guard against the intrusion of oxygen, but not the exit of gas under feeble pressure which is formed during the electrolysis, and which can thus escape by the cracks which the heating produces in the clay mass.

The matte being melted, I passed a current of 10 volts and 23 amperes; the current only showed feeble oscillations according to the voltmeters, and thus proved that there was a great regularity in the conductibility of the molten mass. Gradually the voltage was lowered, although the temperature of the reverberatory furnace was almost constant, which went to prove that the nature of the mixture was changed. After an hour of heating, slow cooling and stoppage of the current, I opened the tube. The positive carbon rod was worn to a feather edge at its upper end, while the negative rod remained intact; as to the matte, I had an analysis made of those parts which were solidified at the point of contact of the two electrodes. The following are the results which were returned by the laboratory of the Ecole des Mines on December 15, 1894. Only the portion insoluble in acids (fragments of the walls of the tube strongly attached to the matte even after cooling) were eliminated from the samples

Analysis No. 1 is that of the original matte.

Analysis Nos. 2 and 3 are respectively those of the material in contact with the anode and with the cathode after the completion of the electrolysis.

1. Read before the Paris Academy of Sciences, January 28, 1895.

Analysis No. 4 shows an average of Nos. 2 and 3.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| S..... | 21.10 | 16.60 | 4.70 | 10.65 |
| Fe..... | 33.30 | 33.40 | 49.10 | 42.30 |
| Ni..... | 16.30 | 5.13 | 19.10 | 12.14 |
| Cu..... | 29.00 | 39.90 | 26.13 | 33.02 |
| | 99.70 | 99.20 | 99.03 | 98.11 |

These analyses show:

1. That 50 per cent. of the sulphur is eliminated, the remaining sulphur combining chiefly with the copper, especially near the anode.

2. The iron remains near the cathode, where it seems to accumulate according to the average analysis, No. 4.

3. The nickel regularly increases in quantity from the anode to the cathode.

4. The copper diminishes in arithmetical progression from the anode to the cathode.

I think that we may conclude from the results of the above experiments:

1. That sulphur combined with the metals in the molten state, in the absence of air, when traversed by an electric current (the electrodes, at least the anode, being of carbon), is gradually eliminated in the form of sulphide of carbon.

2. In a molten mixture of metallic sulphides, in the absence of air, traversed by an electric current, the electric conductivity of the mixture remains homogeneous at every moment, augmenting little by little on account of the gradual elimination of sulphur; the metals and the remaining sulphur arrange themselves in such a way that each elementary section of the bath taken perpendicularly to the direction of the current has the same electric conductivity; thus the copper, a better conductor than iron or nickel, keeps the greatest portion of the sulphur so that its conductivity may be reduced in the desired proportion.

It is possible, I think, from the above experiments, to explain certain observed phenomena, for example, the mode of distribution of the free or sulphuretted metals in veins.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

It is announced that on May 1st in St. Paul and Minneapolis telephone tolls on "party" lines, i. e., those having several subscribers on the same line, will be reduced from $5 for a business firm and $4 for a residence to $4 and $3 respectively. As the continual interruptions on such lines makes them unpopular, there are comparatively few of them in the Twin Cities, and the reduction has not caused any great amount of rejoicing among the patrons of the company. It is hinted that another reduction is in store for the patient and non-complaining subscribers, that of redistricting, and instead of charging all more than a mile away the full rate for two miles, they will be charged for a mile and a quarter, etc.

There is talk of building a telephone line from Council Bluffs to Carson, Ia., via Treynor, and if crops are good the line is reasonably certain.

Dr. W. W. Bradley of Forman, N. D., has completed arrangements to extend the telephone system from Forman to Lisbon, about 26 miles.

Geo. S. Holmes has begun putting in a telephone system at Pierre, S. D.

E. G. Edwards proposes to put in a telephone exchange at Whitewater, Wis., if given sufficient encouragement. A canvass for subscribers will be made, and if successful he will apply for a franchise.

Work on a telephone line from Crookston to East Grand Forks, Minn., will begin May 1st.

Work will begin at once on a telephone line from Sioux Falls, S. D., to Dell Rapids.

Nothing more can be learned as to the connection of Minneapolis men with the Standard Telephone company, nor of the time when the Minneapolis system would be put in. The Bell company officials profess to be densely ignorant of the existence of the company and extremely indifferent whether it puts in a system or not.

P. W. Bossart of St Paul is superintending the work of putting in the La Crosse Telephone company's new system at La Crosse, Wis.

## Electrical Men of Texas to Organize.

A number of the representative gas and electrical men of Texas have signed a call for a meeting to be held in Mason's Hall, Houston, at 10 A. M. on May 22d, to form a state organization. It is announced that "the meeting will be a strictly business affair—no banquets, excursions or 'blow-outs' of any kind," and all interested are urged to attend. Especially low excursion rates can be obtained on the railroads on account of the Confederate Veterans' reunion.

## Double Carbon Lamp Litigation.

The case of the Brush Electric company against the Western Electric company for alleged infringement of the former's patents for double-carbon arc lamps was argued on Monday and Tuesday before Judge Showalter in the United States Circuit Court at Chicago. Three forms of the Scribner arc lamps are claimed to be infringing by the complainant, which is represented by H. A. Seymour. Barton & Brown appeared for the defendant.

## New Fort Wayne Multipolar Dynamo

In the accompanying illustrations, Fig. 1 represents a new 60 kilowatt medium speed dynamo designed for incandescent lighting and power. It is the first of a series of multipolar dynamos designed by James J. Wood, the electrician and mechanical engineer of the Fort Wayne Electric corporation, which vary in size from 25 to 800 kilowatts. As will be seen from the cut, the design of this dynamo presents a very beautiful and substantial appearance, while the mechanical perfection of detail, workmanship and finish stamps it at once as a modern high grade machine. In the several sizes up to and including 120 kilowatts, the lower portion of the field, pedestals and base are made in a single casting, while in the larger sizes, which have an outboard bearing, the parts are cast separately and bolted to the base, making the dynamo easier to install, as should the same design be maintained throughout the castings would become very heavy and difficult to handle. A notable feature in this generator is the absence of all loose cables, wires and connections so common on most machines, the connections in this dynamo being made by removing the perforated door where they connect with the main binding posts, which are mounted on slate bases at each side, effectively protecting them from dirt or injury. The two small binding posts shown in front are for the field rheostat connections. The dynamo is compound wound and can be run in either direction by simply reversing the brush holders on the studs and without changing any of the other connections, the brush holders being so proportioned with relation to the commutator that the act of reversing them on the stud changes the point of contact 90 degrees, leaving them in the correct position for commutation when the dynamo is run in the opposite direction. The curved pedestal on the commutator end is also a decided advantage, as it not only reduces the floor space and weight of metal required in the base, but also

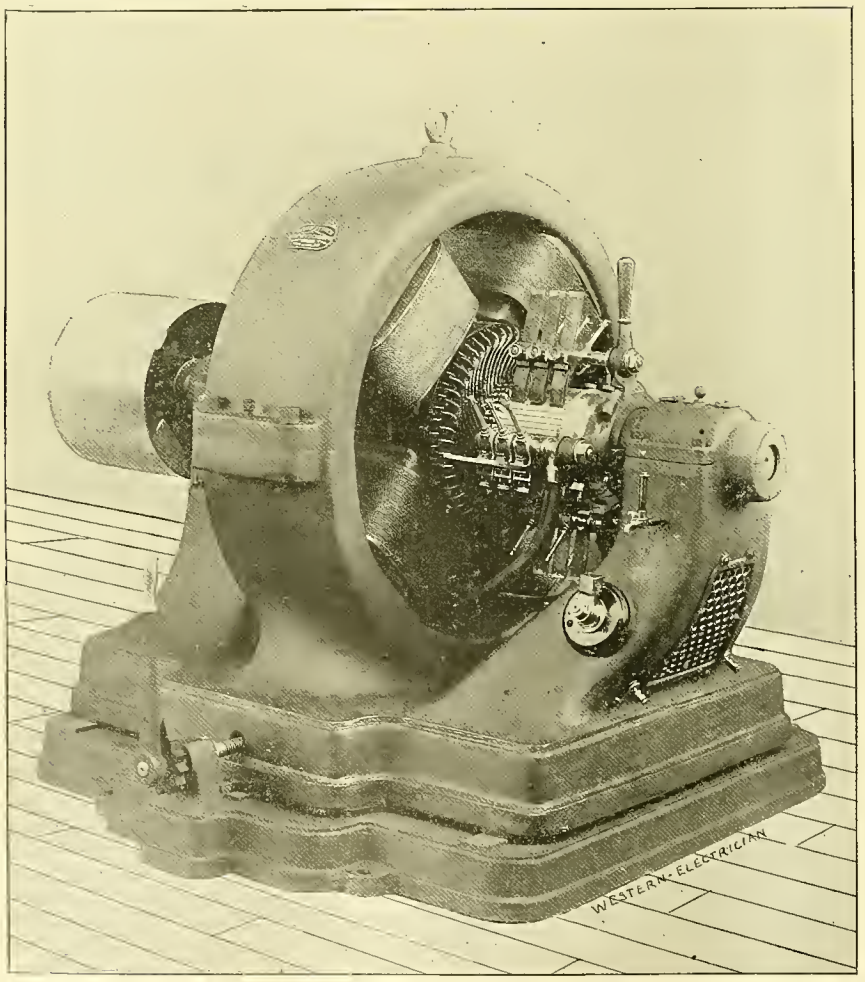



FIG. 1. NEW FORT WAYNE MULTIPOLAR DYNAMO.

enables the dynamo to be turned end for end on the sub-base, should it be required to belt from either end. The bearings are self-oiling and aligning and are of ample proportion to withstand the strains to which they are subjected, while the field coils are wound on steel spools with brass heads, making them very easy to replace in case of an accident.

The armature construction of this dynamo, Figs. 2 and 3, possesses many novel features, showing in a marked degree the ingenuity and originality of the designer. Fig. 2 shows the commutator and core complete, with one of the coils in place, while Fig. 3 shows one of the armature punchings, the method of building up the core, and one of the coils before being insulated. As will be seen from Fig. 3, the armature core is constructed from segmental punchings, having hooks projecting from the inner edge which partly encloses the clamping bolts. These punchings alternate with one another in order to break joints, the hooks making contact with the bolts on opposite sides, but without completing the magnetic circuit around them. It will be seen from this construction that the several segments are self-supporting, there being no strain on the spider or bolts other than that produced by the torque. As a consequence the spider can be of exceedingly small cross section and in marked contrast to the heavy cast-iron or steel structure so common in other multipolar machines, while the labor of fitting is reduced to a minimum, there being no dove-tails or other difficult fits to make. The hooks which engage with the clamping bolts not only break joints but alternate in position, leaving spaces between each equal to the thickness of the iron punchings. These hundreds of spaces enormously increase the radiating surface of the core, which, of course, reduces the temperature.

A careful set of tests shows that with this construction there is absolutely no current generated in the clamping bolts or spiders. Its advantages may be summed up in the following terms: First, minimum weight of armature; second, enormously increased radiating surface; third, self-supporting core construction; fourth, simplicity of spider construction; fifth, economical use of sheet iron; sixth, small cost for punching dies, and their maintenance. This method adapts itself perfectly to armatures of large diameter and any capacity required.

The windings or coils which compose the armature circuit are also of novel construction and present features of extreme simplicity over the bar method of winding heretofore employed. As will be seen from Fig. 3, the coil is composed of four bare wires wound on a former with a heavy copper connector soldered at one end, which makes connections by screws to the commutator segments. The advantages of

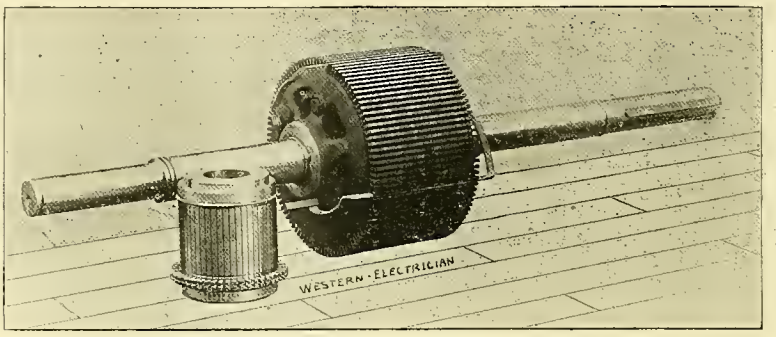



FIG. 2. NEW FORT WAYNE MULTIPOLAR DYNAMO.

this construction are: First, the soldered joints so common in bar winding at each corner, with their tendency to get loose, are entirely dispensed with, there being but one soldered joint to each coil, in place of five in the old method; second, as a consequence the resistance of a turn and the $C^2R$ losses in the armature are materially reduced; third, the four naked wires of which the coil is formed present a greater radiating surface in proportion to their area and consequently carry the currents generated in them at a much lower temperature.

After being formed in shape as shown in Fig. 3, they are then carefully insulated and placed in position on the core, as shown in Fig. 2, the return ends being soldered into holes in the commutator connector before referred to. The commutator is then slipped on the shaft, each connection being screwed to its proper segment by two screws. As there is no strain anywhere on the insulation and as the voltage between each turn is very low while the ventilation is perfect, it would seem as though such an armature ought to last forever.

The commutator of this machine, shown separate in Fig. 2, is constructed from hard drawn copper with mica insulation put together by hydraulic pressure, and both it and the brushes and brush-holders are of ample cross-section for the

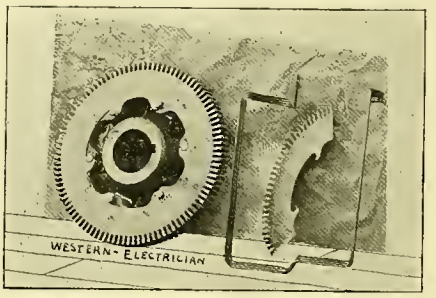



FIG. 3. NEW FORT WAYNE MULTIPOLAR DYNAMO.

currents which the dynamo is intended to generate, and as a consequence it does not heat. The armature circuits are so arranged and connected that either two or four sets of brushes can be used on the commutator; either set can be removed while the dynamo is running, and the remaining set will carry the current without over-heating. On a recent test this dynamo was run on a load of 525 amperes at 120 volts for 10 hours, after which careful temperature readings were made. It was then found that the highest temperature in any part of the dynamo was but 35 degrees C. above the room.

The dynamo weighs complete 7,300 pounds, while the armature weighs but 950 pounds, and at a speed of 650 revolutions per minute delivers 500 amperes at 120 volts, which can be raised to 140 when required.

## Picnic Grounds.

The best picnic grounds near Chicago are located on the line of the Chicago, Milwaukee & St. Paul railway. St. Paul Park, Turner Park and Birchwood are all within 12 miles of Union depot or Kinzie street depot, with low rates and quick transit. For further information call on or address H. E. Laing, city passenger agent, 95 Adams street.

## Special Decorative Incandescent Lamps.

The Columbia Incandescent Lamp company is placing on the market some special incandescent lamps very suitable for decorative purposes. Fig. 1 represents the full size 16 candle power coiled filament round bulb incandescent lamp, which is made in high voltages and is very suitable for window and ceiling decorations. The lamps are capable of being used in a horizontal position without any dropping of the filament. They maintain their candle power to the high degree of the new type Columbia incandescent lamps in high economy and give a very pretty effect, either in clear or in ground glass. Fig. 2 represents a special candelabra

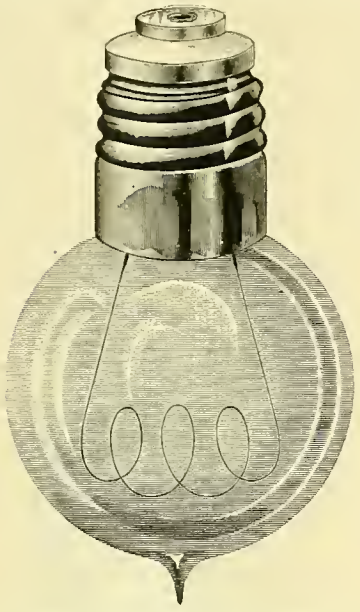


FIG. 1. SPECIAL DECORATIVE INCANDESCENT LAMPS.

lamp, which is suitable for burning in series on 100 volt circuits and upward. These lamps, used with the small yellow and red silk shades, make a very pretty and harmonious effect.

## An Hydraulic Clutch Operating Device.

It is a matter of general remark that the use of friction clutches, clutch couplings and clutch pulleys is becoming more and more widespread in all sorts of engineering work, and especially is this the case in regard to electric lighting and power plants, where it is of the utmost advantage to secure the greatest flexibility of operation, such as providing for the ready shutting down of any portion of the shafting

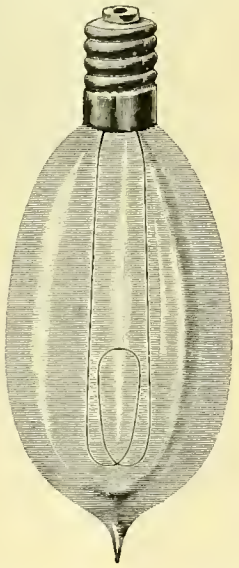


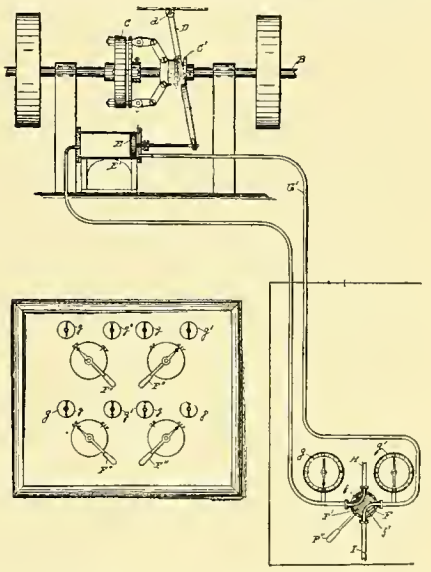
FIG. 2. SPECIAL DECORATIVE INCANDESCENT LAMPS.

without affecting the rest and of disconnecting one or more machines without affecting those in operation.

In the operation of these clutches by hand considerable effort is required on the part of the attendant, and a great deal of running about is necessitated from the points where the clutches are operated to the switchboard, and it is of the greatest advantage to be able to control the operation of these clutches from the point where the general control of the station is centered, namely, the switchboard. By the use of the system here described, which is the invention of J. Brodie Smith of Manchester, N. H., it is possible by the simple turning of suitable valves to absolutely control the operation of any number of clutches or other power transmitting devices from the switchboard or other central point, irrespective of the distance of the different devices controlled.

The action of this device will be understood from an inspection of the accompanying cut, from which it will appear that hydraulic pressure is the means for accomplishing the desired end. Each of the clutches is seen to be provided with a double acting hydraulic cylinder connected with the lever. These cylinders are connected to a source of hydraulic pressure and to the operating point by means of piping, and situated at the operating point is a four-way valve in connection with each of the clutches, suitably arranged to provide for the turning on of the pressure to either piston of the duplex hydraulic center or of cutting off the pressure altogether. In one of the positions of this four-way valve the hydraulic pressure acts upon the piston, which is arranged to throw the clutch in the reverse position of the valve, the pressure is acting on the piston which acts in such a direction as to throw the clutch out, and by a careful manipulation of the valve the clutch may be thrown in and the load "picked up" very gradually. In connection with the hydraulic cylinders may be electrical contacts so arranged as to indicate at the central point the position of the clutch—whether in or out—and pressure gauges are provided corresponding to each clutch showing in which way the clutch is being moved, how fast it is moving and whether or not it has reached the end of its travel.

The character of this device would seem to be such as to appeal with great force to the practical central station man,



AN HYDRAULIC CLUTCH OPERATING DEVICE.

and it is believed that this arrangement is capable of extensive application throughout installations employing this means of transmitting power.

## A New Carbon Holder.

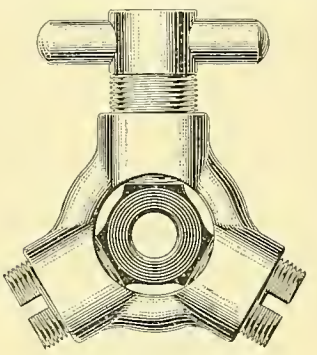
The carbon holder herewith illustrated has recently been placed on the market by the Arc Light Supply company of Elizabeth, N. J. It has several merits that commend it to the electrical trade. It is universal, taking a carbon from one-quarter inch to five-eighths inch diameter, and it will fit any make of lamp. It is simple, strong, durable and strictly interchangeable. The clamping screw, being one-half inch diameter, does away with all liability of twisting or breaking off of the clamping screw. It is self-cleaning, and always brings the carbons in line with the rack of the lamp.

## Medbery Switches.

The Mason Electric Equipment company, agent for the Fiberite company, manufacturer of the Medbery overhead equipment for electric railways, recognizing the demand for a superior station switch, is just putting on the market a line of switches, made from its celebrated composition, of aluminum bronze, which is claimed to be superior to anything on the market. They are constructed in a substantial manner, well finished, mounted on black polished slate, with large contact and guaranteed capacity. They are perfect in design and construction, and the novelty of the design that provides a perfect electrical contact and quick break, with simple and effective mechanical operation, will commend it at once to practical electricians.

Fig. 1 shows the quick break station switch. This switch is constructed in such a manner as to make it impossible for the blades to linger on the edge of the contact pieces, for as soon as the operator pulls the handle the two powerful springs will become strained. Bringing the handles still farther back will make the pins, which are rigidly fastened to the blades, engage with the lower sides of the oblong apertures in the levers, thus lifting the blades until the tension of the springs causes the blade to fly up with a sudden break. It will be seen that the two levers to which the yoke carrying the handle has been securely fastened, move independently on the inner ends of the pivot, thus making it possible to tighten or loosen the contact spring without having it interfere with the easy working of the side levers.

Another feature is the practical device for fastening the guide yoke to the blades. In former switches this has been done by threading a hole in the yoke, but as this yoke generally consists of a piece of fiber, it has been a steady annoyance, the thread frequently giving out, the yoke becoming loose and a consequent flashing on account of the blades not leaving the contact pieces in unison. To obvi-

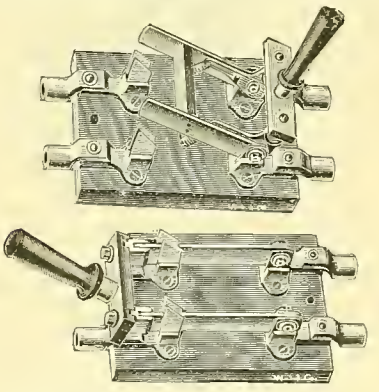


A NEW CARBON HOLDER.

ate this defect, a piece of metal containing two threaded holes in the blades has been inserted into the fiber, thus making a good substantial device that will stand the wear for any length of time.

Fig. 2 shows the slow break switch, also possessing some valuable features. It will be seen that the old way of attaching the yoke to the blades has been improved upon, so as to obviate the defect of having the blades twist and change relations to one another. In the Medbery switch a tenon has been attached to each blade; this tenon fits closely into a mortise in the yoke, thus making a perfect mechanical device that obviates all possibility of twisting the blades or of bringing them out of proper alignment. Each contact piece is secured to the base by two bolts or screws, thus avoiding all possibility of having the contact piece turn on the slate, which is frequently the case when but one bolt is employed. The method of applying the copper clips is such that they are always flexible and not liable to spring apart by use.

The aim has been to provide a switch not only perfect in electrical and mechanical design, but also superior in appearance. The lugs are connected at the extreme ends of



FIGS. 1 AND 2. MEDBERY SWITCHES.

the switch, thus doing away with the necessity of carrying the unsightly wires up over the switch itself. It is believed that the many improvements possessed by these switches will attract the attention of all electrical engineers and station managers. The efforts of the company will be directed by the use of high grade material and workmanship to giving these switches the same enviable reputation as the Medbery insulation now enjoys. It will be seen that the carrying capacity of this switch is very largely increased over the ordinary switch, every switch being capable of carrying 50 per cent. above its rated capacity.

The company has availed itself of the highest class of skilled mechanics, and the workmanship and material which enter into the construction of these switches is of the very highest grade. The company's agent will keep in stock in Chicago a complete line of regular sizes of switches, and will be prepared to make estimates on switchboards for arc, incandescent and power circuits from plans and specifications furnished, or from their own designs.

## The Missouri Telephone Company's Instruments.

Now that the telephone field presents such a promising outlook a number of new companies have sprung up to fill the rapidly growing demand for this now almost absolutely necessary instrument. Among those concerns in the West that are pushing most energetically for business is the Missouri Telephone Manufacturing company of St. Louis, Mo. This company, under the management of I. J. Kusel, its energetic secretary and treasurer, has brought out a fine line of telephones for various services, and has already earned a name as one of St. Louis' growing enterprises.

The accompanying illustrations show the Missouri Telephone Manufacturing company's finest instruments. In a general way it may be said that these outfits are furnished in either oak or walnut, and the woodwork is rubbed down and French polished. No wires show in any of the instruments, as all connections are made on the back. In a word, the company has studied the appearance of its instruments as well as the perfection of their working qualities. In connection with these telephones the Kusel switch is used; this device, the company claims, is one of the few non-infringing switches sold in the United States, and on this account is worthy of careful inspection. The Kusel adjustable transmitter is also controlled by the company, and its efficiency is such that a watch can be distinctly heard ticking through it, and yet it can be easily adjusted by persons knowing nothing of electricity.

Reference to the illustrations will give a clear idea of the general appearance and high finish of these instruments.

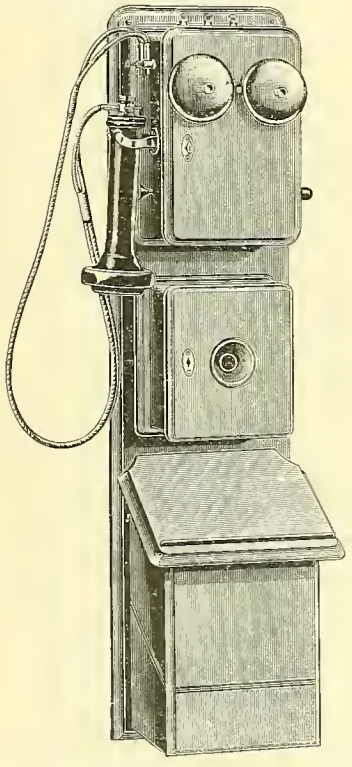


FIG. 1. THE MISSOURI TELEPHONE COMPANY'S INSTRUMENTS.

Fig. 1 represents what the company calls its "No. 1 standard telephone." This instrument is the same in outside appearance as what is referred to in correspondence, but not illustrated herewith, as "No. 1 special." It is designed to supply a demand for a fine telephone at a little lower figure than "No. 1 special." The company will guarantee that on any distance under 50 miles it will give entire satisfaction. The outfit consists of one single standard magneto bell, one carbon transmitter, a standard receiver and cord, a back-board, a battery box and one dry battery. The "No. 1 special" and "No. 1 standard" are built in oak or walnut.

Fig. 2 shows the company's "No. 2 interior system telephone," and it is designed for intercommunication without an operator, it being what the company calls "semi-automatic." This instrument does away with the central station, as each outfit has a switchboard of its own, which allows the person making the call to turn to the station he desires to communicate with, and when through talking he turns back to his original point. The party receiving simply removes his receiver, and when done talking returns it to its place. The company believes that there is a demand for a system of this character and has already a large number of them in use in St. Louis. The simplicity and the perfect working qualities are what will commend the "No. 2 system telephone." A push button and vibrating battery bell are used on this telephone.

Fig. 3 gives a good idea of the outward appearance of the "No. 3 interior and short-distance exterior telephone." This "No. 3" telephone, the company states, is a cheap but serviceable instrument that will talk over distances up to 20 miles. The bell is a battery call that will operate a mile with three cells. This call is actuated by a push button. The company states that there are a large number of these instruments in use that are giving fine service. Although this style of telephone is principally intended for in-

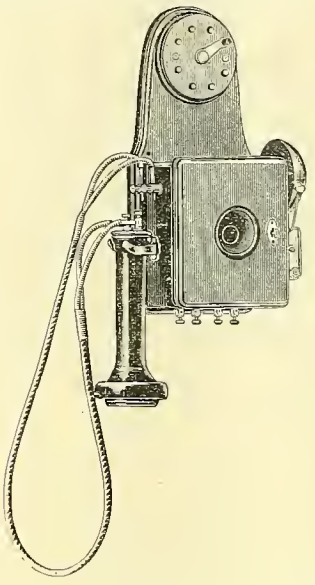


FIG. 2. THE MISSOURI TELEPHONE COMPANY'S INSTRUMENTS.

terior service, it is also recommended for outside work where the distance is short. The transmitter and receiver will answer for service up to ten miles, but the bell is not intended for a distance greater than one mile. Three of these instruments can be connected and worked nicely on one line, but for any number over three the company recommends its "No. 2 system 'phone." In connection with this instrument there is also furnished a desk attachmeut when desired.

In Fig. 4 is shown the "No. 4 telephone." This instrument is practically another style of No. 3 and No. 2 system and instead of placing the batteries away from the instrument they are placed in the battery box shown in the cut, and on the No. 2 system the switchboard is placed above the instrument, while in No. 4 it is placed in the center. In building the No. 3 in this style there is no switch, as is shown in the accompanying cut. One advantage in having either No. 2 or No. 3 in this style is that it condenses the batteries and instruments altogether and makes a fine appearance.

## Lake Shore's Preparation for Transportation to the Montreal Convention.

Those who expect to attend the next meeting of the street railway association at Montreal in October will be inter-

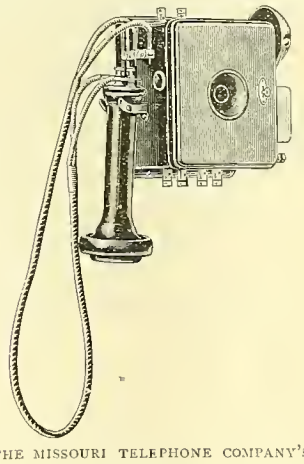


FIG. 3. THE MISSOURI TELEPHONE COMPANY'S INSTRUMENTS.

ested to know of the plans which are even now being made by Western Passenger Agent C. K. Wilbur of the Lake Shore railway for their comfort and pleasure on the journey. The present plan, and the one which will doubtless meet with universal approval, is to run the Lake Shore convention special from Chicago through to Niagara Falls, reaching the Falls in time to spend a portion of the day in sight seeing, but leaving Niagara in the evening in time to reach Fulton Chain in the Adirondacks the following morning. By this arrangement the trip over the Lake Shore will insure the host of delegates that will start from Chicago not only a fine chance to take in the beauties of Niagara Falls, but it will also give them a most enjoyable run by daylight through the forests of the picturesque Adirondacks; it will be seen, too, that they will reach Montreal early in the evening, and will, according to this schedule, be but one night on the road and spend the daylight hours on the luxuriously equipped train, passing through some of the grandest scenery in this country. Of course the Lake Shore will have the train made up in the best modern style with dining cars, etc., and Mr. Wilbur feels that the way the trip is now planned, what would otherwise be a tedious journey will be turned into an ideal summer pleasure trip; in fact there is no doubt that a large number of the delegates will seize this opportunity for sightseeing, and include the trip to Montreal over the Lake Shore as a part of the summer's vacation. Delegates to the recent electric light convention in Cleveland will remember the kind treatment of the Lake Shore officials who ran the Chicago-Cleveland special. Mr. Wilbur realizes that there will be a large number of electrical and street railway men from various points who will wish to start for Montreal with the Chicago contingent, and his early interest in the matter of preparations for their comfort and pleasure indicates that the Lake Shore railway is fully alive to the importance of the Montreal meeting. Further information as to the details of the Lake Shore's plans for the Montreal special may be obtained by applying to C. K. Wilbur, room 34 Lake Shore depot, Chicago.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, April 27.—The question of the official habitat of the General Electric company lately came up in

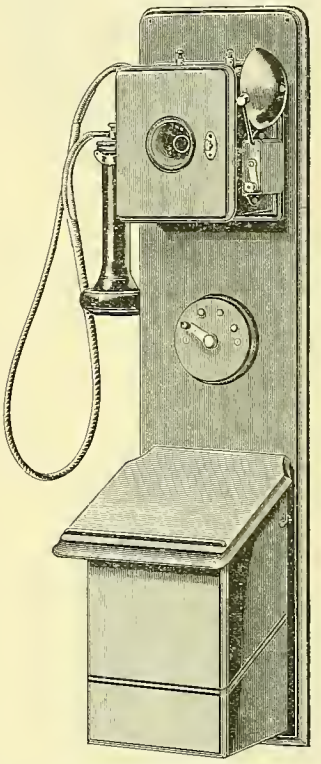


FIG. 4. THE MISSOURI TELEPHONE COMPANY'S INSTRUMENTS.

relation to taxation. Justice Russell of the Supreme Court has decided that Schenectady is the legal residence for the purposes of taxation of the General Electric company, the Edison General Electric company and the Edison Electric Light company. The companies paid personal taxes in New York county in 1893, so that the decision deprives the county of a large amount of revenue. The three companies obtained writs of certiorari to review their assessments for the year 1894. They set up that this county had no right to tax them, and that if it had the amounts imposed were excessive. The General Electric company was first assessed for $50,000,000, but on appeal to the commissioners of personal taxes the assessment was cut down to $9,776,934, the tax on this amount being $163,000. The company had paid taxes on an assessment for this sum in 1893. The company was incorporated under special act of the Legislature in April, 1892. It was then resolved that the principal office for the transaction of its business should be in Schenectady, but that it should have an office in this city. In October, 1893, the New York office force was removed to Schenectady. Its directors hold their meetings in Schenectady. The Edison General Electric company and the Edison Electric Light company also decided that their principal offices should be in Schenectady, and they were to have branch offices in this city. Justice Russell writes an opinion in the General Electric company case, but says that it is decisive of the writs in the cases of the other two com

panies. He says that on the facts the principal offices of the company—a fact which is determinate as to where the companies must be taxed—must be held to be in Schenectady.

The Nyack Traction company has made application to the commissioners of highways of the town of Orangetown for permission to construct, maintain and operate a trolley road in Piermont avenue from South Nyack to Piermont. The grant is opposed on the ground that a fine driveway will be marred.

At Tuesday's meeting of the Brooklyn Board of Aldermen fourteen inspectors of trolley speed, at a salary of $3 a day, were appointed. Alderman Walsh's amendment to the trolley ordinances, making it permissible for passengers to enter or leave the cars by either platform, was passed. The Reid avenue trolley managers have compelled people to walk over bad pavements to the rear door in order to get into the cars. The Business Men's association of the Twenty-fifth Ward called attention to it.

The New York & Philadelphia Traction company has run against a snag in laying its tracks between Somerville, N. J., and Bound Brook, and, in consequence, no work has been done on the line for several days. About six weeks ago the company began putting down its track two miles from Bound Brook, and said that the road would be finished through to Raritan by April 15th. The work progressed rapidly, and two weeks ago ties and rails were laid to a point near Finderne. Then the work was stopped owing to the serving of a writ of certiorari on the trolley company by the Central Railroad company of New Jersey, through its counsel, John L. Conover. This writ, which calls for the review of the grant of right of way through the town by the Board of Commissioners, is returnable on June 10th and, as it acts as a supersedeas, not a stroke of work can be done until a decision is given. In case the decision is adverse to the trolley company, then it will be without permission to go through the town, nor can it obtain such permission until the Legislature gives it to it. W. F. O.

## Northwestern Notations.

MINNEAPOLIS, April 12.—Geo. J. Gerlicher, late head engineer of the Winona General Electric company of Winona, Minn., has sued S. B. Livermore, receiver, for $5,000 for malicious prosecution. Gerlicher was arrested and charged with malicious tampering with the machinery at the plant and was acquitted.

A new telephone company at La Crosse, Wis., announces that it has 250 subscribers under contract for three years, and nine-tenths of them are present patrons of the Bell company. The Bell company says it is going to stay, but it has less than 100 subscribers left. The stockholders of the new company are solid business men.

The secretary of the street railway company in Mankato, Minn., says that his company will not put in electricity for power this year, owing to the report that Tesla, the electrician, has made a discovery which will revolutionize electrical traction. He says he has been told that $1,000,000 worth of stock in the Minneapolis Street Railway company is likely to be made worthless at any time owing to the changes and improvements under way.

Alderman Nordeen's ordinance looking to the re-arrangement of the present ordinance governing electric wires in Minneapolis has been favorably reported by the committee to which it was referred.

The work of surveying a telephone line from Fargo to Grand Forks, N. D., is being pushed. The right of way for more than half the distance has been secured, but part of the way will have to be condemned by the courts.

A meeting was held in Winnebago City, Minn., recently of committees from Wells, Easton, Delevan, Huntley, Granada, Fairmont, Elmore, Blue Earth City and Nashville center, Minn., to discuss telephone matters. A line from Wells to Fairmont, and from Elmore to Winnebago City, and later to Mankato, and connecting there with Mineapolis, was favorably considered, and also a line from Nashville Center to Winnebago City, connecting with all the intermediate towns in Faribault and Martin counties. A stock company will probably be formed to build the lines.

Mrs. M. I. Clark is reported to be contemplating building an electric car line in Mason City, Iowa.

The White Bear Telephone company of White Bear, Minn., has incorporated with $10,000 capital stock.

The Postal Telegraph company will extend its lines from Peoria to Burlington, Iowa, construction beginning about June 1st.

Albia, Iowa, has granted J. Kolty a telephone and telegraph franchise conditional on work beginning in 60 days.

Chilton, Wis., voted to have electric lights.

The Beach Electric railway has laid rails to the village limits in Waukesha, Wis.

The old project of an electric line to Lake Minnetonka from Minneapolis has its regular spring revival. Sir Chas. Gibson of St Louis is the one who is going to extend the St. Louis Park car line to some point on the lake, according to this year's report.

The Fort Dodge Electric Light & Power company of Fort Dodge, Iowa, has enlarged its plant, and will use 40 street lamps in place of 23 after June 1st. As soon as the enlargement is completed a street railway line will be begun.

N. L. Davidson, H. R. Kibbee and Wm. M. Smith have applied for a telephone franchise for the Mitchell Telephone company, in Mitchell, S. D.

W. L. Porter has secured over 200 subscribers to his prospective telephone exchange in Ashland, Wis. Connection will be made with Washburn and Bayfield.

Hillsboro, N. D., is putting in electric communication between the jail and the sheriff's office, house and the chief of police's house, in order that the prisoners may give the alarm in case of fire.

The Central Wisconsin Electric Railway company has notified the cities of Oshkosh, Vinland, Neenah and Menasha, Wis., that it has secured an assignment of the franchises granted J. K. Tillotson and will fulfill the terms or them. Tillotson's franchise at Appleton was declared void by the council, owing to the conditions not being complied with.

The St. Paul Street Railway company has leased the privileges of Como Park of the park board for three years and will put in additional lights and boats and have music and entertainments. M.

## PERSONAL.

J. W. Marsh, general manager of the Standard Underground Cable company, Pittsburg, was in Chicago on Sunday last.

Henry S. Manning, who was long identified with the western central station department of the General Electric company, but who some time ago was transferred to Schenectady, is now visiting Chicago.

J. S. Harris, president of the Philadelphia, Reading & Pottsville Telegraph company, announces that on April 17th L. Horton, Jr., was appointed superintendent, with headquarters at Reading, Pa., to fill the vacancy caused by the death of E. R. Adams.

## NEW INCORPORATIONS.

United Electric Telephone company, New York, N. Y.; capital stock, $50,000; Norman C. Raff, New York, N. Y.

Vance Electric company, New York, N. Y.; capital stock, $10,000; to carry on a business of general contractors and electrical engineers for all classes of electrical construction work; Arthur F. Vance, Brooklyn, N. Y.

## ELECTRIC LIGHTING.

The newly organized Empire Light & Power company of Quincy, Ill., has added to its equipment a 75 kilowatt belted generator for a 500 volt power circuit. The machine is of the Walker multipolar type and was sold by Kohler Brothers of Chicago.

The city of Chattanooga, Tenn., will receive bids until June 3d for the erection of a municipal plant of 300 arc lights capacity; also for lighting the city by electricity and supplying 175 to 250 arc lights. J. O. Martin is chairman of the light committee.

## ELECTRIC RAILWAYS.

The work of changing the Chicago North State street horse car line into a trolley line was commenced last week. The State street horse cars are the last to give way to the trolley, and by July 15th, when it is expected the present change will be completed, every branch of the North Chicago system will be a cable or trolley line. A cable will be laid under the river to keep the trolley wires south of the river alive when the bridge is swung. The line will probably extend from Clark and Division streets to its present terminus at Lake and State streets. Trolley poles were put up in South Halsted street, from Randolph to Van Buren streets, last week. The wires will not be strung until new tracks are put down. This will take at least a week, and by that time the rest of the line to Fullerton avenue will be completed. The cars will run from Fullerton avenue to Van Buren street by electric power, where they will be coupled on to the Halsted street cable trains and trail the rest of the way to Eighteenth street. The Paulina street and Robey street trolley lines will be ready for operation by the end of next week. The Twelfth street line will be opened up as soon as the tracks on Clinton street are laid. Work is being pushed on the Harrison street line so that it will be ready for operation by the first of next month. Cars on this line will run from Kedzie avenue to Clinton street, and thence north on Clinton to Van Buren, where they will couple on to the Blue Island avenue and Halsted street cable trains and trail down town.

## MISCELLANEOUS.

The Electrical Society of Cornell University announces that its transactions for 1894-1895 will be out of the publisher's hands about May 15th. The book will be a handsome cloth-bound volume of 130 pages, well illustrated throughout. The table of contents is as follows: "Differences of Potential between Metals in Contact," C. D. Child; "Metals for Magnet Cores," C. E. Barry; "Fuses and Safety Devices," C. P. Matthews; "Lightning Arresters," C. E. Hewitt; "Mechanical Equipment of Power Stations," Prof. R. C. Carpenter; "Modern Views of Electrolysis," Prof. Ernest Merritt; "A Method of Reducing Hysteresis Losses in Armatures," R. B. Mann; "Electricity and Mining," C. R. Sanderson; "Electrical Resonance and Some Allied Phenomena," Dr. Frederick Bedell; "Alternating Current Motor Practice," Prof. Harris J. Ryan; "Resistance," F. J. Rogers; and "Pennock Lighting System," J. J. Swann. Subscriptions may be sent to C. E. Barry, 6 South avenue, Ithaca, N. Y.

## TRADE NEWS.

Lundell and other fan motors are described in an attractive pamphlet just issued by the Central Electric company.

The Standard Underground Cable company, through its western manager, J. R. Wiley, has closed a large contract for electric light cable with a Minneapolis concern. Mr. Wiley has just returned from a trip through the Northwest, where he met with gratifying success.

Kohler Brothers, of 1648 Monadnock building, Chicago, have sold to the Missouri Railroad company of St. Louis, of which P. C. Maffit is president, 30 sets of Walker controllers and 12 thirty horse power motors. This order is particularly gratifying in its recognition of the merit of the new Walker controller.

The western office of the Perkins Electric Switch Manufacturing company is now located in new quarters in rooms 1537 and 1538 Monadnock block, Chicago. Ample storeroom is now provided, which will enable Mr. Conover to carry a large stock of Perkins switches, arc lamps and other well-known specialties.

The Metropolitan Electric company of Chicago has made a new departure by establishing a bargain counter, on which can be found a complete line of useful devices at hard-time prices. It will be well for the trade to inspect these goods before placing orders. The company has also placed on exhibition in its store a sample board showing a complete assortment of pliers, splicing clamps, vises, etc.

In their second catalogue Huebel & Manger, makers of electrical and brass goods, Brooklyn, call the attention of patrons and purchasers generally to the neat and improved styles of their goods. They say: "It is our aim to produce a general line of electrical goods, reliable in every respect, and to offer them at a reasonable price. We have and are constantly improving our line of goods so as to make them the most serviceable, reliable and perfectly constructed in the trade." The firm has several new specialties, which it is exploiting and the returns are very satisfactory.

Among the recently published catalogues and similar trade pamphlets those just issued by the Babcock & Wilcox company easily rank with the very best in every respect. They are models in the methods of arranging and presenting facts relating to the subjects considered, the illustrations are artistic and the mechanical features perfect. They are the best possible evidence of prosperity of the company and the confidence it has in its claims of superiority. The recent publications, "Steam" and "Facts," are typical of the general policy of the company to give the public the very best article that can be procured.

The Siemens & Halske Electric company of America has issued a circular under the title "A Universal System for the Distribution of Light and Power from the Same Conductors," in which it advocates, for plants in cities and towns where the power house can be located near the center of lighting, the direct, 220 volt, two-wire (multiple arc) system of distribution. Arc and incandescent lights and motors can, by this system, be operated from a single dynamo, preferably directly connected to an engine or water wheel. These advantages are detailed: "The low pressure system involves no danger to life, eliminating the possibility of the owner of the plant being made a defendant in damage suits. This is important, as the long list of fatal accidents from high pressure systems (alternating incandescent and series arc) demonstrates. The original cost of this system is usually less than that of a high speed, high pressure system. Recent determinations made for several cities show that while often more copper wire is needed, one dynamo is used in place of from four to six; and no countershafting, belting, friction clutches, transformers or other energy wasting appliances; less real estate and a smaller building is occupied. The cost of operation is from 20 to 40 per cent. less. A single Siemens dynamo of slow speed directly coupled to a good engine, costs less to operate than half a dozen high speed machines belted to a shaft. We save in friction, oil, repairs, attendance, wear and tear and we obtain a higher efficiency." The company uses 220 volt incandescent lamps, of which it says: "Two hundred and twenty volt incandescent lamps are now being made and guaranteed by many prominent lamp manufacturers in the United States and by Siemens & Halske in Berlin. The Edison incandescent lamp patent has expired, and we are now importing the lamps of our parent company, and we are prepared to guarantee them fully. In Europe they are recognized to be the best lamps; they are of high efficiency, long life and of uniform candle power during their full life."

## BUSINESS.

The Louisville, Ky., Electrical Works have issued a neatly printed descriptive pamphlet of their Phœnix transformer. Campbell Scott is general manager and Frank S. Culver superintendent and electrician of this company.

The Racine Hardware company reports general improvement in its business in all parts of the country. It has recently received several contracts for equipments in the South and West. The Chicago office is in the Marquette building.

The Whitney Electrical Instrument company of Penacook, N. H., is exploiting the Hoyt ammeters and voltmeters for alternating current. These instruments are claimed to

be extremely accurate, handsome in appearance, with positively no lag and unaffected by outside influences.

James Brown & Son, electrical engineers and contractors of 114 Wood street, Pittsburg, report business as satisfactory. The firm has lately engaged to install an electric plant in the large business block of Gladen & Holmes at McDonald station, on the Panhandle road. Brown & Son are also furnishing a plant for the Barclay Bank of Greensburg, Pa.

The Brodie Electric company of Manchester, N. H., has just placed upon the market a special tree insulator, adapted to carry heavy wires and cables up to No. 0000. It is of the same general form as the well-known insulator which this company has for some time been furnishing to the trade, making use of a porcelain pulley to carry the conductor and a malleable iron lag-screw for attachment to the tree. These insulators are furnished with either single or double petticoats, and are especially intended for use on street railway and other heavy feeders which demand a high degree of insulation.

The Miamisburg Electric company, Miamisburg, O., reports a largely increased sale for its Imperial dry battery and the Burnley cartridge battery. This company is making and selling a larger number of batteries than ever before, and owing to this increased output is enabled to manufacture its goods at a less expense, and therefore can offer reduced prices. The really remarkable sale of the Imperial battery shows that the trade appreciates a thoroughly good article sold at a reasonable price. The Burnley cartridge battery is recommended as the very best wet battery for telephone use, and is being adopted by many of the leading telephone companies in the country. A revised list of this company's goods is now being issued.

The electric alarm and pressure gauge manufactured by the E. G. Bernard company of Troy, N. Y., is designed to provide an electric alarm signal for high or low pressure that can be attached to all forms of pressure gauges. At the same time it is provided with a simple means of testing the gauge to see if it is in working condition at all times, which same operation also tests the signal bell or recorder in circuit. It can be attached to both a signal bell and to a recording clock, thereby giving, in the latter case, at all times a record of the pressure when it exceeds certain limits, either high or low. This gauge is of special value on sprinkler systems. On the wet system of automatic sprinklers, it will be of great service, as very often a defective head or other leak will start, or a fire cause only a single head to go off. For use on steam boilers it will also prove of great value.

Warren Webster & Co., Camden, N. J., specialists in examining steam plants, where increased economy in fuel is desired by utilizing waste exhaust steam, report that there is considerable activity in their business, which they claim is due to the better appreciation of their manufactures, as compared with other apparatus for similar purposes. Among the recent orders for the Webster vacuum feed water heater and purifier they mention the following: Estate of John Nesmith, Lowell, Mass., 100 horse power; New Orleans Railway & Mill Supply company, New Orleans, La., 200 horse power; Proctor & Gamble company, Ivorydale, O., 3,000 horse power; Pennsylvania Tin Plate company, New Kensington, Pa., 2,500 horse power; Norwich Printing, Dyeing & Finishing company, Norwich, Conn., 3,000 horse power; Water & Light company, Harrisburg, Pa., 500 horse power; J. Horne & Co., Pittsburg, Pa., 250 horse power; A. Hubbard & Co., Norwich, Conn., 300 horse power; W. F. Slade & Co., Pascoag, R. I., 500 horse power; Nashua River Paper company, East Pepperill, Mass., 600 horse power; Standard Steel Works, Burnham, Pa. (duplicate). 400 horse power; Aultman & Taylor Machinery company, Mansfield, O., 500 horse power; F. S. Field & Co., Boonton, N. J., 300 horse power; Pulaski Iron company, Pulaski City, Va., 300 horse power; Russell & Co., Massillon, O., 400 horse power; Arbegast & Bastian, Allentown, Pa., 150 horse power; Crescent Steel Works, Pittsburg Pa., 750 horse power; Moro Phillips Chemical company, Camden, N. J., 450 horse power; Crane & Waters, Millbury, Mass., 400 horse power. In some of these contracts they say that a number of standard makes of feed water heaters were removed. They also report numerous orders for the Webster separators and Williams' vacuum system of steam heating.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued April 23, 1895.*

537,829. Electric Alarm Clock. Henry W. Knapp and Lawrence E. Gerrety, St. Paul, Minn. Application filed October 25, 1894.

The combination with a clock, having its operating parts connected to one pole of an open circuit battery of the series of contacts surrounding the clock, and slidable toward and from the same and connected to the other pole of the battery, and the hook or bend upon each of the contacts for holding a marking tag.

537,855. Electric Appliance for Elevators. James H. Roberts, Grand Rapids, Mich. Application filed October 6, 1894.

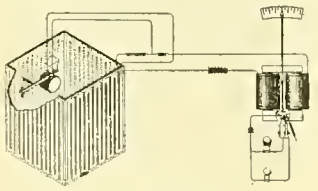
The elevator and the motor are combined with the liquid chamber, having a piston at each end, one piston being provided with brake mechanism for the motor, and the other adapted to be operated after the power has been cut off from the motor on the descent of the elevator.

537,856. Electrical Appliance for Elevators. James H. Roberts, Grand Rapids, Mich. Application filed February 23, 1895.

The switches are mounted in bearing, and have at one end the sleeves insulated from each other to engage the contacts in pairs, and at the other end are provided with the angular levers adapted to turn with the switches, and to have a reciprocating movement independent of the switches, combined with the hoisting mechanism, the threaded shaft connected therewith, and the traveler on the shaft adapted at the ends of the line of travel of the elevator to move the switches and break the circuit.

537,857. Electric Motor Car. William Robinson, Boston, Mass. Application filed April 12, 1889.

In a motor car or truck, the combination with the car axle of a motor having one end journaled to said axle and the other end supported flexibly by an independent bar or device, said bar or device being partly supported by the motor journal boxes and partly, directly or indirectly, by another axle, independently of the truck frame and of the ordinary axle boxes.



NO. 537,932.

537,860. Electric Guest Call. Frank O. Smith, La Crosse, Wis. Application filed June 2, 1894.

A clock, an electric bell and a battery, having its poles electrically connected with the clock bell respectively, a ring of insulating material surrounding the clock mechanism, a series of insulated wires with exposed ends projecting through the ring to form a series of contact points around the clock mechanism, a circuit-closing finger attached to the hour arbor of the clock and adapted to form electrical contact successively with the contact points, together with an insulating keyboard provided with the contact plates attached severally to the wires, the dial plate connected to the bell by a single wire, and removable switch key for connecting the dial plates severally with the contact plates, with removable room indicating checks adapted to be hung upon the keys.

537,876. Rheostat. George H. Whittingham, Baltimore, Md. Application filed December 11, 1893.

In a rheostat, the combination of a heat-radiating casing, a resistance wire within the casing, and loose sand packed within the casing and separating the resistance wire from the casing.

537,920. Coupling for Electrical Connections. James M. Faulkner, Philadelphia, Pa. Application filed August 9, 1894.

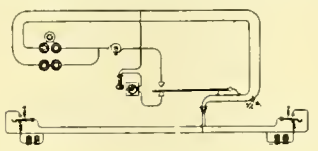
The tubular sectional coupling, arranged to be secured on and embrace the line wire or wires, one section of which has a mercury cup or depression, the other section having an opening through which a side line can be inserted into said mercury.

537,932. Method of and Apparatus for Protecting Electric Circuits. John M. Oram, Dallas, Tex. Application filed January 15, 1895.

The method of guarding an electric circuit illustrated consists in automatically varying the current flowing in the circuit at predetermined intervals, according to a set plan or pattern, changing the nature or arrangement of the pattern, and the intervals of variation thereof in a predetermined manner reproducing such arbitrary variations upon an indicating instrument at a distant point, in accordance with an arbitrary co-operative plan of action, known only to the receiving operator, and causing the alarm signal to be given or depend upon the cessation of or variation from such arbitrary co-operative plan.

537,967. Telephone System. William Coonan, Jersey City, N. J. Application filed August 4, 1892.

This arrangement is devised for use in telephone exchange systems, and the apparatus, as shown in the illustration, consists of two electro-magnets of different resistances, connected in parallel and acting in opposition upon a pivoted armature, in combination with a switching apparatus and a subscriber's line, the switching apparatus being arranged to connect the subscriber's line in series with one of the magnets.



NO. 537,967.

537,989. Storage Battery. Morris Moskowitz, Newark, N. J. Application filed May 7, 1894.

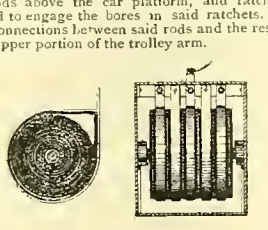
A storage battery is shown in the cut, comprising therein a single cell or casing bearings, or supports in the casing, a bearing bar or shaft therein, and elements on the shaft, the elements being spirally wound to permit free action of expansion and contraction, and having their free ends rigidly connected with the casing.

537,994. Controlling Mechanism for Electric Motors. Charles H. Richardson, Philadelphia, Pa. Application filed June 9, 1894.

The invention, which is here illustrated, consists in the combination of the motor, conductors connecting the armature of the motor with the supply circuit, the speed regulating resistance in the supply circuit, the supplementary resistance in one of the conductors connecting the armature of the motor with the supply circuit, and the supplementary resistance switch mechanism, by one adjustment of which the armature is short-circuited and the supplementary resistance thrown in to prevent an overflow of current, and by the opposite adjustment of the switch mechanism the supplementary resistance is short-circuited, thus cutting it out of the armature circuit and removing the short circuit from the armature.

538,005. Electric Railway. Conrad C. G. Wolpers, Brooklyn, N. Y. Application filed October 2, 1894.

One claim is given: In an underground system for electric railways, a box suspended from a car frame, a trolley arm having pivotal bearing in said box, and having a trolley or contact wheel, operative shaft or rods and cranks located at opposite ends of the car, chain reels carried by the lower portions of said rods, pawls and vertically bored ratchets connected with said rods above the car platform, and ratchet-locking pins adapted to engage the bores in said ratchets, and spring and chain connections between said rods and the respective corners of the upper portion of the trolley arm.



NO. 537,989.

538,020. Insulated Conductor. William M. Habirshaw, New York, N. Y. Application filed October 16, 1894.

The combination is claimed with a conducting core of an insulating coating or covering composed of contiguous layers of soft vulcanizable rubber and cut-sheet alternately applied and vulcanized.

538,023. Electric Arc Lamp. Frank M. Lewis, London, Eng. Application filed October 12, 1894.

The last claim follows: In arc lamps the combination of a single solenoid and plunger with a differential or epicyclic train of wheels, so that the movement of the plunger in one direction effects the striking of the arc through one side of the train, while the movement of the plunger in the opposite direction releases the feed gear through the opposite side of the train.

538,024. Electric Brake. Edward D. Lewis, Savona, N. Y. Application filed December 7, 1894.

In an electrical brake there is the combination with the brake a spring for normally holding the brake set, means for varying the tension of the said spring, an electro-magnet disposed to normally act in opposition to the said spring to release the brakes and hold them out of action until the circuit is interrupted, and means for varying or changing the relative position of the electro-magnet.

538,090. Electric Cut-out. Herbert A. Wagner and Ferdinand Schwedtmann, St. Louis, Mo. Application filed January 5, 1895.

The features claimed are: An outer hollow shell, a core fitting therein and making closed joints therewith, a fusible wire carried in a groove in the core, electrical connections for the fusible wire, and suitable vents leading from the groove through the shell to the atmosphere.

538,097. Commutator Brush. Louis Boudreaux, Paris, France. Application filed October 28, 1892.

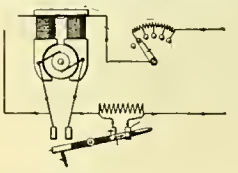
A commutator brush is formed of superposed folds of metallic sheet foil compressed into a compact body.

538,104. Electric Motor for Railway Cars. Charles E. Emery, Brooklyn, N. Y. Application filed April 19, 1894.

In the construction of an electric car motor an integral yoke section is provided with internally arranged field magnets and side openings, in combination with frames adapted to close such openings, and provided with armature and car axle bearings.

538,127. Electric Door Opener. John Schneider, Long Island City, N. Y. Application filed May 7, 1894.

The claim is as follows: In an electric door opener, in combination, a casing, a magnet, an armature lever, a rock-lever pivoted in the casing, and adapted when moved in one direction to be engaged and held against movement by the armature lever, and when moved in the other direction to be out of position to be engaged by the armature lever, a catch mounted to swing in the casing and adapted to be engaged by a bolt on the door, a tail on the catch, and stops on the rock-lever projecting



NO. 537,994.

therefrom, and adapted to engage opposite faces of the tail, one stop being adapted to be engaged and moved by the tail of the catch, when the armature lever is disengaged from the rock-lever, to move the rock-lever out of position to be engaged by the armature lever, and the other stop being adapted to be engaged and moved by the tail of the catch to move the rock-lever into position to be engaged by the armature lever.

538,132. Electrical Igniting Device for Gas Engines. Alfred J. Signor, Elkhart, Ind. Application filed March 26, 1894.

An improved igniting device for gas and other explosive engines, comprising an electrical circuit, a device within the exploding chamber for normally continuing the circuit, the device being spring-held, a shaft, an arm carried thereby which is adapted to engage the device for the purpose stated, a means for suddenly imparting motion to the shaft, and a spring for resisting this movement of the shaft, which is stronger than the resistance of the spring-held device.

538,136. Working of Railway Points and Signals by Electricity. Illius A. Timmis, London, Eng. Application filed June 9, 1894.

The combination is claimed with the points provided with a locking bar, and an electric motor operatively connected to the points, of a locking bolt engaging with the locking bar, and a second electric motor operatively connected to the bolt, an electricity generator, and conductors for operating the two motors, and two switches provided with interlocking mechanism, preventing them from being operated simultaneously, and operating to connect the generator with the respective motors.

538,158. Electric Railway System. James M. Faulkner, Philadelphia, Pa. Application filed January 12, 1895.

In an underground electric railroad system, an exposed sectional conductor, in combination with a flexible carrier arranged loosely and longitudinally in a conduit, one of the elements having contact points, and the other depressions containing mercury, arranged so that the contact points can enter the same.

# Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, MAY 11, 1895. No. 19.


## Louisville Auditorium Plant.

As may be judged by the illustrations which accompany this article, the isolated electric lighting plant for the Auditorium Amphitheater at Fifth and Hill streets, Louisville, Ky., is one of the handsomest in the country. Especial attention has been paid to the ornamental possibilities of an electric lighting plant, and the result is an installation which, both in exterior appearance and interior finish, is a credit to the fine residential section of Louisville in which it is placed.

The station building itself, Fig. 2, is a handsome two-story structure of brick. The first floor is divided into an engine room and a boiler room. The steam generating plant in the boiler room, Fig. 3, comprises three tubular boilers of 100 horse power each, of the B. L. make, from Dayton, O. When the photograph was taken coal was used as fuel for these boilers, but the furnaces have since been fitted with oil burners, which greatly adds to the neatness of the station—a consideration always kept in mind by the owner, Mr. Quilp.

The Auditorium theater, of which Mr. Quilp is the sole proprietor, depends entirely upon this plant for its light, and for this reason the whole plant is arranged in duplicate, so that ample boiler, engine and dynamo capacity is present for any emergency. Indeed, in case of necessity the theater could be lighted by means of one boiler and one engine, but to prevent all possibility of interrupting the performance three boilers and three engines are provided. The auxiliary steam plant includes two boiler feed pumps—a Columbia pump and a Riley pump—with a Korting injector. There is a deep well pump in the boiler room, and the station is also provided with automatic boiler cleaners, an adequate feed water heater and an oil separator. A fuel oil pump is used for pumping oil from an underground tank, which is some distance from the boiler room. Draft for the furnaces is supplied by an ornamental round brick stack, 100 feet high, shown in Fig. 2.

An excellent view of the finely finished engine room is presented in the illustration given on this page, Fig. 1. The inside of the room is finished in fine pressed brick and beaded joints. The ceiling is of hardwood, with natural finish, and the floor is laid with eight inch tiles of various colors in tasteful design. As shown, there are three engines belted to six dynamos. One engine is a Ball & Wood machine of 75 horse power capacity, and the other two are of 100 horse power each, one of the Ball & Wood type and the other from the Bass foundry. The only exposed pipes are the main steam supply pipes for each engine, which are neatly covered with asbestos and Russia iron, with brass bands. The engines exhaust in an underground main. With each engine a separate set of wrenches is provided, and in each case these wrenches are mounted on a wall-board. In the engine room there is a complete set of finely mounted steam and water gauges connected with each of the boilers, and also an oil gauge and a pressure valve for regulating the fires, thus enabling the engineer to control fire, water and steam while in the engine room. The lubricating oils are stored in tanks on the upper floor and are piped down to a handsome oil cabinet. The engine room is heated by six indirect radiators supplied by underground pipes. These radiators are finished in black, with gold and silver leaf ornamentation.

The six dynamos used to generate current consist of two Wood arc machines and four Fort Wayne incandescent dynamos, giving a total capacity to the station of 65 arc and 1,800 incandescent lights. With the exception of the cables leading from the dynamo brushes and the arc plug cables, not one inch of wire is exposed to view in the whole room, and this statement also includes the switchboard. A view of the switchboard in the station is given in Fig. 4. This board is made of solid cherry and runs to the ceiling of the room, being ornamented with handsome hand carving. The instruments are carefully arranged, and the whole appearance of the board is very attractive. All of the dynamo leads to this board are in lead cables laid beneath the floor. The lighting of the engine room itself is on a luxurious scale commensurate with the whole design of this pleasing station, there being four four-light and one six-light oxidized combination chandeliers and two arc lamps.

Three hundred feet from the station switchboard is the stage switchbord, which is illustrated in Fig. 5. The

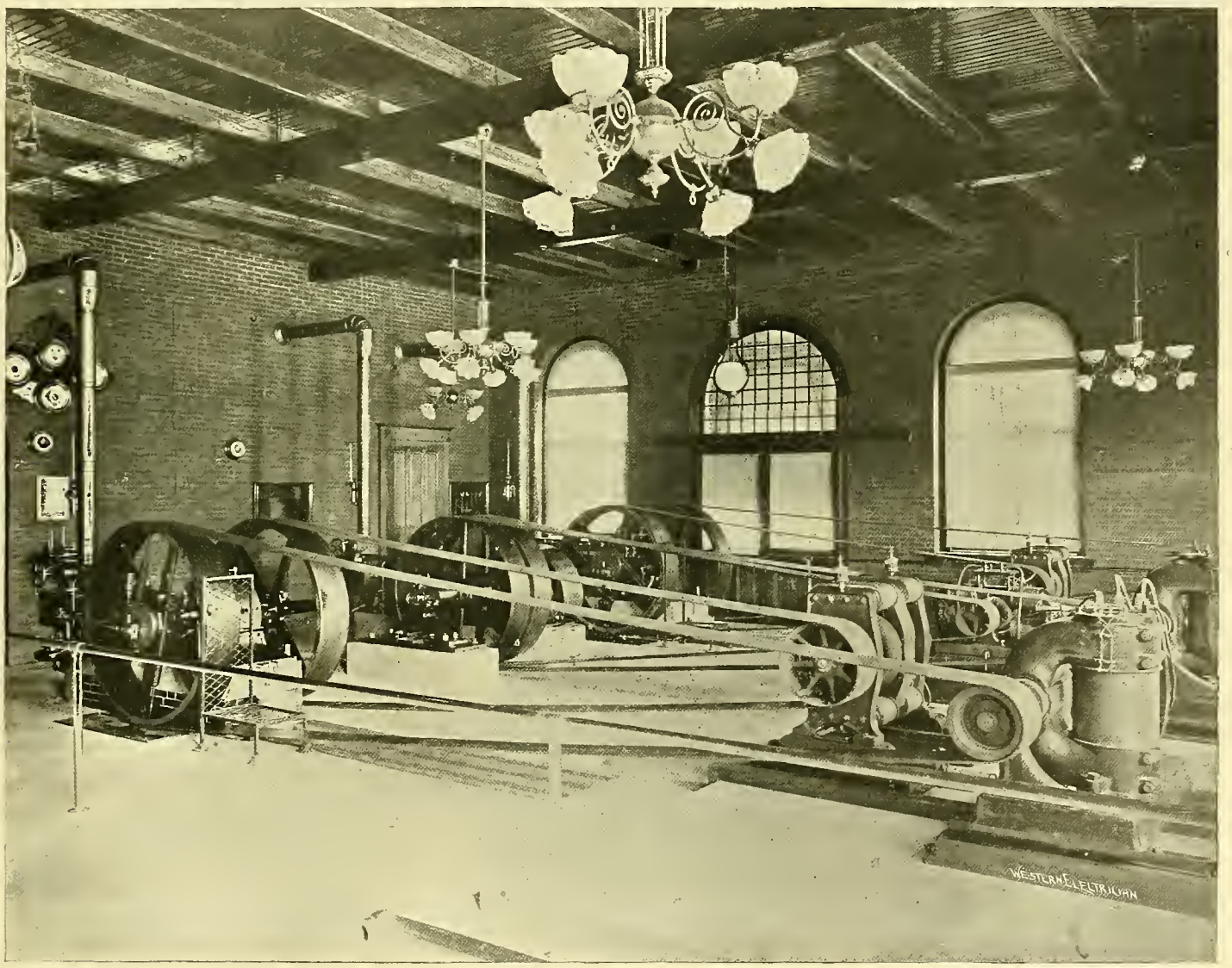



FIG. 1. LOUISVILLE AUDITORIUM PLANT.—A PLEASING INTERIOR.

mains from the incandescent machines run to a set of busbars on the stage switchboard, and all the branching is done from this point. The Auditorium Amphitheater covers an entire block, and every light, both incandescent and arc, can be controlled from this stage switchboard. Two sets of field rheostats for the dynamos are provided, one on the station board and the other on the stage board, and there is also a set of regulating instruments at each board. The electrician on the stage has full control of all the dynamos in the lighting station. Should an accident occur to any part of the machinery, he is notified by the engineer by means of a prearranged signal. The electrician at once shuts the current off from the machine indicated and throws the load on another dynamo. This can be done during the most quiet stage scene without the audience noticing any defect in the lighting system.

The second story of the station, Fig. 2, is devoted to the electrician's private constructing room and is also used for storing electric supplies and as a laooratory, being provided with a small boiler, engine, lathe, etc., for construction and repair work.

An interesting feature of this plant is the electric sign visible on top of the Auditorium. This consists of a framework bearing letters made of electric lights, spelling out the name of the attraction on the boards in the theater beneath. Each letter is about 24 by 30 inches, and as all the letters of the alphabet are kept on hand, there is no difficulty in spelling out any word or words desired. This sign is operated by an automatic cylinder switch and motor in such a manner that the letters of a word are lighted and extinguished in succession. When the word or words have thus been spelt out in flashing letters of light, the operation is repeated until the performance below comes to a close, thus making a very attractive and striking advertisement, as the sign is over 100 feet from the ground.

In the Amphiteater is a bicycle track, and it is a noteworthy fact that this was the first track in the country on which racing was accomplished by means of the electric light. Forty arc lamps are placed about this track, so arranged as to avoid shadows on the path. After the first bicycle meet on this track, Mr. Quilp asked Mr. Sanger, the famous wheelman, how he liked racing by electric light. The answer was: "The sun is not in it; there is sufficient light, and it is so much cooler."

Still another novel feature of this interesting plant is the electric curtain hoist. This is believed to be the first theater in the country to be supplied with an electrically operated drop curtain. The idea was developed by Mr. Parfitt, the electrician. The device consists of a three horse power motor so attached and controlled as to do the work formerly accomplished by four men, and to raise and lower the curtain at varying speed. The curtain can be instantly checked in its downward progress if desired, thus precluding all possibility of an accident if anyone should be happening to pass beneath. The curtain motor is situated in the fly-loft, and is controlled from the stage switchboard.

This unique station is due to the liberality and enterprise of Daniel Quilp, proprietor and manager of the Auditorium, and to the skill and ingenuity of the electrician in charge, Frank W. Parfitt, whose portrait (page 227) accompanies this article. Mr. Parfitt is an Englishman by birth, but has resided in this country for a number of years. His first electric work was with W. H. Driftmeyer of the Fort Wayne Electric company at the Southern Exposition held in Louisville in 1883. Mr. Parfitt has remained in the Kentucky metropolis ever since, being associated with Mr. Quilp since 1886. The station which forms the subject of this article was designed and constructed entirely under his personal supervision, and many of the devices connected with it, such as the station and stage switchboard and the curtain hoist, are entirely of Mr. Parfitt's design. The whole installation reflects much credit on his skill and taste.

## Gerst Telephone Bill Commended.

Further efforts will be made to secure consideration of the Gerst telephone bill, now tied up in committee, before the New York Legislature adjourns. At a special meeting of the Black Rock Business Men's association last week the following resolutions were unanimously adopted:

*Whereas*, The people of this city are deeply interested in the passage of the bill before the Legislature known as the Gerst Telephone bill, and

*Whereas*, The public in general throughout the state is deeply interested in the adoption of this measure, and this association, believing in the justice and propriety of the adoption of this measure, believing it to be for the best interest of the citizens generally, and that the measure, as proposed, is a fair and just one to all interests concerned, therefore be it

*Resolved*, That this association earnestly requests the members of the assembly and senators from the county of Erie to use all their influence to secure the passage of said bill, and for that purpose to use every legitimate means to have the committees of the Senate and Assembly, who now have said bill under consideration, discharged from further consideration thereof as soon as possible, and

*Resolved*, That the secretary of this association be directed to transmit copies of the foregoing to the said members of assembly and senators from this county, and to the Hon. Hamilton Fish, speaker of the Assembly.

## Harrison International Telephone Company.

At the annual meeting of the Harrison International Telephone company at Chicago, May 6th. the following named directors were chosen for the ensuing year: Stephen B. Elkins, R. C. Kerens, George R. Peck, William Warner, C. M. Ferree, Dr. E. M. Harrison, H. M. Holden, H. J. Hanford, Patrick Egan, H. S. Smith and J. T. Blake. The only changes made in the board were the addition of Mr. Smith and J. T. Blake. There were not many stockholders in attendance, the explanation being offered that a trustee had been appointed to vote the stock of the principal stockholders. Patrick Egan of New York presented the report of the directors, in which he briefly outlined the history of the organization and the progress that had already been made. This report will prove interesting not only to stockholders in the Harrison company, but to capitalists who are contemplating investing in other telephone enterprises in competition with the Bell interest:

Your company was incorporated early in 1893, but all of that year and the first half of 1894 were consumed almost entirely in the work of canvassing, sending out samples and preparing for the foundation of a wider organization. In the latter half of 1894, however, until the severe winter weather prevented the setting up of poles and other outdoor labor, work was carried on in the way of establishing local Harrison exchanges, of which there are now a considerable number in full and satisfactory operation, many more in course of construction and others being organized.

From the beginning the whole power and influence of the Bell monopoly has been employed, without limit and without scruple, to impede and destroy our work. They have endeavored to frighten away from us the local capitalists and all those whom they could reach financially or otherwise; and before the important decisions in regard to the Berliner patent and the Bate refrigerator case were rendered against them they in many instances succeeded; they have cut rates in several localities, and even offered the use of their telephones free, and they have attempted to injure us with bogus lawsuits founded upon pretended intringements on minor and entirely unimportant details; but we are defeatintg their machinations at every point, and in some instances driving them entirely out of the field.

Your directors consider the progress made by your company, in face with the desperate opposition with which it had to contend, as very satisfactory. The profits resulting from a few months of active work have been sufficient to meet the entire expenses incurred from the date of the company's formation and leave a balance to the credit of profit and loss; through the Harrison International Telephone Construction company state organizations are now formed in thirty-one states; your telephones are in satisfactory operation in over one hundred and fifty different places—many of these important cities and towns; the construction of the telephones has been improved until it is now conceded that they are the best instruments in the market, and the prospects for a large and increasing extension of the company's business through the channels already opened up seem most encouraging.

It was explained that the company had determined to guard against the possibility of rival interests securing control of its stock by placing it in the hands of a trustee. It is announced that the company is in the field for business; that it is not a "paper concern," and that it has already repulsed overtures from other telephone companies, the inference being that an opportunity to sell out had been refused.

FIG. 2. LOUISVILLE AUDITORIUM PLANT.—THE STATION BUILDING.

## Telephone Bill in the Missouri Legislature.

The usual fate of telephone bills seems to be in store for the one proposed for the consideration of the Missouri Legislature. According to a recent dispatch from Jefferson City, Representative Elmer Phipps says that there is very little chance for getting a bill reducing telephone charges before the extra session. The hitch lies in the governor's office, he declares. "Before the assembly met," said Mr. Phipps, "I went to all the leading citizens and got them to write letters to the governor asking him to include the telephone bill in his message. Probably dozens of letters were sent. I am credibly informed, however, that the governor has reached an agreement with the Burlington railroad's representative by which it is understood that if the Burlington will keep its hands off the telephone bill will not be sent in. As I understand it, Perkins of the Chicago, Burlington & Quincy is the largest western stockholder in the Bell Telephone company. Our people want cheaper telephones, but if the governor has made his agreemen with the Burlington, of course we can't get the rates reduced. It's a shame, however, that we must be the victims of extortionate telephone rentals because a governor and a railroad have agreed to join hands."

On May 1st, according to a special dispatch from Jefferson City to the *Kansas City Daily Journal*, Mr. Phipps again took up the fight for lower telephone rates in Kansas City and St. Louis. The dispatch continues: "He this morning introduced a resolution calling upon the governor for a supplemental message enabling the General Assembly to take action upon that matter. Mr. Phipps will, if the governor complies with the request, introduce a bill fixing the maximum rate for any telephone in the state at $60 per annum. The rate for Kansas City cannot exceed $45. In cities of 75,000 and not less than 25,000 the rate shall not exceed $30. In cities not exceeding 25,000 inhabitants the same rate is fixed. The rate for private residences is lower, that for Kansas City being $30." Concerning the prospect of the measure the correspondent adds: "It is not probable that Mr. Phipps' bill will ever get before the house."

## Lower Telephone Rates for Kansas City.

[From the *Kansas City Star.*]

An ordinance fixing reduced telephone service rates will be introduced in the lower house to-night by Speaker Stoner. It is drawn up by attorneys of the Telephone Users' association. This momentous instrument is brief and to the point. It reads: "That no individual, company, or corporation, now or hereafter owning, controlling or operating any telephone line in Kansas City shall charge or collect rental for the use of telephones, transmitters and receivers, and for keeping them in repair, an amount exceeding the sum of $36 per year for business offices and $25 per year for residences."

An individual, company or corporation that shall collect

or receive compensation for such service greater than the sums named is made guilty of a misdemeanor, punishable by a fine of from $100 to $300. This measure will receive a reference to the public improvements committee of the lower house, which will sit on the question with the representatives of the telephone company and the Telephone Users' association. A bill to this effect was introduced in the Legislature and is now hung up in the "corporations committee, other than railroads" of the Senate. The Telephone Users' association has waited for action by the Assembly, and the indications thereof being considered slim, has carried its war into the city council. The Missouri & Kansas Telephone company is operating under incorporation by state charter and municipal privilege to use the streets and alleys. It has no franchise or exclusive rights. The present rates are $72 per year for business telephones and $60 for residences.

## New Telephone Company for Kansas City.

The Inter-state Long-distance Telephone company, with capital stock of $100,000, has been organized in Kansas

FRANK. W. PARFITT, ELECTRICIAN OF THE LOUISVILLE AUDITORIUM PLANT.

City and a charter has been applied for. The directors in the concern are W. T. Hewitt, J. W. Fogler, W. N. Todd, Al. Rothenberg and Louis P. Rothschild. The persons interested in this company are also connected with the People's Telephone company, now at work in Leavenworth.

## How Minneapolis Receives the Bell Company's Concession.

The proposed extension of the "party service" in Minneapolis is not received by subscribers with demonstrations of great joy. The *Journal* of that city calls attention to the fact that "the system has the disadvantage to the subscriber of allowing every other subscriber on the line to hear all that passes over it, if inclined to do a little telephonic eavesdropping, and then, too, every telephone on the line rings every time there is a call for any particular one." But in spite of these little drawbacks, the party-line service has proved a very convenient thing for residences and lines not used for regular commercial business. Care is generally taken in arranging the circuit on a party line so that the sum total of its business will not exceed or even equal that of a single line.

## Telephone Charges in New York.

[From the *New York Herald.*]

New York city has a telephone service which is certainly no better than the average, and may be much worse. But the rate that each subscriber pays for the use of the system is away beyond reason. For many years this extortion was made possible by the fundamental patent under which alone the telephone could be operated, and therefore a monopoly was set up. Now that the patent has expired the same monopoly continues, because the connections in the streets and the general plant previously existing give the monopoly such an advantage that competing companies have not yet entered the field.

But, in view of the privileges given to the telephone company by the city, the service is one that is properly subject to legislative control, and there have been several attempts made to regulate the charge for telephone service. Recently, after a careful investigation of the cost of supplying and operating each instrument in this city and elsewhere, a bill was prepared limiting the charges that might be made by the telephone companies.

As the figures fixed upon were far below those which are now in force throughout the state, there was a bitter opposition made to the bill at once by nearly all the telephone companies. It was asserted that the rentals permitted by the bill would cause the companies to do business at an actual loss. Against such a possibility every company brought to bear its heaviest arguments, though without much effect, for two reasons. In the first place, the telephone service not only in this country but in Europe costs much less in other cities than in places of similar size in the state of New York. Secondly, the bill expressly stipulates that the telephone companies shall be entitled to a profit of ten per cent. upon their capital stock.

Certainly the New York companies ought to be able to work as cheaply as similar corporations in other states, but at any rate they ought to be satisfied with 10 per cent. dividends on their capital, especially when watered stock, if there be any, gets as much as the rest.

But, notwithstanding the liberal features of the bill, the telephone monopolies continued to fight against its adoption. Oral arguments before the committee to which the bill had been referred did not seem very likely to produce results, and therefore the eloquence of the lobby was brought to bear.

When the matter had been thrashed over at two public hearings, on March 6th and March 20th, the friends of the bill waited nearly a month before proceeding further. Last week, however, a motion was made to discharge the committee from further consideration of the bill, a motion which, if adopted, would have brought the bill before the Assembly for a vote on its merits. The motion was rejected by a vote of 49 to 60, and the bill therefore remained in charge of the committee.

This disposition of the bill, some members may imagine, relieves them of the necessity of putting themselves on record, but they will probably find that such an attempt to whip the devil around the stump will deceive no one. Their votes to keep the bill in committee make a sufficently definite record to guide their constituents hereafter.

There is another incidental feature of the vote which deserves attention. "You send your bill right along into the committee," was the advice given to a novice in legislative lobbying, "and then 'see' the go-betweens and get it out." But if the go-betweens should first be "seen" by the bill's opponents, would it ever get out?

In view of the interesting side lights thus cast upon the fate of bills thrown into committee while the go-betweens are in a receptive mood, the question naturally arises concerning the telephone bill: Has any one "seen" the go-betweens yet, or will the bill have to stay in committee until some one discovers them?

Who keeps the telephone bill in committee? What is it kept there for? Will it ever get out?

## The Outlook in Rhode Island.

[From the *Providence Journal.*]

The reported entry into competition with the American Bell Telephone company of a powerful and wealthy rival and the reductions in telephone rates in various parts of the country recently have naturally stimulated curiosity among telephone subscribers in this state regarding the probable action of the local company. President Henry C. Cranston of the Providence Telephone company was asked if his company contemplated a reduction in its rates, and he said in answer to the inquiry that while no such step had been considered and no formal action taken looking toward such a step, the company was carefully watching the trend of events elsewhere and would endeavor to continue giving its patrons the best of service at as low rates as are anywhere given for similar service.

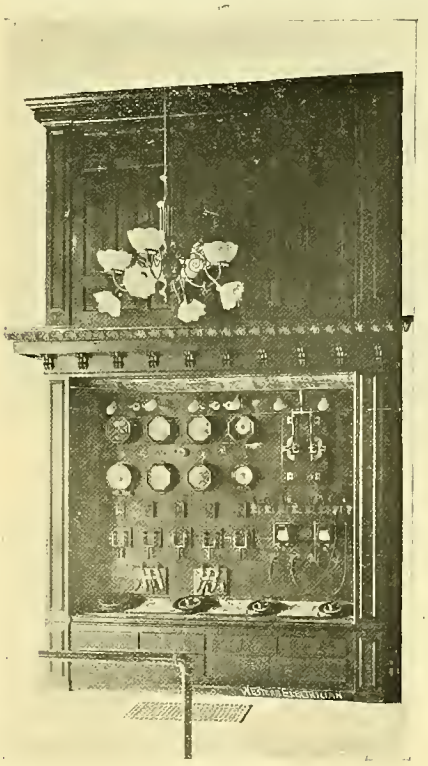


FIG. 4. LOUISVILLE AUDITORIUM PLANT.—STATION SWITCHBOARD.

He called attention to the rates in Rhode Island as compared with those in some other parts of the country, the rates in New York city being more than double those charged in Providence and vicinity.

Mr. Cranston, in reply to another question by the reporter, said that he did not understand that his company had an exclusive franchise in this city. The telephone company, he said, simply has the right to build conduits in the city streets for the purpose of placing its wires under ground, a privilege for which it pays the city. It has no exclusive franchise, he said, in the sense that the Union Railroad and Electric Lighting companies have.

The local company has recently been to great expense in perfecting its system and equipment, and it is safe to say that in no respect will the company, in these particulars, be inferior to any in the country.

The Standard Oil opposition, as previously stated, is supposed to be represented here by Mr. Roelker, the Union Railroad company's attorney, and H. E. Wellman. How deep is their interest, however, is not known. It is not supposed to be very alarming at this stage, as Mr. Wellman, when questioned regarding the matter, replied that he really knew very little about it.

If a rival organization seeks to enter this field it will hardly find as fallow ground as in other places.

## No Decision in the Berliner Appeal.

There has been no decision reached as yet in the appeal of the American Bell Telephone company from the findings in the Berliner case. The United States Circuit Court of Appeals has finished hearing the arguments of counsel in the case. Hon. Causten Brown closed for the United States and J. J. Storrow for the Bell company. At the closing Judge Taylor of Ohio, for the United States, asked the court for permission to file a printed or written index to oral references made by him in his argument in reply to what had been put forth by the appellant's counsel. The court gave him permission and also allowed the counsel for the appellant ten days thereafter to file counter citations. The court then took the case under advisement. It is likely that it will be several weeks before a decision will be forthcoming, as the evidence in the case is bulky. The arguments took up four days.

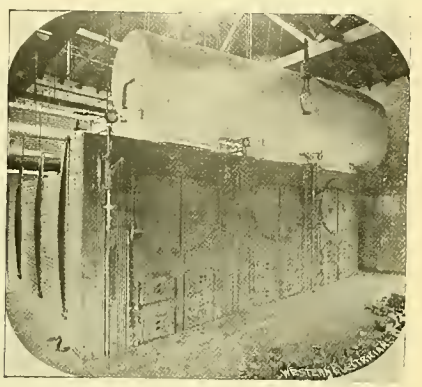


FIG. 3. LOUISVILLE AUDITORIUM PLANT.—BOILER ROOM.

## Telephone War in Ohio.

A recent press dispatch from Chillicothe, O., says: The Western Telephone Construction company of Chicago has secured the contract for placing in operation the new Home Telephone company of this city, which will compete with the Central Union company. The latter company threatens to enjoin every person using the Home telephone boxes.

## Mutual Automatic Telephone Company to Operate in Buffalo.

[From the *Buffalo News.*]

President Smither of the Board of Aldermen had a field day yesterday if ever he had one in his life, and he made trouble in several directions, the kind of trouble which will apparently redound to the benefit of the people of Buffalo in one way and another.

He started in by opening the doors for a big telephone fight, which will assuredly give the people the best of it, for the competition will be between two telephone companies which have millions behind them.

One company, the Bell, has the undivided monopoly of the Western New York field and has kept the rates for telephones up in the air, although there have been reductions all around Buffalo. The new company is the Mutual Automatic Telephone company, with a capital stock of $6,000,000, with such men as John Jacob Astor, Smith M. Weed and Dr. Seward Webb behind it.

The new company has rates fixed for Buffalo, and the difference is appreciable. The Bell Telephone company charges Buffalonians in business $75 per year; residences pay $50. The Automatic company will charge $36 for business places and $30 for residences. The greatest difference is that the Bell limits the number of messages to 500 a year at the rates quoted above, while the Automatic company will give unlimited messages for the prices quoted.

The first resolution offered yesterday was by Ald. Smither, and gave permission to the Mutual Automatic company to put up telephones connecting the city clerk's and the corporation counsel's offices in the city hall, the bureau of buildings in the municipal building and police headquarters. These telephones will be put in with the automatic switchboards, and operated just the same as would be the extensive system of the big company when it is organized.

There has been enough stock subscribed already to assure the success of the new company, and just as soon as the company is incorporated, locally, application will be made for a franchise from the city. All the new company will ask for will be an equal chance with the older corporation, which has got so much from the city and done so little for it.

The main stockholders in New York will retain considerable of the stock of the local company. They look upon Buffalo as the coming great city of the United States and they want to be connected here.

Mr. Smither's resolution was the cause of a great deal of favorable comment among the aldermen. They all saw in the near future cheaper telephone rates and better service.

## The Legal Aspects of Electrolysis.[1]

By Henry C. Townsend.

It is, at the present time, a well settled fact that a continuing and serious damage is done to the buried gas and water pipes and to the metal sheaths of buried telephone and other cables by the action of electricity as now generally employed by electric railway companies for propelling their cars, and, while efforts are being made to obviate the trouble, the success of the remedies proposed or their suitability for constantly changing conditions is somewhat doubtful so long as the rails are employed as a part of the electric return circuit.

It is generally admitted that a complete remedy is found in the use of a return circuit entirely insulated from the earth, such as would be afforded by the use of a double trolley wire; but there is a natural aversion on the part of the street railway companies to such an expedient because of its expense, although it may be seriously questioned whether the deterioration or corrosion of the rails themselves, when buried in the earth and used as a return circuit, is not a source of loss whose magnitude, if fully appreciated, would virtually compel the adoption of this remedy.

The disposition, however, is to palliate the evil, if possible, by improving the conductivity at the rail joints, thereby furnishing so good a path for the return current that the amount diverted to the earth and to buried conductors will not produce a material injury. The injury arising from imperfect bonding had, however, grown to be very great before the extent of the evil had been suspected, and will continue to exist wherever the bonding is imperfectly done or where it may deteriorate.

The question arises on this general state of facts, Upon

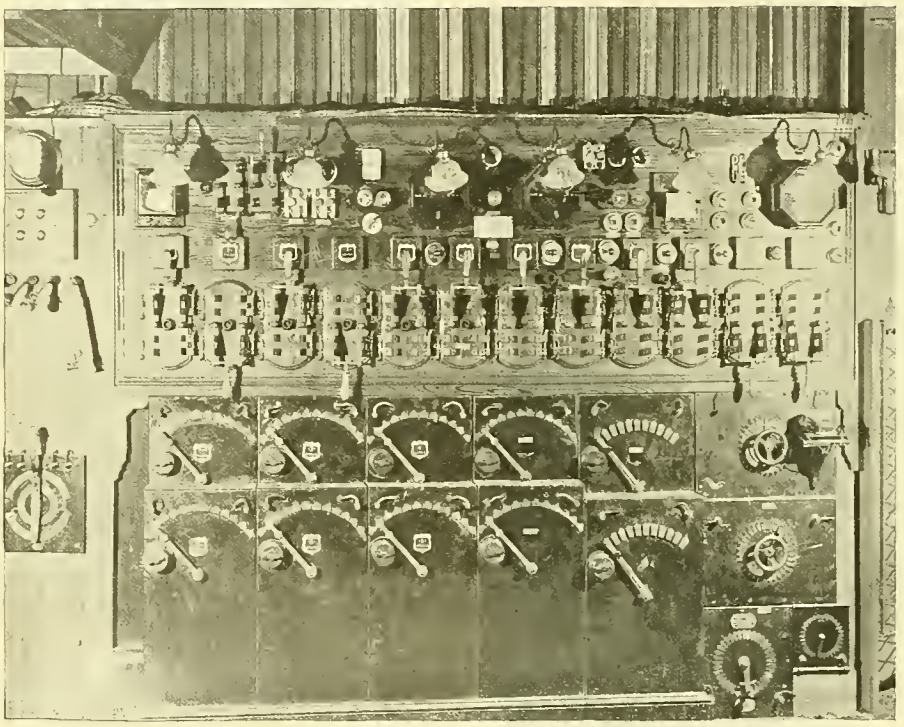


FIG. 5. LOUISVILLE AUDITORIUM PLANT.—STAGE SWITCHBOARD.

whom does the responsibility rest for the injuries heretofore accruing, or which may hereafter arise, from the corrosive action of the railway currents? A similar question arose some years ago in controversies between the telephone and electric railway companies. The injury complained of by the telephone companies in these cases was due, not to corrosive action of the railway currents, but to the inductive disturbances upon their pole lines parallel to the trolley wires, and to the presence upon the telephone lines of the electric railway currents passing to earth and thence to such lines.

In the majority of these controversies the courts refused relief to the telephone companies, and it has been suggested that these cases furnish precedents for the disposition of such controversies as may arise from the corrosive action of the railway currents upon buried metal. Their value as precedents is, however, open to grave doubt.

The contention of the railway companies, as advanced in the prior cases, virtually resolved itself into the claim that they cannot be held liable for the injuries caused to neighboring property through the operation of their road by electricity, because their enjoyment of their rights and franchises is in pursuance of legislative authority. But, as said by the Supreme Court of the United States in a similar case, the grant of power and privileges to do certain things does not carry with it immunity for private injuries which may result directly from the exercise of those powers and privileges, nor is the liability of a company to respond for damages caused by it affected by its corporate character. Its liability for annoyance, discomfort or damage is the same as that of individuals for a similar wrong.

Nor is its liability affected by the extent or character of its franchise. Whatever the extent of the authority conferred, it is accompanied with the implied qualification that it shall be so exercised as not to work an annoyance or damage to others, and, even if that authority extend expressly to permitting the use of the rail return, the liability for damage caused thereby cannot be escaped, although in some quarters the notion prevails that the railway company cannot be held liable, on the general rule that whatever is authorized by competent authority cannot be treated as a nuisance.

There is, however, a wide distinction between that class of cases in which the act complained of is a public work, done under the authority of the government by persons deriving no personal advantage, but acting within the best of their skill and scope of their authority, and that in which the act complained of as having wrought injurious consequences is done by private individuals and not essentially for a public purpose, but for private emolument. In the one case the execution of the act is a public duty imposed by the government, and which, having been accepted, must be executed. No claim can lie for consequential damages arising from the execution of that duty. The act of the other is not essentially and only for a public purpose, but mainly for private emolument.

The electric railway company, in respect to individuals or the public, stands in the position of doing an act for its own profit and benefit, the direct and necessary consequence of which is an injury, if the act from which that injury arises is the use or operation of its system by a return through the rails. The act upon which the legal injury is founded is not the operation of the road by electricity generally, but the employment of the specific kind of plant which the company has elected to build and operate, not because the purposes of its character, so far as the benefit of the public is concerned, could be best carried out by that plan of operation in preference to the system which would work no injury, but because it is primarily for its own pecuniary benefit, though attended by a continuing and grave pecuniary damage to the physical property of others.

It cannot be justly claimed that the beneficial uses of the street, so far as the public is concerned and in respect to the uses for which the railway company becomes the servant of the public, are in any substantial manner enhanced by the employment of the earth or rail return circuit in preference to that other method which was open to the railway company to employ, though at considerably greater expense and, of necessity therefore, at a diminution of profits. Facility and speed of transportation in the city streets is the primary purpose or benefit in consideration of which railway companies enjoy their franchises to employ the electric current, but no one can safely affirm that this benefit can be accomplished only by the use of that one of the known systems of distributing the electric power which is now generally employed.

The question is, practically, whether the railway company, for its own profit, and not for the benefit of the public interest in the streets, shall be allowed to employ that method of distributing its power, of which the usual and known consequences are to work a serious interruption to the enjoyment of a previously granted franchise in pursuance of which the streets and the earth have been occupied for the operation of a plant in what was, at the time of its installation, a well-known and recognized way and was within the corporate powers and grants. There are wrongs or damage for which the law provides no remedy, and it is the general rule that if the owner of property, in the prudent and necessary exercise of his own right of dominion, does acts which cause loss to another, it is, as the law puts it, *damnum absque injuria*. So, too, acts of public agents, within the scope of their authority, if they cause damage, cause simply *damnum absque injuria*.

With some exceptions the general rule is said to be that no person is liable for damages incidentally occasioned to others by the necessary and beneficial use of his own property or of a franchise granted to him by the state; that every man has the right to the natural use and enjoyment of his own property, and if, while lawfully in such use and enjoyment, without negligence or malice on his part, an unadvoidable loss occurs to his neighbor, it is *damnum absque injuria*.

On these general propositions a circuit court of the United States denied relief to a telephone company injured by the operation of an electric railway with a ground return; but the decision seems to have rested largely upon the erroneous assumption that the use of the ground return was necessary to the enjoyment of the franchise of electrically propelling cars. Even if, however, the use of the single trolley be lawful, the charge of negligence cannot be escaped if the railway company fail to use the best method of bonding its rails, provided that bonding would remove the damage from corrosion, and any damage that could be shown to have resulted from its failure to use the best means in its power would be recoverable.

While the failure to use the double trolley may not, in the opinion of the courts, constitute a reasonable ground for charging negligence in those cases where a telephone company is injured by induction or vagrant current passing onto its lines and ringing its bells, such a ruling affords no precedent under which the railway company may be held to be relieved of the obligation to use the best rail-return after it has elected to adopt that method of enjoying its franchise. But not a few cases are found in the reports wherein a company is held liable for damages caused by acts done within its chartered powers.

A notable one, peculiarly apposite to the matter here treated, is that of a corporation charged with repairing the public streets, and which, in so doing, used rollers so heavy as to injure buried gas pipes. The rollers were economical and well fitted for the purpose, but the repairs could have been effected by rolls which would not have produced the injury. The defendant was held liable for the injury. Here was a case of a public grant to a gas company, enjoyed in a certain way, followed by the grant to another company to exercise a right which, if exercised in one way, would injure the former, but, exercised in another, would not.

In another case the defendant was a corporation engaged in digging a canal. In the prosecution of the work it was found necessary to blast rocks, and the fragments injured adjoining property; for this immediate and direct damage, resulting from an authorized act necessary to the enjoyment of the privilege, the company was held liable.

In still another case a company, under authority of the government to enter a city with its tracks and to construct such works as it might deem expedient for the completion and maintenance of its road, placed its engine repair shops in a position where they interfered with the use of neighboring property, acquired by the plaintiff long before the shop was built. The court held that such authority did not permit it to place its shops wherever it might think proper without reference to the rights of others. The court said:

"Whatever the extent of the authority conferred, it was accompanied by the implied qualification that the works should not be so placed as, by their use, to unreasonably interfere with and disturb the peaceful and comfortable enjoyment of others in their property. Grants of privileges or powers to corporate bodies, like those in question, confer no license to use them in disregard of the private rights of others and with immunity for their invasion."

As to the running of the cars in the streets, it held that no one could complain of the incidental inconvenience unavoidably following the occupation of the streets by the cars and the noises attending the running of them. The damages by electrolysis cannot, however, be said to be unavoidable, because there is a plain remedy in the use of the double trolley, the employment of which is not inconsistent with the full enjoyment of all the advantages to the public from electric transportation. Among other instances are the flooding of another's land by a party authorized to build a dam. The authority was held not to carry with it immunity for the resulting damage. So, also, the diversion of the waters of a running stream by the trustees of a city, authorized by a statute to provide a water supply for a city, was held actionable.

In another case a railway was adjudged not liable to a telephone company on the ground that the dominant purpose of the streets is public travel and transportation, and the right of the railway company to use improved modes of conveyance was, therefore, superior to the rights of the telephone company. Whether or not this decision be sound, it is obvious that it affords no support for the proposition that the railway company is not responsible for material and direct damage to gas and water pipes.

While the chief use of the streets is for travel, this is not the only use recognized by the law. The laying of water and gas pipe has long been recognized as a necessary use and may be well held superior in importance to that use which involves the employment of electricity in the particular way which works a damage to the property of others while another way, free from objection, is open to adoption. Claims to immunity for damage, because of superior right, will not, we imagine, avail the railway as defenses in any suit brought for a damage that could be proved to result to water or gas pipes from the grounded electric railway return.

In the telephone cases the courts were apparently influenced to a decision in favor of the railway company by the consideration that the injury to the telephone company was in the nature of an inconvenience rather than a direct or material damage—the visible, positive and necessary result of the railway current. The opinion seems to have been that as there was no actual, physical invasion or destruction of property, amounting to a taking or visible damage capable of exact ascertainment, therefore the injury should be treated as consequential and not to be remedied in the absence of fault or negligence in the exercise of the railway franchise. Nevertheless, it is well recognized that a serious interruption to the common and necessary use of property may be equivalent to a taking of it, and so be within the prohibition found in the constitution of most of the states in America that private property shall not be taken for public use without just compensation, and it is not to be supposed that the courts intended to go so far as to ignore that principle, founded on the natural principles of equity.

The damage to water and gas pipes is a continuing and material one, involving a physical destruction of property and practically an invasion of it by a foreign agent or force, called into action and directed to the pipes by the acts of

1. From *Cassier's Magazine* for April.

the railway company, and which, like other natural agents, as water, light, heat, is, as Blackstone puts it in the case of water, a "wandering thing," only kept in bounds and directed by some positive means applied by the user.

In prior adjudications upon the rights of telephone, telegraph and electric light companies, as joint occupants of the public streets, courts have apparently found difficulty in dealing with the subject, because, in the strictest sense, there is no physical invasion of property such as exists in the case of the flooding of lands or a trespass on property. Modern research, it is true, indicates that light and electricity are but different manifestations of properties of the same medium filling all space and termed ether, and modern theory goes so far as to assert that such apparently diverse forces as electricity, light and gravitation are properties of this one universal and all-pervading ether.

A recent secretary of the treasury of the United States has ruled that electricity, conveyed by conductors laid across the frontier, is not dutiable, being, as the learned secretary put it, "intangible and not capable of being measured," and a state court has exempted an electric light company from taxation as a manufacturing corporation on the ground that electricity is not a manufactured article.

Nevertheless, although electricity is not a substance or fluid in the ordinary sense, the idea of fluid pervades the whole language of electrical science and even the definition of electrical units, as adopted by all scientists, suggests a fluid theory, and so the analogy of water naturally suggests itself in dealing with the present subject. So dealt with, the law furnishes many analogies in its treatment of the rights of riparian owners and of persons injured by water, heat or other natural agent. Many of these analogies support the proposition that the invasion of a telephone company's plant by foreign and superior currents, if producing a serious interruption of, or interference with, its use, is a damage for which the law gives a remedy, but the analogy approaches much nearer to exactness in the cases where the injury goes beyond the mere annoyance or temporary interruption to use, such as was considered to exist in the case of the telephone companies, and involves the actual physical destruction of the property invaded, as is the case of corroded water and gas pipes or telephone cable sheaths. These injuries cannot be dismissed as mere incidental inconveniences, unavoidably following the use of electricity for street car propulsion. The damage is a continuing physical one and is repeated with every repair. It is, moreover, the natural proximate and immediate result of the use of the ground return, chosen by the companies in preference to the double trolley, mainly for their own convenience and profit rather than for giving increased speed of transportation.

It has been urged, as in the telephone cases, that the demand for damages or injunction by those whose previously acquired property, or rights of property, are injured by the railway currents introduced into the earth amounts to a claim to the monopoly of the use of the earth. But priority of enjoyment of a right is frequently a factor in determining what is or is not a nuisance. Thus, it was held to be a nuisance in a certain case for the defendant, a pastry cook, to put into a room in his house, which adjoined a room of the plaintiff, previously long used as a wine cellar, a stove so large that, when it was being used, it heated the wine cellar and made it useless for its purpose.

Blackstone says of nuisances: "If one does an act in itself lawful, which, yet being done in that place, necessarily tends to the damage of another's property, it is a nuisance, for it is incumbent on the person to find some other place to do that act where it will be less offensive." And it is a general rule that acts, lawful in themselves, may become unlawful if exercised without regard to time, place and circumstances. An offensive trade may not be established on one's land to the prejudice of the previous occupants of neighboring land; but if the neighboring land be not occupied there is no nuisance.

A distinction exists between such injuries as may result from the uses of the public streets by different persons, owing to a conflict of their interests and methods of use, and such injuries as may result to the rights of the owners of abutting property, due to corporate or other acts in a street or highway. As between two occupants of the public highway, each exercising its right by legislative authority through the power of control which the state has over the streets for public uses, the state may, in the exercise of its power of eminent domain, authorize a beneficial use in a manner to work an injury to another use beneficial to the public, if public necessity or convenience may require it. But this is subject to the constitutional right of the person injured to just compensation if the injury amount to a taking or damage, or amount to more than a mere incidental injury or inconvenience. But in respect to abutting property there resides in each owner an easement or right to the unrestricted use and enjoyment of the street for purposes of access for drainage, supply of heat, light, water, etc., which the law recognizes as appurtenant to the land and not passing with any conveyance of the street or land thereof to the state or corporation for street uses.

Each lot owner has a peculiar interest in the street which neither the state nor the municipal corporations, nor the general public can pretend to claim—a private right of the nature of an incorporeal hereditament legally attaching to his continuous grounds and the erections thereon; an incidental title to certain facilities and franchises. This easement, appendant to a lot, is as much property as the lot itself. For an injury to that right the law gives the land owner a remedy by injunction or award of damages, according to the nature and the circumstances of the injury.

While the electric railways may lawfully occupy the streets for the purpose of facilitating the uses of the streets for passage and transportation, they cannot impair or lessen lawfully an abutting owner's easement in it by any method of operation which attaches to the maintenance and use of the electric railway in any special or particular manner. As was held in the elevated railway cases in New York, the use of the streets by the railway structure operates to take from the abutting lot owner a portion of his easement in the street, without making compensation, and hence, as to him, it is illegally there, although, so far as concerns the public, the rights of the road could be allowed to stand. The illegality in respect to the lot owner was not in making use of the franchise legally granted, but in appropriating a part of the owner's easement without acquiring it by negotiation or condemnation.

In this particular case the easements taken were those of light and air, impaired by the presence of the structure and by smoke, cinders, gases, etc., which were necessary accompaniments of the operation of the road. But there are other easements which undoubtedly belong to the abutting lot owners, namely, the right of gas and water connections; and, if these be impaired by the use and operation of the electric railway, there is an injury or damage for which the owners are entitled to compensation.

The appropriation of the land forming the street for street uses carries, by implication, the extension of those in vogue at the time of the grant, dedication or conversion, to those which the progress of civilization and the growing demands of increasing population may require; therefore, a use of the streets for cars or vehicles propelled by electricity, in so far as increased rapidity of movement may be beneficial, is within the purposes of the original use. But this principle cannot be equitably extended so as to legalize particular ways of employing the electric force which are inconsistent with and subversive of those prior, necessary uses of the soil of the street for carrying water and gas pipes, or of the right of the abutting owner to make connection with them.

While, therefore, the courts may dismiss the claim of a telephone company for damages arising from joint occupancy of the streets because the injury is the result of a joint attempt of individuals to make use of that to which each alike has a right, and is produced without fault or negligence on the part of the railway company, no such disposition would necessarily follow as to any claim which the owner of an abutting lot might make for damage to his easement in the street for the purposes of water and gas pipe connection, because, on principle, that use stands practically upon the same footing as his right to secure light and air from the street.

A remedy exists for the injury by corrosion, to which buried pipes and cables are at present exposed through the operation of the electric railway companies, and while the difficulty is, from the electrician's standpoint, best met by resort to the double trolley, there is sufficiently reasonable expectation of relief from the expedients which are now being proposed to free the railway companies from the charge of negligence.

The remedies now proposed will, in any case, probably so diminish the evil that it will become difficult to place the liability, or to say with certainty that the extent of corrosion to be hereafter observed is not attributable rather to the direct corroding influence of the constituents of the earth itself or to the decomposing action of the weak currents which may be set up, as in an earth battery, by different sections of pipe or cable, electro-positive and negative to one another, either by reason of the difference of the metals themselves, or by different kinds of earth in which neighboring, similar metals are buried.

It is beyond the compass of this paper to discuss the different ways in which feeble earth currents may be set up, but inasmuch as recent experiments seem to show that a mere directive force in the way of electric pressure, even so low as 0.001 of a volt, is sufficient to produce electrolysis of the earth salts and liberate corroding agents, it is quite obvious that without resorting to the double trolley the corrosion may be so far diminished by other proposed means that the responsibility for the corrosion remaining cannot be fixed upon the railway companies.

TOWER USED IN THE WIRING DISTRIBUTION AT SALZUNGEN.

## Tower Used in the Wiring Distribution at Salzungen.

The accompanying illustration is interesting as showing one of four sub-stations for distribution in the electric lighting system of the German city of Salzungen. As will be seen, it consists of a mast for overhead wires, with a small switchboard at the base. The feeders leading to these points of distribution are underground. The switchboard is enclosed in a cabinet, to which only the employes of the company have access, and from it the consumers' and street lighting circuits are controlled for the district served. A large use of accumulators is made in this plant, the generating station being some distance outside the city and feeding into a battery of storage cells in town, from which, in turn, current is sent to the distributing masts, one of which is illustrated. The picture is taken from the *Elektrotechnische Zeitschrift*.

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CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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## HIGH WATER MARK

CIRCULATION, 16,630.

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WE are pleased to learn from no less authority than S. M. Hamill that there is little prospect of the Brush works shutting down. Rumors to this effect have been persistently circulated of late, and in order to secure definite information a telegram was sent to the Brush company last week. In response to this inquiry the following dispatch was received from Mr. Hamill:

Answering your telegram, these rumors have been circulated against us for the last three or four years. If the Brush works are going to shut down, I have not heard of it.

ELECTROLYSIS and its destructive effects upon water and gas pipes and other metallic substances buried in proximity to the lines of electric railways as at present constructed is a topic of absorbing interest. The subject has already received much attention, and experiments have been conducted with a view to determining the best means of remedying the evil and preventing a recurrence of the trouble where it has already appeared. As an engineering problem first, it has been considered, and secondarily as a source of public danger it has demanded immediate attention; but there is another aspect of the subject that must be recognized as being of equal interest and of pressing importance. This is the legal aspect, involving many fine points in construing the law and going into the relative rights and duties of corporations, the special privileges conferred by franchises and the demands of public service. All of these conditions must be considered in determining this question, and the satisfactory solution of this problem will require as much care and discussion as did the plans for providing a remedy when the danger was first discovered. In view of this fact, it is believed that the able paper by Henry C. Townsend on this subject, which is reproduced elsewhere in this issue, will prove both interesting and instructive at this time. The writer has given special study to the question, he is well equipped for the work, by reason of his experience in the Patent Office as an examiner in the electrical department, and his reputation as an expert in patent work will give additional value to the opinions expressed in this article.

IN another column a comprehensive account of the third annual report of the General Electric company is presented, together with balance sheets and comparative statements that will be examined carefully by many who are not personally interested in the securities of that corporation. Commenting upon the decision in the Bate case, the report says: "Your company still owns patents of more or less importance upon the incandescent lamp, but it will chiefly rely upon the high quality of the lamp manufactured by it and its facilities for manufacturing in large quantities at a low cost to maintain its commanding position in the lamp business, irrespective of patent control." Referring to patent litigation generally, the report continues: "During the year the company has been successful in a number of suits in which it has been attacked by the owners of patents which it was charged with infringing. It has been defeated in no such suit. A valuable patent on the Edison form of socket has been sustained by a Court of Appeals. Several important suits on railway patents owned by the company are in progress, some of which will be argued this spring." No allusion whatever is made in this report to the negotiations with the Westinghouse company, about which so much has been said in the daily papers, but the announcement has been made unofficially in the Sunday papers that the representatives of the companies had failed to reach an agreement and that they would continue the same course that had been followed heretofore. It had been hoped that an arrangement might be made which would terminate the patent litigation between these corporations and enable them to secure better prices for their products. Judging from the report of the General Electric company, such an arrangement would be very desirable.

AMONG the first companies formed to take advantage of the expiration of the fundamental patents of the American Bell Telephone company was the Harrison International Telephone company, which held its annual meeting at Chicago last Monday. This corporation, like other concerns in the same field, follows closely the form of organization which the Bell interests found so advantageous. Through its construction company it has formed numerous state organizations, built exchanges in various parts of the country and exhibited considerable enterprise and skill in presenting and pressing its claims for public favor. According to the secretary's report, which is printed on another page, this activity has incurred for the company the enmity of the Bell interests, and the new concern has already experienced considerable difficulty in securing a firm footing in the most promising fields. In spite of this opposition the company claims to have made material advancement and the announcement is made officially that "the profits resulting from a few months of active work have been sufficient to meet the entire expenses incurred from the date of the company's formation and leave a balance to the credit of profit and loss." This is indeed a most remarkable state of affairs, very unlike that predicted by telephone experts who have prepared estimates of the cost of construction and maintenance of the telephone exchange service for the Bell company. It is to be regretted, however, that the Harrison company did not present some details of the work it has accomplished and the expenses it has incurred by which the value of its experience could be more closely determined. It is claimed that there are 150 Harrison exchanges already established, and while many of these are comparatively small there are some large plants, one of which operates as many as 600 telephones. It would be interesting to compare the cost of construction and operation of such an exchange, equipped with Harrison instruments and built by the Harrison company, with one of the Bell exchanges of equal size, taking into consideration, of course, the conditions under which both are operated and the service furnished. Such data, however, the new company does not seem any more readily inclined to give than does its formidable opponent. Each is careful to guard the most important items of cost, giving only a general statement of results, but in this their experience seems to differ and for that reason alone an opportunity for a careful scrutiny of the means by which these conclusions are reached is very desirable.

MUCH that is said and written about street railway companies injuring and killing pedestrians comes from people who have no idea of the thought, labor and money that have been expended in devising and perfecting safety appliances for trolley and cable cars. With the introduction of rapid transit the demand for fenders or guards of some kind became manifest, and for several years inventors have been at work on this problem; but thus far, it must be confessed, their efforts have met with very little success. Some curious devices in the way of fenders have been turned out, but none of them seems to have proved entirely satisfactory in operation. It is estimated that fully 6,000 of these devices have been exhibited to street railway managers, and although many companies have adopted what they consider the most efficient and reliable of these devices, none of them are entirely satisfied and they are still looking for improvements. As an incentive to still greater efforts to solve this problem the railroad committee of the Assembly has recommended to the New York Legislature a bill requiring every person or corporation operating a street surface railroad in any city in the state, on or before September 1st, to cause each of its cars, propelled by electricity or cable, to be provided with the guard fender or sweep, if any, adopted by the Common Council of the city, and otherwise, with the guard, fender or sweep adopted by the State Railroad Commission. It is further provided that "every person or corporation using or operating a car after September 1, 1895, which is not equipped with a guard, fender or sweep as required by this section, shall be liable to a penalty of $25 a day for each car so used, to be collected by the city and paid into the city treasury, to be applied to the improvement of the streets of said city." It is thought that the enforcement of such a law will impress upon the street railway companies the importance of meeting the demand for an efficient and reliable safety device. The necessity of such action by the Legislature is neither creditable to the street railway companies of the Empire State nor complimentary to the inventive genius of the country.

IT seems almost impossible for daily newspapers to present a fair statement of facts in any matter concerning street railways operated by the overhead trolley system. The New York *Sun*, which prides itself upon its accuracy, published a very misleading item recently, under the heading: "The Deadly Trolley—An Accident Insurance Company Declines to Renew Risks at the Old Price." Here is the item printed in the *Sun:*

The Guarantor Indemnity company of Philadelphia will no longer carry the risks for the Consolidated Traction company of Newark and Jersey City. The latter company closed its contract with the Philadelphia company at noon yesterday. There has been much dissatisfaction on both sides recently, it is said, and accidents have been so frequent that the indemnity company was not inclined to renew on the same terms as before. The Consolidated Traction company will now assume its own risks, and has opened an insurance department, which has been put in charge of John T. Courtney.

And here is the account of the transaction furnished the WESTERN ELECTRICIAN by Richard F. Loper, general manager of the Guarantors Liability Indemnity company of Pennsylvania, to whom the matter was referred for verification:

Permit me to advise you that such is not the case. The contract between the Consolidated Traction company and ourselves gave us the right to cancel the policy upon the 26th day of April. The reason we cancelled the policy was the fact that on account of the inadequate system between that company and its motormen, it could not comply with the conditions of our policy, requiring it to furnish us notice of casualty within ten days after occurrence of such—the traction company taking exception to this condition; we, upon our part, insisting upon the observance of it. There is the kindest feeling existing between that company and ourselves, and we have no fault whatever to find with "the frequency of accidents or the claims for damages," the entire matter being purely one of underwriting, and the business up to the present time in other respects than the 10-day notice, being entirely satisfactory to this company.

We have great hesitation in permitting any publication of confidential matters between our clients and ourselves, and I only make this statement to you to set you straight in regard to the article published in the New York *Sun*.

This places the matter in an entirely different light. We have no doubt that our esteemed contemporary, in justice to the much abused trolley, as well as to the particular traction company mentioned, will institute further investigation of the case and present the facts as it finds them. That is all that the electrical interests desire at any time and in any case, and surely every fair minded man should be willing to grant this request.

## Moonlight Schedules for Arc Lighting.

By F. B. Badt.

Probably the oldest moonlight schedule prepared for public lighting is what is known as the Philadelphia Moonlight Schedule. It is based on the following rule:

Light one-half hour after sunset.
Light one hour before moonset.
Extinguish one hour before sun rises.
Extinguish one hour after moon rises.

While this whole matter seems extremely simple, moonlight schedules based on this rule have caused a great deal of confusion and have, in many instances, given cause for lawsuits between cities or towns on one side and electric lighting corporations on the other.

The author has received a large number of letters from central station men, asking what seem to him rather unnecessary questions concerning the moonlight schedule published by the Western Electrician.

The questions indicated that this matter was very imperfectly understood, and rather than answer each individual letter, it was determined to present the following simple explanation:

Not considering the territory of Alaska, the United States covers the latitudes from the 25th parallel to the 48th parallel.

Of course the sun and the moon rise and set at different times under the different latitudes, and it is therefore plain that each latitude has its own calendar and should have its own moonlight schedule. Below is given copy of a clipping from an almanac issued for the year 1895, and the data are given for the 1st of January, 1895:

| Day of year. | Day of month | Day o week. | About Lat. 42°. CALENDAR For *Boston*, New England, New York state, Michigan, Wisconsin, Iowa and Oregon. SUN RISES. | SUN SETS. | MOON R. & S. | About Lat. 41°. CALENDAR For *New York city*, Philade'phia, Connecticut, Pennsylvania, New Jersey, Ohio, Indiana and Illinois. SUN RISES. | SUN SETS. | MOON R. & S. | About Lat. 39°. CALENDAR For *Washington*, Maryland, Virginia, Kentucky, Missouri and California. SUN RISES. | SUN SETS. | MOON R. & S. | About Lat. 33°. CALENDAR For *Charleston*, North Carolina, Tennessee, Georgia, Alabama, Mississippi and Louisiana. SUN RISES. | SUN SETS. | MOON R. & S. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | H. M. | H. M. | H. M. | H. M. | H. M. | H. M. | H. M. | H. M. | H. M. | H. M. | H. M. | H. M. |
| 1 | 1 | Tu. | 7 30 | 4 38 | 10 10 | 7 25 | 4 43 | 10 12 | 7 19 | 4 49 | 10 13 | 7 5 | 5 5 | 10 16 |

It is evident by looking at this table that there is almost a half hour difference between sunrise and sunset in Boston (lat. 42°) and Charleston (lat. 33°). The time given in the calendar is what is called "the mean local time."

It is well known, however, that this mean local time by no means corresponds with the time of the "standard time zones." There is always exactly an hour difference between all towns in one zone from the standard time of all towns in the adjacent zones. We have Inter-colonial, Eastern, Central, Mountain and Pacific time.

The meridian under which the mean local time and the standard time are identical of course is always located in about the middle of each zone, so that the standard times in the extreme east and west of each zone differ about half an hour from the mean local times.

If a town therefore follows standard time and the moonlight schedule is calculated on mean local time, the data may be half an hour ahead or behind the local time.

Now if one of such places under latitude 42° uses the moonlight schedule calculated for latitude 33°, it is evident that the moonlight schedule may be either an hour ahead or behind time. It would seem that it would be a good plan for the publisher of a moonlight schedule to state on the title page for which degree latitude the table was calculated and what the rule was which he observed in stating lighting and extinguishing hours.

Before closing it might be well to draw attention to a moonlight schedule for arc lighting prepared by Prof. C. A. Young of Princeton, which was published by one of your contemporaries. I copy his rule and the data for the fourth day of January, 1895; the statements are self explanatory and to the point:

The following table gives the time when the moon reaches an elevation of five degrees either rising or setting, computed for latitude 41° (Chicago) and 33° (Atlanta).

The dynamo may be shut off at this time when the moon is rising and must be started at this time when it is setting. January 4, 1:45 A. M. means 1:45 A. M. of the night January 4-5, *i. e.*, January 4 is counted astronomically as beginning at noon of January 4 and running till noon of January 5:

| | January, 1895. 41 Degrees. | 33 Degrees. |
|---|---|---|
| 4. Light..... ..... | 12:49 A. M. | 1:45 A. M. |

## Institute Meeting Postponed.

Announcement is made that the annual meeting of the American Institute of Electrical Engineers for the election of officers, reception of reports and transaction of other business of the Institute will be held at 12 West Thirty-first street, New York city, Tuesday evening, May 21st instead of May 14th, as already announced on the balloting circulars.

At the same meeting the discussion of Prof. Anthony's paper will be resumed and it is expected that a paper will also be presented by A. D. Adams of Boston on "The Most Economical Form for Bipolar Field Magnets."

## Convention of Telegraphers at Washington.

[Special correspondence of the Western Electrician.]

Washington, D. C., May 2, 1895.—A convention of the Telegraphic Historical Society of America was held in this city May 1st, at the Board of Trade rooms. The object of the society is the collection, preservation, discussion and publication of information relating to the history, progress and development of the electric telegraph in North America. The president is ex-Governor Alonzo B. Cornell, of New York, who has been in continuous telegraphic service for fifty years.

According to the report of the secretary, the society now has a membership of 265, scattered all over the United States. By no means all of them to-day are connected with the telegraph business. Many of them have drifted into other vocations, in which for the most part they have achieved success, but all of them love to think and to talk of the days when they had a share in the work of spreading the usefulness of the system for which they all delight to honor the memory of the late Prof. Morse. As showing how the members have scattered into other fields of activity, it is said that the present president of the Western Union Telegraph company received his first lessons from a man who is now prominently connected with the newspaper business in this city, but who was in the early days an operator in a small town in Ohio.

The secretary's report also showed that there was a treasury balance of $134.93. The following named officers were unanimously re-elected for the ensuing year: President, Alonzo B. Cornell, Ithaca, N. Y.; first vice-president, S. H. Kauffman, Washington, D. C.; second vice-president, William B. Wilson, Philadelphia, Pa.; third vice-president, Thomas D. Lockwood, Boston, Mass.; secretary and treasurer, George C. Maynard, Washington, D. C.; members of executive council, J. H. Emerick, New York, B. F. Dillon, Jacksonville, Fla., William R. Plum, Chicago, Ill., and J. Q. Mason, Tacoma, Wash.

Henry A. Reed, secretary of the Bishop Gutta Percha company of New York, read a paper on the "Paternity of the American Electric Telegraph." Mr. Reed was an intimate friend of Prof. Morse, and he gave an interesting account of the early life of the great inventor and of his life in England.

E. L. Morse, the youngest son of Prof. Morse, an artist, who has spent many years in European schools, talked informally to the meeting, and exhibited a copy of the note book of his father, in which was outlined the first ideas and the characters used for letters of the first telegraphic instrument made by Prof. Morse.

Dr. J. J. Clark and William H. Young read papers of interest on early telegraphic subjects, after which the chairman read an exhaustive paper prepared by Thomas D. Lockwood of Boston, on "The Electric Telegraph of America."

Among those present at the meeting were William B. Wilson, Philadelphia; J. B. Austin, Washington; J. B. Taltavall, New York; Henry A. Reed, New York; M. W. Barr, Washington; Edward Lind Morse, Lakewood, N. J.; Morell Marean, Washington; James H. King, Washington; A. G. Safford, Washington; Dr. J. J. Clark, Forest Glen, Md.; R. G. Callum, Washington, and A. B. Talcott, Washington.

A second meeting was held in the afternoon, and an informal dinner was given at the Donn Tonn Club's rooms at six o'clock in the evening, where the conversation and the speeches all had for their subject the history of the telegraph.

The society was made the recipient of a handsome present, whose historical value will increase as the years pass by. It is a framed collection of portraits of Prof. Morse and the members of his family, and was presented to the Telegraphic Historical Society of America by the inventor's grandson and namesake, S. F. B. Morse of Chicago.

T. I. P.

## Metropolitan Elevated Road in Operation.

On Monday, May 6th, the first all-elevated electric railway in the United States—the Metropolitan West Side line of Chicago—was opened for traffic. Only a portion of the system is now operated and until a thorough test of the daily traffic and capacity of the road has been made the terminals of the working line will be Canal street on the east and Robey street on the west. The latter station is on the northwest branch. Three-car trains are used on the greater part of the day. These trains are made up of a motor car and smoker combination and two trailers. Each train is in charge of a motorman, conductor and guard, and the average speed is 16 miles an hour.

## General Electric Company Annual Report.

The annual meeting of stockholders of the General Electric company will be held at the company's office at Schenectady, N. Y., on May 14th. At this meeting the annual report of the president will be submitted, together with a detailed statement of the company's affairs prepared by the second vice-president. Following is an abstract of the president's report:

The report has been divided into two sections, showing: First, the result of liquidating the assets which appeared on the company's books prior to January 31, 1894, and secondly, the result of the business of the fiscal year ending January 31, 1895. As previously reported, the profit and loss statement showed on January 31, 1894, a debit balance of $12,454,967.42; the result of liquidating and providing for loss on the old assets has increased this by $2,754,392.27; making the total loss on old accounts (prior to 1894) as now ascertained or estimated $15,209,359.69. The business of the year 1894 has yielded a net profit (over interest on debentures) of $414,642.72, leaving the present debit balance of profit and loss $14,794,716.97.

In the last annual report your directors sought to exhibit the extent to which your company had suffered from the panic of 1893 and from other causes inherent in some of the enterprises in which it became interested at the time of its organization. Mention was made of the fact that the accounts receivable included $2,531,609 88 due by the Fort Wayne and Northwest companies and other allied interests. Contrary to the expectation of your directors, and the statements of persons directly interested in the Northwest company, your claim as a creditor of that company now proves to be without value; and certain other interests inherited by your company through the Northwest company are also valueless. The aggregate loss from these sources is about $945,000 (viz., $456,484.43 on the account owned, and about $489,000 on other items), and this sum is included in the charges to profit and loss in the supplementary statement for the year 1893 attached hereto.

During the past year the Fort Wayne Electric company, a former ally of one of your constituent companies, has gone into the hands of receivers, and its affairs are now being liquidated by the court. Your company has filed with the receivers its claim for $1,137,555.48.

The balance sheet and the schedules accompanying it show the outstanding interests of your company as stockholder in manufacturing and other companies. Many of these securities will be sold as opportunity offers. Such a course will in some instances involve considerable shrinkage from former book values.

There exists also several unsettled contracts antedating the formation of your company, but which your company has to recognize, and which will cost, perhaps, $500,000 to settle.

To cover the estimated loss on all the matters mentioned, your directors have arbitrarily charged $2,000,000 to profit and loss account, and the results, as shown at the head of this report, are after making this deduction.

In the last report, your directors expressed the opinion that they could, out of the then unliquidated assets, pay off the balance of your floating debt and also provide all necessary working capital. These expectations have been realized, and in addition thereto the company has purchased and canceled $1,250,000 of its own debentures at an average cost of less than 89 per cent.

As will be seen by the statement of profit and loss herewith, the business of the year just closed amounted to $13,263,611.58; the cost of goods sold, legal and general expenses and taxes were $11,451,863.98, leaving a gross profit of $1,811,747.60 against which is charged interest on debentures outstanding $464,583.33, leaving (over interest on debentures) $1,347,164.27.

There are further charged off: Various old losses which are difficult of division between 1894 and earlier years, and are therefore all charged against the year ending January 31, 1895, $443,023.96; cost of all patents and franchises acquired or settled for during the year $162,298.11; depreciation of inventories, $288,401.14; sundry losses, $38,798.34; making $932,521.55 and leaving a net profit of $414,642.72.

As a result of the decision in the "Bate case," recently announced by the Supreme Court of the United States, it is now settled that the fundamental patent upon the Edison incandescent lamp expired in November, 1894. Your company still owns patents of more or less importance upon the incandescent lamp, but it will chiefly rely upon the high quality of the lamp manufactured by it and its facilities for manufacturing in large quantities at a low cost to maintain its commanding position in the lamp business irrespective of patent control. Lamp prices have necessarily been greatly reduced. While the volume of this important part of your business will without doubt by largely increased in the future, the percentage of profit thereon will necessarily be less than heretofore.

During the year the company has been successful in a number of suits in which it has been attacked by the owners of patents which it was charged with infringing. It has been defeated in no such suit. A valuable patent on the Edison form of socket has been sustained by a Court of Appeals. Several important suits on railway patents owned by the company are in progress, some of which will be argued this spring.

The licensee companies contribute an important part of the business done by your company in central station lighting and distribution of power, and their growth and prosperity are closely identified with the welfare of your own company. The relations which have heretofore existed between these licensee companies and your company continue, and the policy of your company in the future, as in the past, will

be to cultivate their business and co-operate in the development of such licensees.

At the last annual meeting the following vote was passed:

"*Resolved*, That the matter of reducing the capital stock of the company in the manner prescribed by law be referred to the incoming board of directors, with request that they give it attention; and, if such a course commends itself to them, that they call a special meeting of the stockholders for consideration and proper action."

Your board, after careful consideration, has deemed it inexpedient to take any action with reference thereto.

The $8,159,264.02 at which patents are carried is the amount at which their value was taken on pages 8 and 9 of the first annual report of your company.

The statement of the second vice-president includes the consolidated balance sheet and the consolidated statement of profit and loss. The former includes the assets and liabilities of the Edison General Electric, Edison Electric Light and the Thomson-Houston Electric companies, which, for convenience of bookkeeping only, are consolidated with those of the General Electric company. The assets and liabilities of the Thomson-Houston International Electric and the Pennsylvania General Electric companies were taken over by the General Electric company during the year and are also included in this balance sheet. The consolidated statement of profit and loss includes the profit and loss accounts of all the companies mentioned. The following explanation of the items in these sheets is presented:

ASSETS.

*Patents and Franchises.*

This account remains at the amount shown in the last two annual reports. It represents, as stated in those reports, the cost to the General Electric company of the Edison and Thomson-Houston patents and contract rights, and its interest in the patents of the various Thomson-Houston subcompanies. During the year $94,917.11 was expended in purchasing and taking out new patents, and $67,381 in acquiring the territorial licenses which the Thomson-Houston company had granted to the Thomson-Houston International Electric and the Thomson-Houston Electric Light companies, the latter being the predecessor of the Pennsylvania General Electric company. These amounts, as well as all expenses of patent litigation for the year, have been written off to profit and loss.

*Manufacturing Plants.*

This account represents the real estate, buildings, machinery, tools, etc., at Schenectady, Lynn and Harrison. Their book value on January 31, 1894, was $3,941,128.98. During the year, $61,124.34 was expended for new buildings and $268,079.73 for new machinery. On the other hand, $370,333.05 has been written off to profit and loss as an allowance for depreciation, leaving the present book cost of these plants $3,900,000, or $41,128.98 less than at January 31, 1894.

*Real Estate.*

This account has been increased during the year $100,098.19, chiefly by taking real estate mortgaged to secure old accounts in settlement of those accounts.

*Stocks and Bonds.*

Those having a market value have been taken at book values slightly under the price of recent sales. Where there is no established price it has been necessary to estimate their value from financial statements submitted by officers of the respective companies. Effort has been made to keep the book values of stocks and bonds of "local companies" down to present cash values.

There are stocks and bonds of various companies amounting to $3,500,000 at par, but of so speculative a character that they are carried at a total book value of only $82, being one dollar for each lot. Some of these latter are practically worthless, but others possess some merit and their aggregate value is likely to be considerable.

*Notes and Accounts Receivable.*

This account represents what is believed to be a conservative value of notes and open accounts of customers, after deducting and charging off to profit and loss old notes and accounts receivable of 466 debtors, not now dealt with except on a C. O. D. basis, amounting to $2,291,844.48, heretofore carried at $234,973.69, but no longer carried as assets, except for the aggregate sum of $466, being one dollar for each debtor. They will be liquidated as speedily as possible.

*Inventories.*

This account represents raw materials, goods manufactured and in process of manufacture at the works and manufactured goods on consignment and at sales offices, all at factory cost. They have been inventoried item by item.

Reductions from the sum at which they were previously carried have been made and charged to profit and loss. The continued writing down of manufactured goods is with the intent that only standard salable apparatus shall be considered an asset.

*Work in Progress.*

This account represents the amount expended on installations in progress, without any credit for the profit to be derived from such installations when completed and billed.

LIABILITIES.

*Capital Stock.*

To acquire five shares of common and four shares of preferred stock of the Thomson-Houston Electric company, which had not been exchanged at the date of the last annual report, three shares of common and one share of preferred stock of this company have been issued during the year.

*Indebtedness.*

Pursuant to the policy announced in the last annual report, various stocks and bonds, which it was not desirable for the company to hold permanently, have been marketed. Their proceeds were placed in a special fund. The cost of all securities purchased has been charged to that fund, as follows:

| | |
|---|---|
| Securities were sold for | $1,307,298.07 |
| Securities were acquired at a cost of | 1,085,226.56 |
| Leaving a balance | $222,071.51 |
| To this was added from the liquidation of old notes and accounts receivable the sum of | 885,996.82 |
| Making a total of | $1,108,068.33 |

which was used to buy $1,250,000 of the company's debentures in the open market at an average price of about 88 5-8.

By liquidating as above, and by adhering to the policy of selling for cash or on short time, the company has not only collected enough cash to retire all its floating and reduce its funded debt, but has had sufficient working capital to pay cash for all its purchases during the year.

The following comparison shows the debt of the company other than outstanding debentures and real estate liens, on the 31st days of January, 1894 and 1895.

| | 1894. | 1895. |
|---|---|---|
| Notes payable | $ 744,341.31 | None. |
| Accounts payable, accrued interest, etc. | 446,307.92 | 494,258.01 |
| Total | $1,190,649.23 | $494,258.01 |
| Less cash on hand | 591,143.88 | 404,236.48 |
| Net amount of unfunded debt | $ 599,505.35 | $90,021.53 |
| Paper endorsed and discounted | 1,422,949.48 | None. |
| Total | $2,022,454.83 | $90,021.53 |
| Reduction of unfunded debt | | $509,483.82 |
| Reduction of real estate liens | | 26,200.00 |
| Debentures cancelled | | 1,250,000.00 |
| Reduction of debt during the year | | $1,785,683.82 |
| Reduction of endorsements | | 1,422,949.48 |
| Total reduction of obligations | | $3,208,633.30 |

PROFIT AND LOSS.

It is difficult to separate losses ascertained during the current year into those properly chargeable to this year, and those due to the errors or misfortunes of previous years. The division of the profit and loss statement has been made with a view to exhibit, as far as it could be distinguished, the profit of the year just ended. The losses incurred on notes and accounts over and above the allowance made therefor last year are due largely to diminished values of notes and accounts of customers of the Northwest General Electric company.

The general expenses decreased $774,832.09 as compared with the previous year.

CONNSOLIDATED BALANCE SHEET, JANUARY 31, 1895.

| ASSETS. | | | LIABILITIES. | | |
|---|---|---|---|---|---|
| Patents and Franchises | | $8,159,264 02 | Capital Stock | | |
| Manufacturing Plants | | 3,900,000 00 | Common | $30,460,000 00 | |
| Real Estate (other than Manufacturing Plants). | | | Preferred | 4,252,000 00 | |
| Edison Building, N. Y. City | $412,584 63 | | | | $34,712,000 00 |
| Less mortgage thereon | 200,000 00 | | Five Per Cent Gold Coupon Debentures | | 5 750,000 00 |
| | 212,584 63 | | | | |
| Other Real Estate | 211,198 79 | | Accrued Interest on Debentures | 72,916 65 | |
| | | 423,783 42 | Accounts Payable | 421,341 36 | |
| Stocks and Bonds (see Schedules A and B) | | 5,079,012 51 | | | 494,258 01 |
| Cash | | 404,236 48 | | | |
| Notes and Accounts Receivable | | 6,550,499 50 | | | |
| Work in Progress | | 757,087 04 | | | |
| | | 7,711 822 — | | | |
| Inventories | | | | | |
| At Factories | $3,046,014 59 | | | | |
| At Sales Offices (including consignments) | 813,654 39 | | | | |
| | | 3,859,668 98 | | | |
| Sundry Debits | | 27,989 09 | | | |
| Profit and Loss | | 14,754,716 97 | | | |
| | | $43,956,258 01 | | | $43,956,258 01 |

SUPPLEMENTARY CONSOLIDATED PROFIT AND LOSS ACCOUNT OF JAUUARY 31, 1894.

| | | | Cr. | | |
|---|---|---|---|---|---|
| Balance, January 31, 1894 | | $12,454,967 42 | Profits belonging to last and previous years' business | | |
| Losses chargeable to further liquidation of last and previous years' business | | | Discount on Debentures purchased | $141,931 67 | |
| Sundry Liquidation Accounts | $164,048 36 | | Sales of Stocks and Bonds in excess of book values | 147,067 37 | |
| Claims against Northwest General Electric Company | 456,484 43 | | | | $288,999 04 |
| On Account of Settlements with United Electric Securities Co of Bond transactions under Thomson Houston Electric Co's Contracts | 46 382 86 | | | | |
| Old Notes and Accounts Receivable wholly charged off | 314,973 69 | | | | |
| Sales of Plants and Real Estate below book values | 41,501 97 | 1,023,391 31 | | | |
| Special Allowance (see page 2) | | 2,000,000 00 | Balance carried down | | 15 209,359 69 |
| | | $15,498,358 73 | | | $15,498,358 73 |

CONSOLIDATED PROFIT AND LOSS ACCOUNT OF JANUARY 31, 1895.

| | | | | | |
|---|---|---|---|---|---|
| **Adjusted Balance as of January 31, 1894** | | **$15,209,359 69** | | | |
| Business of the Current Year | | | Business of the Current Year | | |
| Cost of Goods Sold | $9,557,327 69 | | Sales | $12,540,395 12 | |
| Legal and General Expenses and Taxes | 1,894,536 39 | | Royalties and Sundry Profits | 420,818 17 | |
| | $11,451,863 98 | | | $12,961,213 29 | |
| | | | Interest and Dividends on Securities owned | 137,946 81 | |
| | | | Interest and Discount | 114,451 49 | |
| Interest on Debentures | 404,583 33 | | | 307,398 29 | |
| | 11,916,447 31 | | | $13,263,611 58 | |
| Losses chargeable partly to previous and partly to current years' business | | | | | |
| Consignments and Contracts written off | 434,770 96 | | | | |
| Additional Depreciation allowed for | | | | | |
| On Plants, Consignments and Contracts | 177,417 50 | | | | |
| On Notes and Accounts Receivable | 130,833 50 | | | | |
| | 308,251 00 | | | | |
| | 743,023 96 | | | | |
| Further Amounts now charged off | | | | | |
| Patents and Franchises | 162,308 11 | | | | |
| Various Investments | 288,401 14 | | | | |
| Sundry Losses | 38,798 34 | | | | |
| | 489,497 59 | | | | |
| | 932,521 55 | | Balance, January 31, 1895 | | 14,794,716 97 |
| | $28,058,328 55 | | | | $28,058,328 55 |

## Compulsory Use of Fenders on Trolleys and Cable Cars.

[From the *New York Herald.*]

The regulations adopted by the commissioners of the District of Columbia ordering the cable lines to adopt safety fenders and wheel guards on their cars afford a good example for the authorities of Brooklyn and New York in respect to the trolleys and cable cars. In Washington the cable lines have already begun to carry out the regulations. All the grip-cars on one line have had attached to them fenders elevated about eight inches above the track and projecting about six feet in front of the car, designed to pick up and carry on a netting any person who may be struck by the car.

Baltimore also has for some time made the use of fenders on all its trolley cars compulsory by law. As two of our large cities have taken steps to secure the lives of citizens from trolley and cable car accidents, the authorities of all towns in which these dangerous cars are run should do likewise. No regulation of their speed will alone suffice to prevent fatal accidents. This has been demonstrated by experience. And the sooner all large municipalities adopt regulations similar to those enforced in Baltimore and Washington the better will it be for both the car companies and the public.

In Brooklyn the trolleys have already killed 108 persons, and the city government has done nothing to stop the slaughter save to limit the speed of the cars. Not a day should be lost in ordering efficient fenders to be placed on all the cars.

How long will the new reform government of Brooklyn, that came into power with such a flourish of trumpets and such profuse promises to set things right, refuse to protect the lives of citizens from the deadly trolley?

---

The work of laying the power transmission wires from the plant of the Pittsburg Reduction company on Buffalo avenue, Niagara Falls, N. Y., to the power house of the Niagara Falls Power company has been begun. The wire cables are being placed in the mammoth conduit extending eastward from the power house. The General Electric company has the contract for the work, which will be pushed vigorously.

## Meeting of the Executive Committee of the National Electric Light Association.

A meeting of the executive committee of the National Electric Light association was held on Saturday evening, May 4th, at the Grand Central Palace, New York, and was one of the most important meetings that has been held in several years, as the general line of discussion had much to do with forming a policy which the association will probably follow for a number of years.

President C. H. Wilmerding, who presided, extended his thanks for the large attendance, and said he would like to hear from the executive committee suggestions regarding the time and place for holding the next meeting of the National Electric Light association. The committee was unanimous in the selection of New York as the place of the next meeting and May as the month in which it should be held. C. R. Huntley, in speaking upon the subject of the next meeting place, said he thought the association large enough and of sufficient importance to-day to abandon the plan heretofore followed of drifting each year from city to city to partake of the hospitality of local companies. He believed the association should have only two meeting places, New York and Chicago, and that it should alternate between these cities. This suggestion was enthusiastically applauded by those present.

J. A. Seely spoke forcibly of the advantage the association would gain in 1896 by having a complete exhibit of electrical apparatus in connection with the convention, and he suggested the Grand Central Palace as the place best fitted for such an exhibition in New York. A. J. DeCamp contended that Mr. Seely was not correct in the position he had taken regarding the advantages to be gained by the association being in any manner connected with an exhibition of electrical apparatus at its meetings, and advocated "cutting loose from the manufacturers entirely."

Upon motion of Frederic Nichols, C. R. Huntley, J. A. Seely, A. J. DeCamp and the president and vice-presidents were appointed a committee to decide the date in May, 1896, when the next meeting of the association will be held, and also to decide whether it would be advisable to hold an exhibition at that time, and if so to select the location. The committee was given full power to act in the matter.

Mr. Seely asked that Secretary George F. Porter be added to the committee, and this was done.

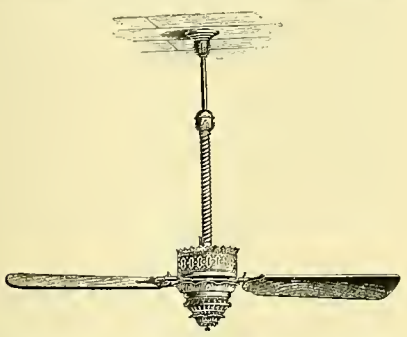
President Wilmerding called upon T. C. Martin to speak upon the subject of holding an exhibition at the next meeting of the association. Mr. Martin presented the views of those favoring the holding of an exhibition and gave many substantial reasons for advocating a complete display.

The meeting adjourned and an invitation to the gentlemen present to inspect the Grand Central Palace was accepted.

The following named gentlemen were present at the meeting: C. H. Wilmerding, E. F. Peck, G. F. Porter, C. O. Baker, Jr., Frederic Nichols, J. A. Seely, E. H. Davis, A. J. DeCamp, W. R. Gardener, G. A. Redman, J. J. Burleigh, C. R. Huntley, R. B. Corey; T. C. Martin, *Electrical Engineer;* S. L. Coles, *Electrical Review;* W. D. Weaver, *Electrical World;* J. L. Gans and B. E. Greene, *Electricity*, and W. F. Osborne, WESTERN ELECTRICIAN.

## Alternating Current Ceiling Fan.

The Emerson Electric Manufacturing company of St. Louis, manufacturer of the well-known Meston fan motor,



ALTERNATING CURRENT CEILING FAN MOTOR.

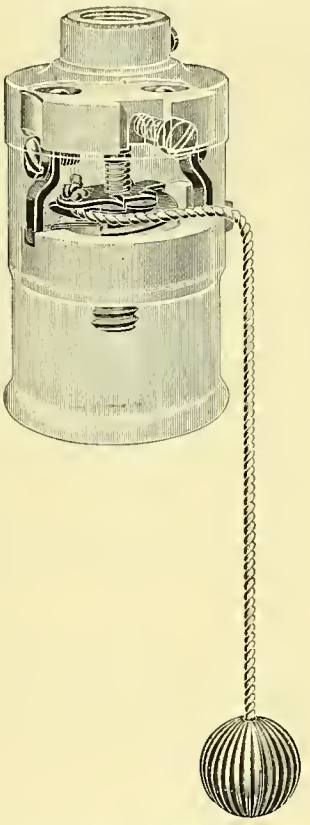
is keeping up its record in alternating current appliances, as shown by the new alternating current ceiling fan, illustrated herewith. The motor is direct acting and slow speed, with metallic brush, and revolves the fan blades at 140 to 150 revolutions per minute. This new departure in alternating current motors will no doubt meet with a large demand, as the field is almost unlimited. These fans are in many cases much preferable to the small fan motors, and as they consume no more current, it can be seen that they are very efficient. They are made up in three finishes, nickel, oxidized copper and polished brass, and are decidedly ornamental. The company is pushing its factory so as to be ready for warm weather with this specialty as well as others in the fan line. The Electric Appliance company, Chicago, is general western agent for the Meston ceiling fan, as well as the entire line of Meston motors.

## Bryant Pull Socket.

A socket "with a pull" is a rather vague expression, somewhat after the vernacular of the ward politician; yet this is exactly what the Bryant Electric company has just placed upon the market. By looking at the cut a clear idea can be obtained of this recent candidate for popular approval. The device consists of a socket, in size and outward appearance similar to the regular sockets now in use, excepting that where the key is usually found there is a hole and extending through this hole is a cord with a ball on the end. This cord is attached to a ratchet device, small and neat, concealed within the socket shell. One pull of the cord turns the ratchet and there is light, and the next pull darkness reigns once more—thus a socket "with a pull." Grier Brothers, western managers, will have a stock of these unique sockets in their store rooms at Chicago.

## Westinghouse Machine Company's New Shops.

Contracts have been let and ground broken for the Westinghouse Machine company's new shops at East Pittsburg,



BRYANT PULL SOCKET.

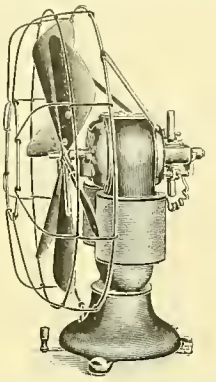
Pa. A few years ago the Westinghouse Air Brake company erected large shops at a point on the main line of the Pennsylvania railroad, about twelve miles from Union Station, Pittsburg, where the town of Wilmerding was laid out and built. The location at East Pittsburg of the Westinghouse Electric & Manufacturing company's immense plant and the Fuel Gas & Manufacturing company's facto y, to be followed now by the removal of the Westinghouse Machine company to the same place, will form, with the Union Switch & Signal company's works at Swissvale, a concentration of Westinghouse interests, practically at one point, within a half hour's ride of the city.

The main building of the Westinghouse Machine company's new shops will be 602 feet by 230 feet. The construction throughout will be as nearly fireproof as modern building methods can devise. To meet this requirement the specifications call for a steel structure with brick walls, slate roofs, wire-glass skylights, etc. A building of similar construction, 200 feet by 60 feet, will contain the hammer shop and power plant.

Within the main building, through which switches are run direct from the main line of the Pennsylvania railroad, will be the machine shops, erecting shop, foundry, pattern shop, warehouse, offices, etc. Two crane runways, each 60 feet span, on which electric cranes of the latest improved design will be used, extend the length of the building. The remaining space is taken up with galleries, provided with lighter crane service. The present equipment of machine tools will be increased by the addition of whatever is best to facilitate the manufacture and handling of the company's enormous product.

The hammer shop will have every convenience that the best shop practice can suggest for doing work thoroughly and expeditiously. It will be equipped with one eight-ton, one three-ton, one two-ton and several smaller hammers, beside the usual cranes, etc.

It is estimated that the cost of the buildings alone will reach $400,000. The contracts call for completion by November 1, 1895. The following are the names of the contractors: Stone work, Fred Gwinner, Pittsburg; brick work, Steele & Hall, Pittsburg; carpenter work, George Hogg, Pittsburg; structural steel, Keystone Bridge Works, Pittsburg; galvanized iron and skylights, T. W. Irwin, Allegheny; slating, Aiken & Co., Pittsburg; painting, Cluley



ROTH & ECK FAN MOTOR.

& Sons, Pittsburg; plumbing, McFadden & Craig, Pittsburg.

## Roth & Eck Fan Motor.

The fan motor season is opening well, the supply houses reporting a lively demand for these conveniences. Roth Bros. & Co. of Chicago are in the market with the neat and compact outfit illustrated by the accompanying cut. This fan motor is well made, with a Gramme ring armature and an especially large commutator, giving ample brush surface. The carbon brushes can be moved along the surface of commutation, making three distinct contact points if necessary. The bearings are self-oiling and require attention but once in two weeks. The speed can be regulated with a switch to give 2,000, 1,400 or 800 revolutions per minute.

## Adams-Bagnall Electric Company.

A company for the manufacture of electrical apparatus has recently been organized in Cleveland, Ohio, which is worthy of more than a passing notice. The man whose name heads the new company, Thomas E. Adams, has been with the Brush Electric company of Cleveland a great many years. He is what is termed a practical inventor; that is, the new idea must put in concrete form some decidedly advantageous or meritorious point in the device, and be accompanied by a reduced cost of manufacture. The usual inventor is one who thinks of the cost of manufacture only after everything else has been considered. Mr. Adams always studies the practical side of the device upon which he is at work. The famous Brush-Adams arc lamp, for instance, is claimed to be the sole production of Mr. Adams. It has very many points of superiority about it, which were obtained from an extended practical investigation. Mr. Adams consulted a great many trimmers, who gave him ideas as to what was needful in an arc lamp during all kinds of weather and in all seasons. He then proceeded to obviate the difficulties actually encountered by these men in the Brush-Adams lamp. The success which that lamp has met in the market tells how well he has done his work. Mr. Adams is one of the incorporators of the new company, and he will give his immediate attention to the production of a new arc lamp.

E. J. Bagnall was with the Brush Electric company for eight years and during that time occupied a number of prominent positions, passing through all the practical branches of the factory. For the last seven years he has been in St. Louis, building and operating electric light plants and stations with great success. He was one of the founders of the St. Louis Engineering company and consulting engineer for the Lindell Railway company, which road he built and equipped with electric power. Mr. Bagnall has been called back to the Brush company and retained by them several times as an expert in the development of railway systems, and on other matters. It is believed that the incorporation of these two names, Adams and Bagnall, will result in the production, literally, of A. B. apparatus in simplicity as well as in name.

The other men who are associated with this combination are: L. H. Rogers, formerly assistant general manager, Brush Electric company, and general manager of the Sperry Electric Railway company; C. W. Phipps, superintendent of the Brush Electric company; S. E. Cox, secretary and practical manager of the Swan Incandescent Lamp Manufacturing company; George Arnold, head of the drafting department of the Brush Electric company.

Mr. Rogers is widely known over the United States. He has been with the Brush and General Electric companies for six years and has been a successful salesman.

Mr. Phipps has been with the Brush Electric company almost from its incorporation. He was sent to Europe in its interest when the Anglo-American Brush Electric company of London, England purchased the European patents. Mr. Phipps was also sent to Japan by the Brush company when it started the development of electrical industry in that country. He has had a very wide experience in the electrical field, especially in the construction and operation of electric plants, and latterly in the superintendence of the large factories of the Brush company. For a great many years Mr. Phipps has had a large force of men under his supervision.

Mr. Cox has, for a number of years, been in the incandescent lamp department of the Brush Electric company. This company has been a separate organization under the name of the Swan Incandescent Lamp Manufacturing company, but it has always been managed in connection with the Brush company. Mr. Cox has proven himself a valuable manager in this department for the Brush company.

Mr. Arnold has also been connected with the Brush Electric company for a great many years and has held various positions of responsibility. His last connection with that company has been at the head of the drafting department, in which position he has shown a decided aptitude in the line of dynamic engineering. He has been of very valuable assistance in the development of the large arc dynamos now being built by the Brush Electric company.

Associated with the men named are quite a number of Cleveland capitalists, including Charles G. Hickox and George W. Howe, business men of very high standing, who are taking an active interest in the development of the company.

Regarding the output of the company, nothing definite can be officially stated at this time. It is positively known, however, that it will make arc lamps, incandescent lamps, and, possibly, railway motors.

The officers of the company recently elected are as follows: President, Charles G. Hickox; vice-president and treasurer, George W. Howe; manager, L. H. Rogers; secretary, S. E. Cox; superintendent, C. W. Phipps.

The company has leased the factory, 47 East Prospect street, built for a manual training school and formerly occupied by the Hackney Bicycle company, and is now arranging for the equipment of the factory. The company is organized under the laws of the state of Ohio with a capital stock of $150,000.

## Wiring Distribution Patents.

The Westinghouse company is particularly active at present in advancing the claims of its patents through the courts. The General Electric and Stanley companies have been sued for alleged infringement of multiphase motor patents and now the Fort Wayne company is made defendant in a suit over distribution systems. The *Indianapolis Sentinel* of April 27th says:

The Westinghouse Electric & Manufacturing company of New York yesterday filed in the United States court a suit for an injunction against the Fort Wayne Electric corporation. The suit involves the validity of patents used in the system of distributing electricity and grows out of alleged infringements on patents owned by the Westinghouse company. The Westinghouse company uses, under assigned patents, the invention of William Stanley, Jr., of Great Barrington, Mass., which is known as the "series" system. The Fort Wayne company uses the invention of Marmaduke M. Slattery, which is known as the "multiple" system.

In 1888 the commissioner of patents was called upon by the Westinghouse people to decide as to the rights of the two inventions. The commissioner held that there was interference between the two patents and that the Stanley invention was the first patented.

Notwithstanding this ruling, the Westinghouse company claims in its complaint filed yesterday that the Fort Wayne company is still using the alleged invention of Slattery, which, it is claimed, is greatly to the injury of the plaintiff, the owner of the original invention. It is asked that a decree be entered, declaring the letters patent issued to Slattery to be null and void.

## BOOK TABLE.

ELECTRICAL BOATS AND NAVIGATION. By Thomas Commerford Martin and Joseph Sachs. New York: C. C. Shelley. 1894. Price, $2.50.

In this volume Messrs. Martin and Sachs treat of a branch of the electrical industry which has an especial and intrinsic interest of itself, with the additional merit of taking the general electrical student over what, so far as book-making is concerned, is practically new ground—or water. As the sea, the lakes and the rivers, with all forms of water transportation, have a peculiar charm of their own, a book dealing with the ideal method of propelling vessels, without sails or furnaces, has in it elements of popular interest which are of necessity lacking in the multitude of books treating of more prosaic electrical subjects. The chapter on "Submarine Electric Torpedo Boats," for instance, is as attractive as a novel, and indeed to many a reader it will recall the spell-bound hours of boyhood spent with Jules Verne's *Captain Nemo* in his memorable journey of "Twenty Thousand Leagues Under the Sea." But although the book is of exceptional popular interest for an electrical treatise, the care to secure accuracy of technical detail is evident throughout, and the work may be accepted as a careful and thorough record of what has been accomplished up to this time in propelling vessels by electric power. Mr. Martin has had general charge of the preparation of the book, and the clear and graceful literary style of this pleasing writer is a conspicuous element of merit. Mr. Sachs contributed the chapters on canal boat propulsion, which are timely and valuable. The volume contains a large number of illustrations and is certainly a distinct gain to electrical literature.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, May 4.—Amid the maledictions heaped on the trolley railways of this vicinity and all concerned in their operation, owing to the surprising number of accidents that have marked the introduction of this form of rapid transit, it is refreshing to encounter an occasional act of life-saving on the part of an employe that wins the praise of the public. The *Tribune* relates a bright incident of this character that happened yesterday: "The life of Howard Butler Don, aged five, was saved yesterday by the coolness of the motorman of trolley-car No. 160, of the Bayonne (N. J.) line. His name is not known, but Don's parents are anxious to find him, in order that they may reward him. They live at No. 111 Ocean avenue, Jersey City. The boy was playing in the street and wandered on the track. The motorman saw him, stopped the car and drove the boy off. The car had only fairly started when the boy ran on the track again, so close to the car that it could not be stopped. The motorman dropped the fender, which caught the boy, and the motorman hauled it up by the chain and lifted the boy to the platform. Then he stopped the car and sent the lad home in charge of a larger boy. Several persons who witnessed the act warmly applauded the motorman, and he went on his way with a happy smile."

Another conspicuous instance of presence of mind on the part of a motorman occurred the other day in Rockland, Me., and although some distance from the district served by the electric railway companies of the metropolitan district, is worth noting. A Mr. Perry, who is very deaf, was walking on the track and could not hear the alarm. Motorman Linnell, seeing that the man made no attempt to get off the track, reversed the motor, but as the rails were slippery, this did not bring the car to a stop. Realizing the danger, Linnell leaned forward over the dasher, caught Mr. Perry under the arms and held him against the dasher until the car stopped. By this action the life of the pedestrian was undoubtedly saved.

After contemplating instances of heroism like these, one is fortified in some measure for the news that the Brooklyn Heights Railroad company has been indicted for manslaughter. The crime charged is the killing of Mrs. Mary Mediuger in front of St. Paul's Church, on Court street, on the night of March 20th last. In reciting the duty of the indicted company the presentment states: "It was the duty of said corporation to carefully, skillfully and cautiously operate, manage and direct the operation of said vehicles, commonly called trolley cars, when the same were in transit upon the streets and highways of the city of Brooklyn; and to propel, operate and run said cars at a reasonable, cautious, careful, safe and proper rate of speed, so that the lives and safety of the citizens of the said city of Brooklyn, passing and repassing along, upon and across the streets and public highways of the city of Brooklyn, used and occupied by said corporation as a railway, should not in any wise be endangered by reason of such occupancy and use. The Brooklyn Heights Railroad company, on the day and year aforesaid, unmindful of its duty, as hereinbefore set forth, did willfully, knowingly and feloniously neglect so to do." Because of this culpable carelessness the presentment says that Mrs. Mediuger was killed. The presentment also touched upon the question of fenders for the trolley cars as follows:

In this connection we beg also to present our opinion that the fenders in use on the trolley cars operated in the city of Brooklyn are not a proper and sufficient protection to human life, and that the wheel-guards on the cars of all the companies are of little or no value in preventing loss of life. We would, therefore, call the attention of the State Legislature now in session at Albany to the necessity for the immediate passage of a law requiring the adoption by all surface railroads, whether operated by horse, trolley or cable, of the best available safeguards for the protection of human life and limb.

The company is indicted as a corporation. The corporation as such is represented by its executive officers, viz., president, vice-president, secretary, manager and board of directors. These, however, are not personally liable. Because the corporation as such is an inanimate, artificial creation, it cannot be punished by imprisonment. The highest punishment possible is a fine of $5,000, which can be lessened by the judge down to 1 cent.

The rapid transit tunnel road seems to be now assured for New York. Governor Morton has signed the Hamilton-McMahon bill, permitting the rapid transit commissioners to spend an additional $5,000,000. Mayor Strong approved it after a hearing last week.

At a special meeting of the Edison Electric Illuminating company on Wednesday it was decided to issue 100-year gold bonds to an amount not to exceed $15,000,000, bearing a rate of annual interest to be determined upon by the directors. The rate, however, is not to exceed 5 per cent.

W. F. O.

## St. Louis, Mo.

ST. LOUIS, May 3.—During the latter part of the annual session of the Municipal Assembly a number of electric railway ordinances were passed, all of which have been signed by the mayor. The following is a brief outline of these ordinances:

The Florissant Avenue Electric Railway company is authorized to build an electric railway on Florissant avenue from Calvary avenue to Robin avenue at the city limits near Baden. A semi-annual tax of two and one-half per cent. of its gross earnings up to July, 1906, and five per cent. from that time up to the termination of the franchise, July, 1910, is required. The road will connect with the Benton-Bellefountain division of the Union Depot company's system, and transfers will be given to and from that line.

The Jefferson Avenue Railroad company is authorized to change its motive power to electricity. This road extends from Geyer avenue to the Fair Grounds and is the oldest cross-town line in the city and the only city line using horses. For this franchise the company is required to pay an annual tax of two per cent. of its gross earnings from $75,000 up to $125,000; two and one-half per cent. of gross earnings from $125,000 up to $150,000, and three per cent. of all gross earnings in excess of $150,000.

The Kings Highway Railroad company is authorized to build an electric railway on Kings Highway from Old Manchester road southwardly to Devonshire avenue, thence westwardly to Wherry avenue. Transfers will be given to connecting lines. For this franchise the company is required to pay a semi-annual tax of two and one-half per cent. of its gross earnings up to 1907, and five per cent. from 1907 to the expiration of its franchise, April 4, 1925.

The Union Depot Railroad company is authorized to extend its Tower Grove branch westwardly from Kings Highway along Arsenal street, Sulphur avenue, Old Manchester road, Columbia avenue and Tamm avenue to Clifton Heights; also a branch road from Old Manchester road along Watson road, Scanlan avenue and McCausland avenue to the city limits. Switches will be built into the grounds of the several eleemosynary institutions of the city located along this route, and the ambulance car will be run directly to these institutions. For this franchise the company will pay to the city $1,000 per annum from January 1, 1900, to 1910, and $2,000 per annum from January 1, 1910, to 1920, and $3,000 per annum from 1920 to the termination of the franchise.

The Lindell Railway company is authorized to extend its Chouteau avenue division, which now terminates at a point in the southeast corner of Forest Park, southwestwardly through the corner of the park to private property along the south side of the park and westwardly along this private property to the city limits, where connection will be made with the St. Louis and Kirkwood electric Railway. For this franchise the company agrees to pay $1,000 annually from 1897 to 1900 and $3,000 annually from 1900 to 1914.

An ordinance was also passed prohibiting minors under the age of 15 years from getting on or off any street car while the car is in motion.

The Adams electric railway patent case has been appealed to the United States Court of Appeals and is set for hearing at St. Paul June 18th.

The Grand Avenue railroad, which was partly built last year and was purchased by the Union Depot Railroad company, has been finished and put into operation as a division of that road.

The St. Louis & Kirkwood Electric Railroad company has completed its right of way from Kirkwood to the city limits, where connection will be made with the city lines. This road will be an air line to Webster and Kirkwood. The entire line is located on private property. The grades are all easy, not greater than 3 per cent. Contracts for construction will be let at an early day.

The Union Depot Railroad company has let a contract to the General Electric company for a 1,500 kilowatt generator. This machine will weigh 180,000 pounds and will be directly connected to two Allis engines, 36 by 60 inches, running at 75 revolutions per minute. One hundred motor cars have also been ordered.

B. E. Sunny, western manager of the General Electric company, Chicago, was in town recently in the interests of the company.

R. J. H.

## Northwestern Notations.

MINNEAPOLIS, May 4.—Joseph Kinnen, a 20 year old boy in St. Paul, was prompted to examine a large box through which a number of electric wires pass on top of the Union block. In making his way to the box he grasped with both hands one of the wires under which he was passing and was instantly killed. The wire belonged to the St. Paul Gas Light company.

Receiver S. D. Livermore, of the General Electric company of Winona, Minn., is giving the line a general overhauling both for the electric light system and for the street cars.

The Board of Fire Commissioners of St. Paul has adopted a resolution recommending the council to pass an ordinance to inspect all buildings, and where the wiring is found defective to compel the owners to put them in good condition.

The Ishpeming, Mich., telephone exchange was burned out by a telephone wire becoming crossed with a trolley wire.

Harry McGill, a lineman for the People's Light company, grasped a live wire on a pole and lost his hold on the pole, falling about twenty feet. The fall killed him.

A. H. Hill of Winona, Minn., has bought the electric light plant at Owatonna, Minn.

The Minneapolis city council has passed the new wiring ordinance. This entails a good deal of extra expense to electrical companies.

A telephone wire crossing a trolley wire in Marquette, Mich., burned out the telephone exchange and deprived the city of service for three days.

The Iowa Falls Electric Light company of Iowa Falls, Iowa, has been incorporated by L. B. Bradley, H. C. Miller, J. D. McKay, Z. K. Hoag and George A. Courtney, with $15,000 capital stock. It will probably turn on the light by May 1st.

The Wisconsin Telephone company will rebuild its exchange at Manitowoc, Wis.

Residents of Itasca, a suburb of Superior, Wis., want the electric car line extended to them.

The telephone line between Lake Winnebegosbish and Grand Rapids, Minn., is completed and in operation.

The Capital Telephone company of Pierre, S. D., will begin work on its exchange the latter part of the month.

The Marshall Telephone company of Marshalltown, Iowa, has been organized and is taking bids for constructing the exchange.

The General Electric company of Davenport, Iowa, secured the contract for wiring the Orphan's Home for electric lights.

Moorehead, Minn., is figuring on putting in an electric light plant.

Windom, Minn., will vote on bonding for electric lights and water works soon.

The Steele County Telephone company of Hope, N. D., is taking bids for hauling and distirbuting and setting poles for the line between Sherbrooke and Hope, N. D., to be completed by June 10th.

An electric light plant is being put in at Independence, Iowa, in connection with the water works, under the supervision of A. D. Guernsey.

In the suits brought by H. B. Moore, receiver for the Great Western Manufacturing company, in the United States court in Duluth, Minn., against the Great Western Manufacturing company, the American Loan & Trust company and the Electrical corporation, the Great Western's answer to the charge of the receiver is that the company was not insolvent at the time 100 shares of its stock and a trust deed was given to the loan and trust company, that it was done in the usual business method, and was not without the consent and knowledge of the directors. The other defendants make similar answers.

The Mankato Gas & Electric Light company of Mankato, Minn., proposes to put in a plant to supply incandescent light and to reduce rates for commercial lighting soon.

The Bathgate Consolidated Electric Light company of Bathgate, N. D., has been reorganized as the Bathgate Consolidated Electric Light, Water Supply & Power company.

The Ackley, Minn., town council and the electric light company are at variance, and the council will use incandescent lights in place of arcs.

The new electric car line in West Green Bay, Wis., will be extended to De Pere, if a favorable franchise can be secured.

In the case of Edwards, assignee of the St. Paul Electric Manufacturing company, against the Pioneer Fuel company, a decision was rendered for the plaintiff. The electric company, prior to becoming insolvent, admitted judgment in favor of the Pioneer Fuel company for $1,400, and the assignee sued to have it set aside, claiming the electric company knew it was insolvent and had done so in order to evade the claims of the other creditors. It was tried in the District Court and judgment rendered for the defendant; appealed to the Supreme Court and remanded back for a new trial. This time the District Court, in accordance with the ruling of the Supreme Court, returned a judgment for the plaintiff.

I. R. Serrin, of the Glenwood Roller Mills of Glenwood, Minn., has made a proposition to the village council to light the town, and it is probable that it will be accepted.

M.

## PERSONAL.

William Taylor, formerly with the Electrical Supply company and more recently of the firm of Taylor, Dee & Mack of Chicago, has removed to New York to take a responsible position in the business office of the *Electrical World*.

Charles L. Tolles, of the Jewell Belting company of Hartford, Conn., and Miss Annie Louise Roberts were married at the home of the bride's parents in Hartford, on April 24th. Mr. and Mrs. Tolles will be "at home" on May 29th and June 5th and 12th at 18 Marshall street, Hartford.

## TELEPHONE.

The Progress Telephone & Telegraph company, West Milton, Ohio, has been incorporated for the purpose of constructing and operating a system of exchanges and trolley lines.

## MISCELLANEOUS.

The Philadelphia Economic and Commercial Museum, a municipal institution established by the city of Philadelphia, has opened a scientific and experimental department, in which a careful study of the scientific value of all products collected will be made. New tan barks will be carefully examined; woods will be studied with reference to their strength, durability and capabilities of finish; gums and resins will be tested for improved varnishes and lacquer. Many new vegetable fibers will be investigated with reference to new applications, and in general new articles will be subject to scientific investigation for the purpose of determining their commercial and educational value. Through the publications of the department, the institution will cooperate and exchange with all other scientific and educational museums of the world.

## TRADE NEWS.

The Auerbach-Woolverton Electric company announces that it has removed its office from New York to 113 and 115 Adams street, Hoboken, N. J., where its factory is located.

The Clark Electric company has removed its office from 192 Broadway to 478 and 480 Pearl street, New York, where the factory is located, and to which address all communications should now be sent.

A complete catalogue of the presses, dies, lathes, etc., manufactured by the Ferracute Machine company of Bridgeton, N. J., has just been issued. Over 300 sizes and kinds of presses are described, and the work is valuable to all interested in machine shop practice.

The Ball & Wood company, engine builders of New York, represented in Chicago by C. E. Sargent, has removed its Chicago offices to No. 404 Fort Dearborn building, where all communications in future should be addressed, and where Mr. Sargent will be very pleased to see all his acquaintances.

Wells' patent balanced compound and quadruple expansion engine, manufactured by the Wells Engine company, 91 Liberty street, New York, is completely described in a recent pamphlet sent out by the company. This type of engines is adapted for both stationary and marine work, and is said to have many advantages. Much stress is laid on the principle of balancing forces.

The United Electric Improvement company, manufacturer of complete central station equipments, with office at Nineteenth street and Allegheny avenue, Philadelphia, calls particular attention to its improved long-distance series apparatus and incandescent lamps to be wired in series for all systems and for any current, candle power or base. It frequently is necessary to make use of series incandescent lamps, and to all such users the United Electric Improvement company offers great advantages.

The Electric Appliance company reports a large business in special Paranite cables for telephone work. The company recently delivered a large number of several hundred conductor cables of considerable length and has a number now under way. As the Paranite factory is located in the West, the Electric Appliance company has the advantage of being able to make more prompt deliveries on special work of this kind than is possible where the goods have to come from eastern factories. As nearly all of the new telephone plants are installed in a hurry, this matter of prompt delivery is an important item.

The Sprague Electric Elevator company of New York is rapidly filling up with work, to such an extent that new men are taken on in several departments at the factory, in order to meet the rapid increase of trade. Among the recent sales is the entire elevator plant of the Hotel Walton, which is in course of erection in Philadelphia, and is expected to be one of the finest hotels in the country; this contract was given after one of the hardest contests in this line of business for several years. This concern has also substituted electric elevators for the hydraulic plant in the Havemeyer building at 126 Liberty street, New York.

The Columbia Incandescent Lamp company of St. Louis is jubilant over the result of a photometric and efficiency test of lamps made by Pierce & Richardson, electrical engineers for the architects of the new Music Temple in Chicago. Samples for testing were asked under these conditions: "No lamps will be considered that have not efficiency of 50 watts per 16 candle power, and 62½ watts per 20 candle power. Guarantee will be asked for as to maintenance of candle power after 300 hours' run; also guarantee as to length of life. A sample of each style must be furnished, which will be subjected to photometric and efficiency tests. Lamps taken at random from lots furnished by the successful bidder will be subjected to test to compare with sample submitted and guarantees made." The Columbia company secured the contract. This is one of the first instances of awarding a lamp contract by specifications and sample test.

## BUSINESS.

H. F. Tate, western manager of the National Conduit Manufacturing company, with offices at 656 Rookery, Chicago, reports excellent prospects for some large orders for his company. Mr. Tate is pushing the National conduit energetically, and has met with good success.

The Pennsylvania Electric Engineering company of Philadelphia has resumed the manufacture of "the Pennsylvania lamp" and is prepared to sell in competition with any other lamp now on the market. The first aim is quality, which means efficiency and long life. The company will carry in stock all standard sizes for any voltage to fit any socket.

An illustrator for the electrical fraternity exclusively is the latest addition to the ranks of Chicago's electrical industries. H. J. Sinclair, who has been for years identified with the constructing and operating end of the business, has gone into the illustrating of advertisements, catalogues, etc., for electrical people. He has an office in the Marquette building, Chicago.

The Electric Appliance company is getting a large share of the telephone supply business, which just at present constitutes a very considerable part of the demand for electrical supplies. The fact that this company carries in stock in Chicago a large stock of telephone line material, such as cross-arms, insulators, etc., and can ship almost any kind of an order promptly from Chicago, gives it a great prestige, which counts for much in the telephone business, nearly all of which to-day is being done in the quickest possible manner.

The Louisville Electrical Works of Louisville, Ky., write that they did not, until within the past two weeks, appreciate how great a demand there was for a really superior transformer. Their Phoenix transformer was only placed on the market some three weeks since, at which time it was fully described in the columns of the WESTERN ELECTRICIAN, but such is the demand already created for this transformer that the company is running its factory at night in order to fill orders promptly, which is a good evidence of the excellence of its apparatus.

James J. Pearson of the Capo-farad Battery & Appliance works, New York, makes the following announcement: "The demand for the Capo-farad battery having outgrown the existing facilities of supply, I have decided to extend the manufacture, and to carry on the same under my individual responsibility. I have therefore established works where the Capo-Farad and other of my patents will be manufactured entirely under my own personal supervision and control. To those who have already used the Capo-farad I promise a good and reliable article, together with fair treatment, and to those who have not yet used it, the same promise stands."

Among the concerns that are making a special effort in the production of high class series incandescent lamps is the United Electric Improvement company, Nineteenth street and Allegheny avenue, Philadelphia. The alternating machinery and long-distance series incandescent apparatus of this company are too well known to require description, and backed by the company's reputation for making high class machinery, its lamp business should unquestionably prosper. Word has been received from General Manager Walter F. Smith to the effect that the company is now making new discounts on standard series incandescent lamps for all systems and for any current, candle power or base.

The Crane company, Chicago, has secured the order for the extra heavy steam valves to be used in the Detroit Citizens' Railway power house. The Crane company is making a high class of appurtenances applicable to heavy steam piping and is meeting with success in this connection in electrical power station work. Some of the largest electric light plants in this country have been equipped with the Crane company's valves and other steam appliances. The energetic manner in which this branch of the company's business is being brought to the front would seem to indicate that the merits of the Crane specialties are highly appreciated by electrical engineers. C. A. Hurd is pushing this branch of the business.

A visit to the works of the Ball & Wood company of New York shows engines on the floor in preparation for many western as well as eastern points. Mr. Sargent, the Chicago representative of this company, has just obtained contracts for several cross-compound Ball & Wood engines for the new Milwaukee city hall. These engines are also being installed in the Temple of Music, Chicago, Grace Hotel, Fort Dearborn building and for Morgan & Wright. In St. Paul the Ball & Wood engine recently placed in the Manhattan building by Mr. Kenyon is attracting very favorable attention. This engine is directly coupled with a Western Electric dynamo, and performs not only very smoothly and noiselessly, but with very close regulation. In New York the list of recent sales of Ball & Wood engines embraces the equipment of the new St. Luke's Hospital on the Heights of Morningside Park, a second engine for the Forty-second street house of the Manhattan Storage Warehouse company, several engines for the New York Central Railroad for the new station at Syracuse, these to be connected with Eddy dynamos. Stoutenburgh & Co. of Newark are also putting in two of these engines, and the Danbury & Bethel Railroad company of Danbury, Conn., is having a second 425 horse power cross-compound built for its roads.

The Essen Coal company of Pittsburg, which is largely controlled by Picands, Mather & Co., the well-known iron and coal shippers of Cleveland, Ohio, has just closed a contract with the Independent Electric company of Thirty-ninth street and Stewart avenue, Chicago, for a complete plant for mining and hauling the coal in their No. 2 and No. 3 mines at Hazeltine, Pa. This is undoubtedly the largest plant ever considered for bituminous mines. It will cost between $60,000 and $80,000, and is intended to produce 2,400 tons of mine run coal per day. The equipment consists of 600 horse power in boilers, three 200 horse power engines, three 150 kilowatt dynamos, two 80 horse power locomotives, station equipment and circuits, and 16 of the Independent chain breast machines. The management of the coal company and its superintendent have been making an exhaustive investigation of "machine mines" in Ohio and Pennsylvania, and are fully satisfied as to the excellence of the machinery decided upon. The Independent Electric company was the first to recognize the superiority of the chain principle over the old form of machines, and has broad patents covering the salient features of its machines. It is encouraging to note even in these times that some companies are ready to invest money in machinery when satisfined that they can make money by so doing. Picands, Mather & Co. have largely made their money by keeping abreast of the times and adopting modern appliances, and this latest move is only what might have been expected. The coal company is to be congratulated upon its enterprise and the Independent company upon securing the order.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued April 30, 1895.*

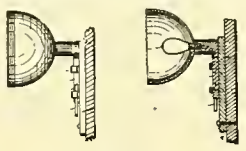
538,243. Changeable Electric Headlight. William Dibb and Frank C. Korabeck, Syracuse, N. Y. Application filed March 19, 1894.

A headlight is illustrated herewith, comprising a contact board, spring fingers normally in circuit with wires connected to them, a second negative pole upon the board and a reflector stem adapted to break the circuit through the fingers, and make it through the positive pole of the circuit and the second negative pole, and a lamp connected to the poles.

538,246. Range Finder. Bradley A. Fiske, U. S. Navy. Application filed September 25, 1894.

In a range finder there are two bodies of conducting material, contact fingers moving over these bodies, sight-bars or telescopes, mechanism for imparting to the fingers movement over the bodies bearing a relation to the angular displacement of the respective associated telescopes, and a Wheatstone bridge circuit as described, including the bodies, contact fingers and an indicating instrument, means for varying the place of contact on the fingers on the conductors, corresponding to definite positions of the telescopes and thereby compensating for variations in resistance per unit length in the conductors.

538,247. Electrical Signaling System. Bradley A. Fiske, U. S. Navy. Application filed December 20, 1894.



NO. 538,243.

This apparatus includes a conductor, in circuit and, at a distant station, an indicating instrument having its terminals electrically connected by line to two points on the conductor, one of the terminals being fixed and the other being movable on each side of the fixed terminal; whereby the index of the indicating instrument is caused to move in a direction corresponding to that of the movement of the movable terminal and over a distance depending upon the fall of potential on the conductor between the terminals.

538,271. Electrically and Chemically Heated Crucible. Henry G. O'Neill, Boston, Mass. Application filed March 24, 1894.

In electro-chemical heating devices, the combination is claimed of a comminuted mixture of diatomaceous earth and carbonaceous material with electric circuit devices arranged to send a current through the same.

538,272. Electrical Cigar Lighter. Henry G. O'Neill, Boston, Mass. Application filed August 27, 1894.

This invention comprises the combination of a hollow handle with conductors forming part of an electric circuit and extending within the same, springs connected to the conductors, a pair of contact plates, a switch bar and buttons arranged to press the springs into contact with the plates for closing the circuit, a resistance extending across the mouth or open end of the handle, and electric connections between the contact plates and the resistance.

538,275. Electrical Brake. Carl E. Pearson, St. Louis, Mo. Application filed April 2, 1894.

A moving element, a core provided with a polar-extension, coils on the core at different points from the polar-extension, means for cutting in the coil farthest from the polar-extension, and each coil thereafter in succession.

538,281. Brush Holder. Edward D. Priest, Lynn, Mass. Application filed August 25, 1892.

The stationary part of a brush holder, a socket piece for the brush, and parallel flat spring arms pivotally connecting the socket piece with the stationary part.

538,284. Thermal Cut-out Device. Charles A. Rolfe, Chicago, Ill. Application filed February 21, 1895.

The first claim reads as follows: The combination in a thermal cut-out of a body of fusible material, a section of circuit conductor removably held in circuit and comprising a wire of high resistance in part coiled within the fusible mass and a holder for the wire having contacts with which the wire is connected, and a spring or weight normally held in tension by the fusible mass and arranged to throw the movable section of circuit conductor away from its co-operating contacts and out of circuit when it is released by the fusion or softening of the mass of fusible material.

538,289. Manufacture of Carbon for Electrical Purposes. Charles P. Shrewsbury, London, and John L. Dobell, Modbury, England. Application filed September 10, 1894.

In the manufacture of carbon from carbonaceous matter, combining anthracite coal, bituminous coal and tar or pitch or tar and pitch in such proportions as to constitute a material which contracts when exposed to heat, submitting the same to pressure and baking the articles formed therefrom

538,292. Switch Operating Mechanism. David Strickler, Wrightsville, Pa. Application filed September 4, 1894.

The combination with an operating lever, of yielding gripping arms, a yoke to move upon the arms, to close the same, a spring to actuate the yoke, and a releasing device to liberate the person.

538,295. Trolley. Judson D. Swacick, Canton, Ohio. Application filed October 29, 1894.

The combination in a trolley of the supporting frame, having secured thereto inwardly directed conical or tapering spindles, a wheel having in the sides thereof tapered sockets or bearings, an oil reservoir, an inside oil chamber, and means for securing the spindles and bearings in desired adjustment.

538,325. Means for Ventilating Electric Motors on Cars. James J. Devine, Clifton Heights, Pa. Application filed March 14, 1895.

The cut shows an electrically propelled car, having a conduit arranged in and extending the length of the under part of the car and provided at its ends with caps which may be opened and closed as desired, and flexible connections between the pipe and the lids of the motor box and opening from the motor box into the main pipe.

538,327. Telephone Central Office System. Ezra T. Gilliland, Pelham Manor, N. Y. Application filed June 5, 1894.

The arrangement illustrated includes an annunciator and an associated plug-socket switch for each subscriber's line, each switch having two contact pieces connected with the same main line circuit conductor but at different sides of the annunciator magnet, a pair of plug connectors adapted to enter and engage with the plug socket switches of any two lines, and thereby to unite the two lines into a through circuit, the plugs being respectively constructed to connect with but one of the contact pieces in one socket switch, and with both in the other socket switch, whereby the associated magnet of one of the lines is included in, and that of the other excluded from the through circuit.

538,328. Magneto-transmitter. Ezra T. Gilliland, Pelham Manor, N. Y. Application filed June 5, 1894.

A magneto-transmitter is described, consisting of a mouthpiece and a permanent magnet, the latter being provided with a pinion, and mounted on a guide rod carrying a rack which engages with the pinion whereby the magnet can be raised and lowered on the guide rod.

538,329. Magneto-generator. Ezra T. Gilliland, Pelham Manor, N. Y. Application filed November 28, 1894.

This invention comprises a frame of magnetic material having a bracket provided with a support for the shaft of a driving wheel, and two legs which carry pole pieces on their ends, the whole being a single casting

538,344. Armature for Dynamos and Electric Motors. Harry Penn and Loftus Lowndes, London, England. Application filed August 13, 1894.

In armatures of dynamos and electric motors, corrugated sheet iron disks are employed in combination with corrugated end plates.

538,345. Dynamo-electric Machine or Electric Motor. Edwin H. Porter, Radford, Va. Application filed August 11, 1894.

A dynamo or motor consisting of a single magnetic frame having six pole pieces with coils and armatures embraced therein in such relation that each has a four-pole field.

538,351. Electric Engine. Luther M. Sabin, Washington, D. C. Application filed April 27, 1894.

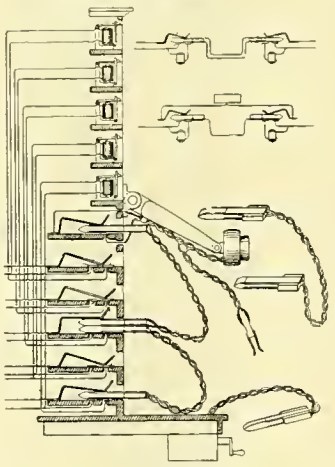
In an electro-magnetic engine there is the combination, with a tubular electro-magnet and means for shunting the current through the coil of the same, of an armature magnet, having a spool of dielectric material, at one end, wound with insulated wire and connected by suitable conductors with a source of electrical energy.

538,357. Underground Electric Railway. John F. Smith, New York, N. Y. Application filed August 15, 1894.

This conduit consists of H-shaped sections arranged end to end, and slot-rails provided with parallel flanges which receive between them the upper edges of the sections.

538,359. Process of and Apparatus for Making Compressed Electrolytic Copper. Francois L. M. Urruty, Paris, France. Application filed May 2, 1894.

In an apparatus of the character described the combination is claimed with a suitable tank of an anode, a cathode consisting of rolls in contact, arranged one above the other, the upper roll being freely suspended and bearing its weight upon the lower roll, and circuit connections.



NO. 538,327.

538,373. Conduit System for Electric Railways. Frank H. Homan, Brooklyn, N. Y. Application filed April 24, 1894.

A conduit, sectional conductors extending along within the conduit and having insulating joints between their ends, the counterbalance lever having forked branches insulated from each other for supporting the ends of two conductors separated by one of the insulated joints, and insulated prime conductors having branch conductors located intermediate of the insulated joints extending up into position to be engaged by the sectional conductors, the branch conductors having cup-shaped upper portions for causing an extended electrical connection between the sectional conductors and the branch conductors when the sectional conductors are depressed.

538,377. Electric Elevator. Nils O. Lindstrom, Brooklyn, N. Y. Application filed February 26, 1895.

An electric elevator comprising a shunt-wound driving electric motor, means on the car for controlling the motor circuit, an auxiliary reversely wound motor coil, and a switch on the car connecting it in circuit to gradnate the speed.

538,390. Trolley Breaker. Walter R. Scott, Buffalo, N. Y. Application filed December 19, 1894.

A hanger or coupling having an end piece provided with a longitudinal eye formed integrally therewith and adapted to receive a wire and having in rear of the eye a pair of upright ears separated by a space which receives the end portion of the wire, and front and rear pins connecting the ears, the wire being bent around the rear pin, and the front pin bearing upon the doubled end of the wire

538,391. Trolley Wire Hanger. Walter R. Scott, Buffalo, N. Y. Application filed March 5, 1895.

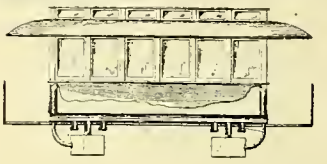
The combination with the body of the banger provided with a seat for the trolley wire, of a pair of cams or eccentrics pivoted to the body above the seat, and a lock engaging with the cams or eccentrics.

538,408. Electric Transmission Wheel or Trolley. Charles C. Burton, Pittsburg, Pa. Application filed August 11, 1894.

An electric current transmitting or trolley wheel having a rigid rim, a series of yielding contact blocks mounted in the rim, a separate current collecting plate within the rim with which the blocks are in contact, and a conductor extending from the annular plate to the wheel hub.

538,409. Trolley Wheel. Charles C. Burton, Pittsburg, Pa. Application filed August 24, 1894.

One of the claims follows: An electric current transmitting or trolley wheel having a rigid rim, a series of yielding contact blocks around the periphery of the rim, lugs on the blocks, and retaining rings having recesses formed therein secured to the rim, the lugs entering the recesses and adapted to move back and forth therein.



NO. 538,325.

538,417. Magnetic Ore Separator. James Houlehan, Chicago, Ill. Application filed June 6, 1894.

In a magnetic ore separator there is claimed the combination of a movable magnet and an armature forming an interposed ore passage.

538,423. Electrical Coupling. Morris F. Koenig and Ira Mann, Hazleton, Pa. Application filed October 15, 1894.

This coupling comprises hollow portions to receive the ends of the wire, and interlocking portions embodying a triple spring tongue.

538,454. Telephone Switch. Albert F. W. Meyer, Blue Island, Ill. Application filed January 11, 1895.

This device comprises a base carrying main-line terminals, yielding contacts connecting the terminals in the main line or to ground respectively through the secondary winding of the induction coil and the signaling instrument circuit, a local battery terminal and a yielding contact connecting it with the transmitter circuit and a spring controlled electrically non-conductive switch lever provided with a support for the receiver and extending at one end between the contacts so connecting the main line terminals and at its opposite end adjacent to the contact so connecting the local battery termioal, whereby turning the lever in either direction forces one contact against an adjacent main line terminal and releases the other from the terminal adjacent to it, and controls the contact adjacent to its opposite end to force it against or release it from the adjacent terminal, according to the direction of turning the lever.

538,457. Electric Arc Lamp. John A. Mosher, Chicago, Ill. Application filed February 9, 1893.

One claim follows: The combination with the poles of an electro-magnet or magnets of a rotatable armature mounted between the poles, the armature consisting of a number of plates successively overlapping each other, devices for supporting the carbon pencils, devices connecting the armature with the pencils in such a way that the length of the arc may be regulated by the rotation of the armature.

538,474. Art of and Apparatus for Transmitting Speech. John Absterdam, New York, N. Y. Application filed February 18, 1891.

Speech is transmitted electrically over a line circuit permanently "open" or incapable of use for telegraphic service and without ground connections.

538,569. Trolley Pole Restrainer. Frank Wheeler, Meriden, Conn. Application filed February 8, 1895.

One claim is presented: A trolley pole restrainer comprising in its construction the tube having a shoulder, the spring-operated head having detents, the links permanently connected to each other and to the detents, means connected with the links for the attachment of a trolley pole cord, and the guard projecting above the detents and the shoulder of the tube.

538,590. Block System and Apparatus on Electric Railways. Eugen Langen, Cologne, Germany. Application filed July 16, 1894.

In an electric railway operated by a contact conductor and an auxiliary contact conductor, both divided into separate block sections, these features are claimed: A vehicle having an electrically operated brake and signal apparatus, and a contact device connected with such brake and signal device and making contact with the auxiliary conductor section, so that when such conductor section receives current the electric brake and the signal of the vehicle will be operated.

538,610. Overhead Trolley. Charles W. Hunt, West New Brighton, N. Y. Application filed February 4, 1892.

There are two intersecting elevated tracks at the same level, each interrupted at the point of intersection, the rails of one track being in line with the opening in the other track, supporting devices for the tracks, a trolley frame adapted to pass through the opening in the track, and supporting wheels for the trolley frame.

538,614. Insulating Material. John W. Kidwell, Washington, D. C. Application filed September 8, 1894.

This compound is composed of titanic mineral, a hydro-carbon material, such as asphaltum, and a silicious material.

538,617. Commutator Brush and Means for Adjusting Same. Robert Lundell, Brooklyn, N. Y. Application filed July 20, 1893.

The first claim is given: In an electro-magnetic machine, the combination of an annular body carrying the commutator brushes, means for rotating the annular body to shift the brushes, and projections in the path of movement of the brushes, whereby when the brushes are brought into engagement with the projections the brushes are raised from the commutator.

# Western Electrician.

EVERY SATURDAY.

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## A Compact Gas Engine Plant.

In the basement of Fraser's restaurant at 165 Clark street, Chicago, is the small isolated plant for electric lighting which is herewith illustrated. The plant is in no way remarkable except in the type of gas engine used to drive the dynamo. This is new and interesting, and as the subject of employing gas engines in electrical work is one that is now attracting much attention in the United States, this plant is presented to the notice of the readers of this journal as representing a very recent example of gas engine practice.

The engine is rated at 20 horse power and it is belted directly to the pulley of a 200 light C & C dynamo. The load carried is 165 incandescent lamps of 16 candle power each, two 1 horse power motors and eight ⅛ horse power motors for driving fans. The lamps burn very steadily and well, and thus far (the new engine has been in operation less than two weeks) the service has been very satisfactory.

The general appearance of the plant is shown in Fig. 1, a separate view of the engine being given in Fig. 2. This gas engine is manufactured by the J. I. Case T. M. company of Racine, Wis., after the design of J. W. Raymond of San Francisco. It is a compact, vertical machine, pleasing in appearance and promising well in performance. It has two cylinders, with cranks set at the same angle on the the main shaft and running in oil. The pistons are of the bucket type, and the mechanism is such that although the cranks are set at the same angle the explosions are alternate, one for each revolution. Each cylinder can be worked independently, with an explosion at every other revolution. Natural gas is used. The engine is guaranteed to run on 20 feet of gas per horse power hour, but it is claimed that in actual practice results as low as 12 feet per horse power hour have been obtained. When using gasoline, the guarantee is $\frac{1}{10}$ gallon per horse power hour.

The rotary valve in the engine head is ingeniously contrived, and ball bearings are provided for the valve gear. To start the engine it is necessary to turn the fly wheel only just far enough to get the cranks over the center. The first explosion is accomplished by striking a cartridge of slow-burning powder. After that an electric igniter is used, seven cells of storage battery being employed to operate a spark coil. One of these electric igniters is provided for each cylinder. Regulation is obtained by a piston ball governor, which admits to the cylinders the quantity of gas and air for the speed desired. The engine illustrated runs at 325 revolutions per minute and seems to be practically unaffected by changes of load.

The exhaust is as steady as a steam engine and makes but little noise. The cylinders are water-jacketed, a constant circulation from the street mains being maintained. The cold water is admitted at the base of the engine and passes off hot from the head.

The engine is well built, of good materials, and is designed to be operated by inexperienced persons. It will be furnished in sizes up to 100 horse power.

James McLaughlin was the electrical engineer in charge of the installation of this pioneer plant.

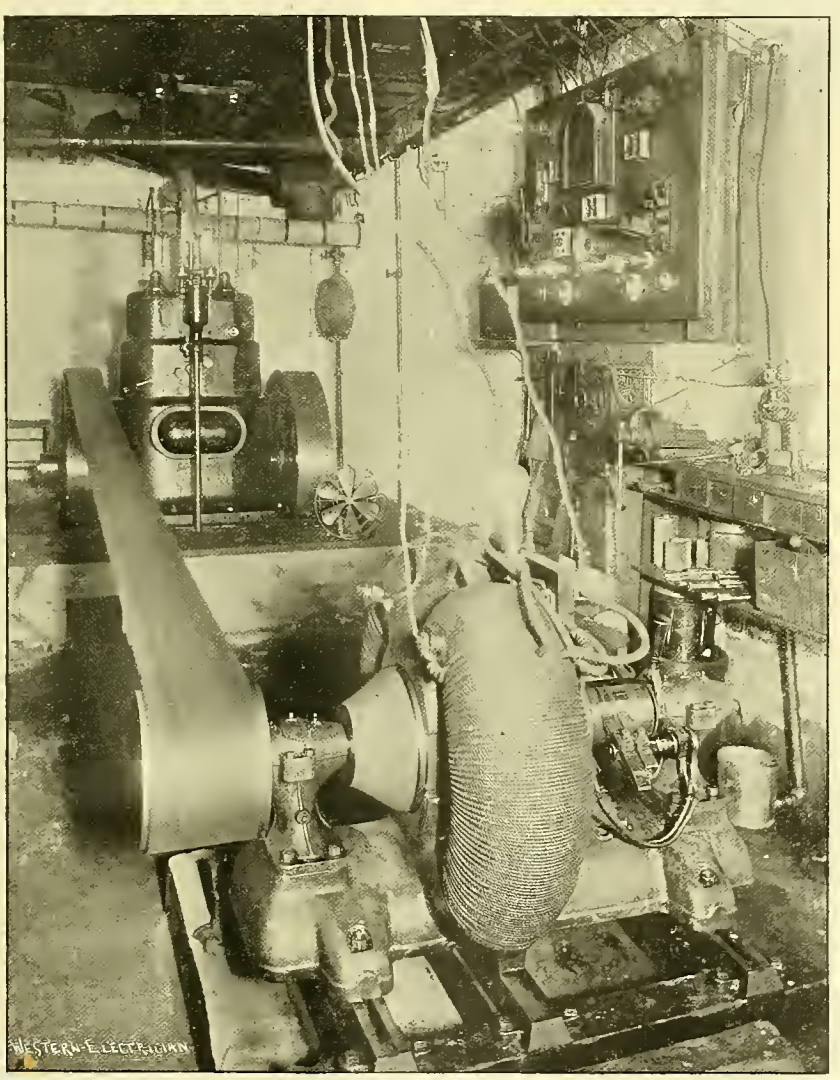



FIG. 1. A COMPACT GAS ENGINE PLANT.

## Street Railway Mail Service in Boston.

Postmaster Coveney of Boston asserts that that city has one of the finest and best equipped trolley mail systems in the entire country, which, to say the least, is a high compliment to the West End Street Railway company. The West End had less than three weeks in which to get the cars ready for the United States mail street car service which went into effect on May 1st, which has already proved a great success. When it was decided to introduce the service in Boston, the work of remodeling old horse cars had to be done before they were fitted for the service required of them. Six cars have been equipped, and they will cover as many routes to points within the city proper and also to suburban offices a few miles out of Boston. The two end doors of the cars have been permanently closed and new doors cut in either side. New panels were put in and new floors and underpinning. Underneath has been placed new running gear of the most approved style. New platforms have been built on each end with dashers that close up the platform on one side and were completed on the opposite side with a patent self-locking gate, such as is used on steam railway cars. New electric headlights, with semaphore, or corrugated bullseye glasses, have been fixed in each over the "boy-catchers." New trolley poles have been placed on the roof and brass letter boxes on the side. These side doors divide the mail car unevenly. The shorter end is lined with wire netting and divided by stanchions for the storing of pouches of mail. The other end has three reversible cases for the sorting of mail. This will give more than the 250 separations that may be called for. Each car has two five-light circuits, giving nine interior lights beside the headlight. Each car is equipped with speaking tubes, and there is also a fire extinguisher in the form of a small chemical engine in each car.

## Electric Plowing in Germany.

Elaborate systems of plowing by electrically transmitted power have been devised by American inventors, but little practical work has been accomplished in the United States, although the great wheat farms of the Northwest offer a promising field. But practical experiment in this direction has been made at Halle-on-the-Saale, Germany, by F. Zimmerman & Co. Here a two-furrow tilting plow was used. The electric motor is fixed to the implement itself. The shaft of the motor, by means of a double spur-wheel gear, drives a shaft fitted with a pinion, over which a chain runs from one end of the field to the other. This chain is held taut at both ends by triple ground anchors. When the motor is put in operation it will haul the plow across the field. When the end of the field is reached the plow is tilted to the other side, and by reversing the motor the plow starts on its return journey, at the same time depositing the chain sideways for the next row of furrows. The anchors are moved by a laboror, who lifts them out of the ground with a hand lever.

The current is generated by a portable dynamo and ten horse power steam engine, and the current is conveyed by a cable that follows the car upon light cars, which turn readily in any direction. The power used in the heavy, loamy clay at Halle-on-the-Saale was an average of eight kilowatts. The plow turned two furrows, measuring together 60 centimeters in width by 24 centimeters in depth, and, travelling at 0.9 meter per second, the actual useful effect was equal to eight effective horse power, which showed that there was a loss of about four horse power between the portable engine and the plow. A 16 horse power engine was used for a four-furrow plow, and the depth of the furrow was 24 centimeters. One of the remarkable features of this system is that, guided by the tightened chain, very shallow furrows can be made with great evenness and regularity, and the balance plow can thus be used for turning over stubble land and other light work. As regards attendance only one man is needed for the lighter plow, while for the larger one three men are required—a plowman and a man at each end to shift the anchors.

The first cost of an electric plow is said to be much below that of a steam cultivating plant. A steam plow with two portable engines will cost from 40,000 to 60,000 marks, but Zimmerman & Co. can supply a four-furrow balance plow with electric motor and reversing gear, as well as 250 meters of chain, two anchors, 600 meters of insulated cable and six cable cars for 10,000 marks, while the entire outfit for a three-furrow plow costs 8,000 marks, and for a two-furrow plow 6,000 marks. In addition to this the dynamos will cost about 5,500 marks, 4,000 marks and 2,000 marks respectively. According to the figures published as to the results of the trial, the working expenses of an electric plow

are about half that of steam plowing, and if these results are borne out in practice upon an extensive scale there seems to be no question of the future of the electric plow.

## Electricity in the Quarries of Euville.

The immense stone quarries of Civet, Crouet, Gauthier & Co. are especially interesting to readers of electrical journals owing to the application of electric power to their

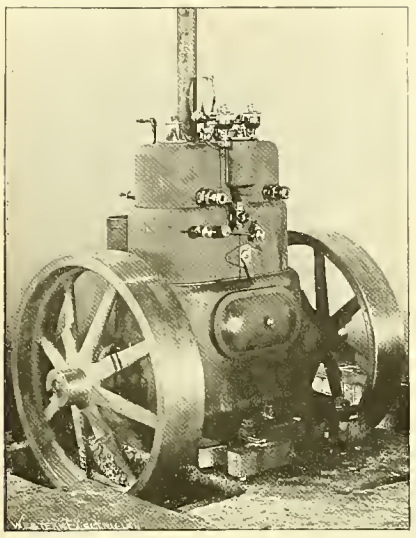


FIG. 2. A COMPACT GAS ENGINE PLANT.

successful working. As will be seen by Fig. 1, the quarries have a very considerable depth as well as large lateral area, and the demands of economy make the use of heavy, readily-controlled machinery a necessity. Electricity thoroughly meets the requirements.

The present installation has now been in operation since 1892. The plant includes a Manchester dynamo, compound wound, having steel collectors with carbon brushes, which furnish current at various points in the yards to electric motors for sawing the stone. The generator has a capacity of 40 to 50 horse power furnishing 135 amperes of current at 240 volts pressure with a speed of 760 turns per minute. The engine which formerly actuated the air compressor has been retained for the present service. There are two circuits leading from the switchboard, of bare copper insulated on porcelain upon posts, these feeders ending at the central portion of each of two divisions of the yards. From these latter points branch lines are carried to four electric motors of eight horse power. These machines are practically con-

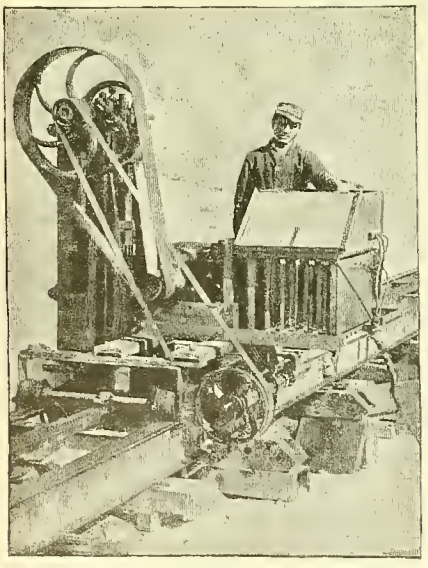


FIG. 2. ELECTRICITY IN THE QUARRIES OF EUVILLE.—ELECTRICAL STONE CUTTER.

stant in speed, despite the changing demands of the work to be done.

The regulating apparatus is contained in an iron case, and consists of coils, as shown in Fig. 2, the switch being in front of the motorman. Change of position is effected at will by a clutch and gear movement.

The efficiency of the combination, based on measurements, is as follows: Industrial efficiency of the generator, 88 per cent.; motor, 80 per cent.; line, 90 per cent.; total efficiency, 63.36 per cent.

An electric motor of six horse power is used to raise water a height of 60 meters for washing the saw kerfs and furnishing the traveling steam engine. This motor is situated at a distance of 200 meters from the generator and receives its current from a lighting dynamo, which developes current at a pressure of 70 volts. A comparative table of the two systems is largely in favor of electricity.

The total cost of the compressed air plant, including an engine of 90 horse power, boilers, compressors, etc., is given at 27,700 francs; the electrical equipment, inclusive of conductors, generators, etc., at 20,000 francs, about 8,000 francs less than the old system. The annual expense of the compressed air system, including interest and depreciation, was 11,584 francs and of the electrical system 4,928 francs, the latter effecting an annual saving of 6,656 francs. A comparative statement of the work accomplished shows a gain in the value of the cuttings. The annual report shows a net advantage in money alone of 13,900 francs for the latter over the former process, according to the *Revue Internationale de l'Electricite.*

## Carbides and Acetylene Commercially Considered.[1]

By T. L. Willson and J. J. Suckert, Ph. D.

Before entering upon the subject matter of this paper, namely, the commercial consideration of the carbides and acetylene, we believe that a brief history of these compounds, their methods of formation and their chemical and physical properties, will be of interest to you. That carbon will combine directly with various metals under the influence of heat has long been known to chemists, but these compounds, generally known as "carbides," have been but imperfectly studied, and with the exception, perhaps, of the carbides of iron are hardly known.

The only group of carbides which interests us this evening is that of the carbides of the alkali and alkaline-earth metals, such as the potassium, sodium, barium, strontium and calcium carbides; for the reason that these are the only carbides which, when brought into contact with water, will decompose it, forming generally the hydrated oxide of the metal and acetylene gas. Of these latter carbides, the combination of calcium with carbon has the greatest commercial possibilities on account of the low first cost of the raw materials which enter into this combination, namely, lime and coal, the abundant deposits of the same in all quarters of the globe, and the commercial value represented by the by-product, hydrate of lime, which is obtained in large quantities by the decomposition of the calcium carbide with water.

The history of the discovery and methods of production of this group of carbides may briefly be stated as follows:

The first authentic reference to this subject was the discovery, by Sir Humphrey Davy, that carbon and potassium, when heated to a temperature sufficiently high to vaporize the potassium, formed a compound which, after cooling, would effervesce with water.

Berzelius, in 1836, determined that the black substance formed in small quantities as a by-product in producing potassium from potassic carbonate and carbon was carbide of potassium.

1. Read before the Franklin Institute at Philadelphia, March 20, 1895.

Woehler, in 1862, prepared calcium carbide by fusing an alloy of zinc and calcium with carbon, and ascertained that it decomposed by contact with water, forming calcic hydrate and acetylene.

Berthelot, in 1866, described sodium carbide or acetylene sodium. He produced it by the following method: Metallic sodium, when slightly heated in acetylene gas, puffs up and absorbs acetylene with the formation of the compound $C_2HNa$. At a dull red heat sodium destroys acetylene, forming a black carbonaceous mass, $C_2Na_2$. The reaction is expressed by the following formula: $C_2H_2 + Na_2 = C_2Na_2 + H_2$. This compound, $C_2Na_2$, in contact with water, regenerates acetylene.

From 1866 until 1888, a period of twenty-two years, nothing further has been recorded of scientific work done in this direction; as a matter of fact, the compounds so produced were not only very impure, but their cost of production also was so great as to render their commercial use prohibitory; they were considered as curiosities and looked upon by scientists as such. In 1888 T. L. Willson began a series of experiments relating especially to the reduction of refractory metallic oxides by carbon, in an electrical furnace. By this method the reductions were to be accomplished by the heat effect of the current alone, and not by electrolytic action.

The results of these experiments, which were numerous and which extended over a period of years, developed some very interesting data as to the action of intense heat on refactory bodies generally, and especially as to the formation of carbides in large quantities. Mr. Willson found that lime, baryta, strontia and even alumina, when subjected to the intense heat of his electric furnace, were liquefied and formed a molten mass, which could be brought to ebullition. An addition of carbon thereto caused a decomposition of the oxide, carbon monoxide being formed, while the fused meta united instantly with the excess of carbon, previously introduced, to form a carbide. Further experiments developed the fact that when a mixture of powdered lime and coke dust was introduced into the furnace, the mixture would melt down to a thick, syrupy mass of practically pure carbide of calcium, and that this, when removed from the furnace and brought in contact with water, evolved acetylene gas in large quantities. The carbides of barium, strontium and aluminum also were prepared in the same manner, and the specimens now before you are the results of these earlier experiments.

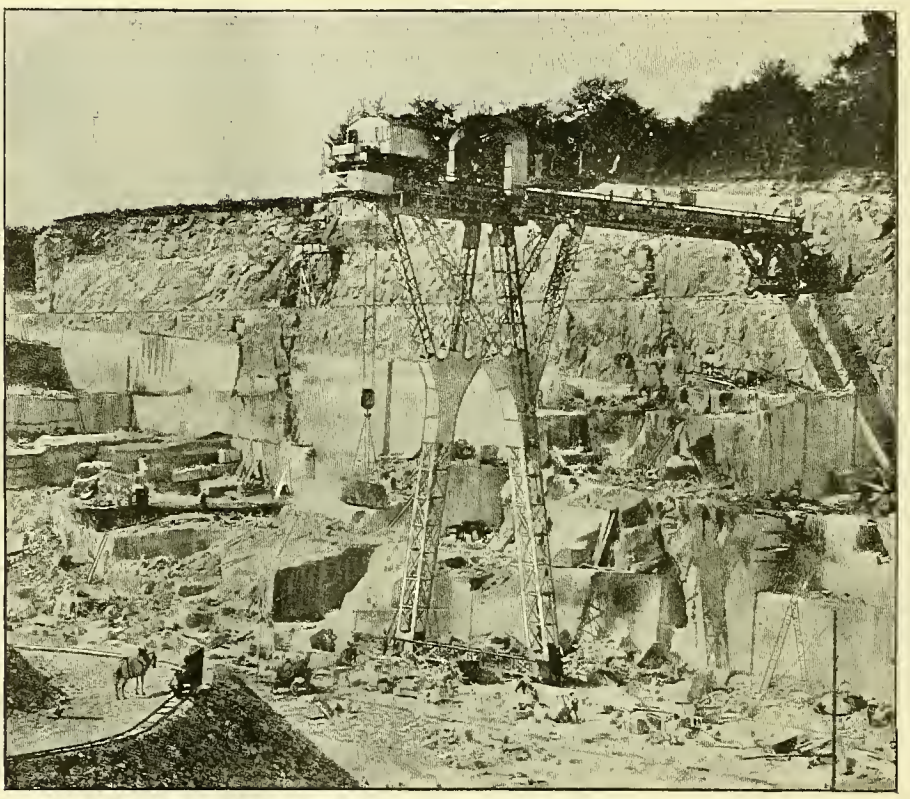


FIG. 1. ELECTRICITY IN THE QUARRIES OF EUVILLE.—GENERAL VIEW OF THE QUARRIES.

We will now introduce a small quantity of each of these carbides into different vessels containing water at ordinary temperature. The carbides of barium, strontium and calcium decompose water readily, forming the respective hydrates of their metallic oxides and acetylene gas, which we now ignite as it is being evolved in each vessel; the resulting gas, as you observe, burns with a luminous sooty flame, Fig. 1. As the carbide of aluminum does not react with water at ordinary temperatures, no gas is evolved from the fourth vessel.

This substantially completes the history of the alkali and alkaline-earth metal carbides up to the date of Mr. Willson's discovery.

The physical and chemical properties of pure calcium carbide, as first prepared in the Willson furnace, is a dark-brown, dense substance, having a crystalline metallic fracture of blue or brown appearance, and a specific gravity of 2.262; it evolves a peculiar odor when exposed to the atmosphere, due to the action of atmospheric moisture. In a dry atmosphere it is odorless. When exposed to the air in lumps, it becomes coated with a layer of hydrate of lime, which, to a great extent, protects the rest of the substance from further deterioration by atmospheric moisture. It is not inflammable, and can be exposed to the temperature of the ordinary blast furnace without melting. When exposed

to the flame of a Bunsen blast-lamp it can be heated to a white heat, the exterior only being converted into lime. When brought into contact with water, or its vapor, at ordinary temperatures, it is rapidly decomposed, one pound generating, when pure, 5.892 cubic feet of acetylene gas at a temperature of 64° F. It also decomposes with snow at a temperature of —24° F. It is not acted upon by the vapor of water at high temperatures. It abstracts moisture readily from alcohol, also from liquefied ammonia gas, rendering the latter anhydrous. If small pieces are treated with common sulphuric acid, a violent reaction ensues. Acetylene is generated with considerable increase in temperature. If, however, large pieces are plunged into common sulphuric acid, the reaction is feeble.

An exhaustive series of experiments, made by Dr. H. Schweitzer, of New York, have shown that when treated at a red heat with dry muriatic acid gas, the carbide is decomposed with the formation of free carbon and small quantities of a yellow substance easily soluble in ether. When treated with steam at different temperatures (up to 428° F.), and different pressures (up to 35 atm.), the material was decomposed with the formation of but small quantities of the same yellow substance, and not in sufficient quantity for further examination.

Benzol, nitro-benzol, phenol, aniline, toluidine and other organic compounds gave no reaction when treated with carbide of calcium alone, and in the presence of water, at varying pressures and temperatures. It would appear from the foregoing to be a very inert body in its action on other compounds, and in view of this fact, the ease with which it decomposes water at ordinary temperatures is remarkable.

When treated with water in a closed vessel properly cooled, acetylene gas continues to be evolved from the material at pressures exceeding 75 atm. Calcium carbide has the chemical formula $CaC_2$, and contains in 100 parts 62.5 parts of calcium and 37.5 parts of carbon.

The gaseous product of the decomposition of the alkali and alkaline earth metal carbides with water, namely, acetylene, is an unsaturated hydrocarbon of the series $C_nH_{2n-2}$, having the chemical formula $C_2H_2$, and containing, therefore, in 100 parts 92.3 parts of carbon and 7.7 parts of hydrogen.

It was first recognized, and its chemical constitution determined, by Berthelot, in 1849. It has heretofore been formed in small quantities by passing ethylene, or the vapors of alcohol, wood alcohol, ether, and other organic compounds through a red-hot tube. It is present in coal gas to the extent of 0.06 per cent., and water gas contains almost 1.0 per cent. It has also been formed by passing hydrogen gas between carbon points brought to incandescence by the electric current, which is the first recorded synthesis of an organic compound directly from its elements. It can also be produced by the incomplete combustion of the vapors of ether, amylene, etc.; or of illuminating gas, in the interior of a Bunsen burner; by passing the vapor of chloroform over red-hot copper; or from chloroform and potassium amalgam; or from chloroform and sodium; or by the electrolysis of fumaric and malic acids; by passing the vapor of ethylene chloride over red-hot soda lime; and finally, by allowing ethylene bromide to drop in a boiling concentrated solution of alcoholic potash, passing the impure acetylene into an ammoniacal cuprous chloride solution; washing the red precipitate with water, and, whilst still moist, boiling it with concentrated hydrochloric acid.

Acetylene is a colorless gas, having a penetrating pungent odor somewhat resembling garlic, which is of great importance in its application to household illumination, as it renders the slightest escape of gas in a room easily detectable. It has a specific gravity of 0.91, and burns with a luminous sooty flame. It is soluble in water in about the same proportions as carbon dioxide, that is, at 64° F. water will absorb its own volume of the gas. Absolute alcohol and glacial acetic acid dissolve about six times their volume. It is practically insoluble in saturated brine, 100 volumes absorbing but five volumes of the gas, whereas paraffine will absorb two and one-half times its volume. By heating acetylene to the softening point of glass, benzol ($C_6H_6$), styrolene ($C_8H_8$), naphthalene ($C_{10}H_8$), anthracene ($C_{14}H_{10}$), and reten ($C_{18}H_{18}$), are formed.

With an alkaline solution of permanganate of potash, acetylene is oxidized to oxalic acid, and with a dilute solution of chromic acid to acetic acid. By treating acetylene copper with zinc and ammonia, ethylene is formed, and a mixture of acetylene and hydrogen, brought in contact with platinum black, forms ethane. By the electric spark, acetylene is resolved into carbon and hydrogen, at the same time a fluid and a solid poly-acetylene are formed; the latter resembles horn, and is insoluble in the ordinary solvents. A mixture of nitrogen and acetylene is converted by the induction spark into hydrocyanic acid.

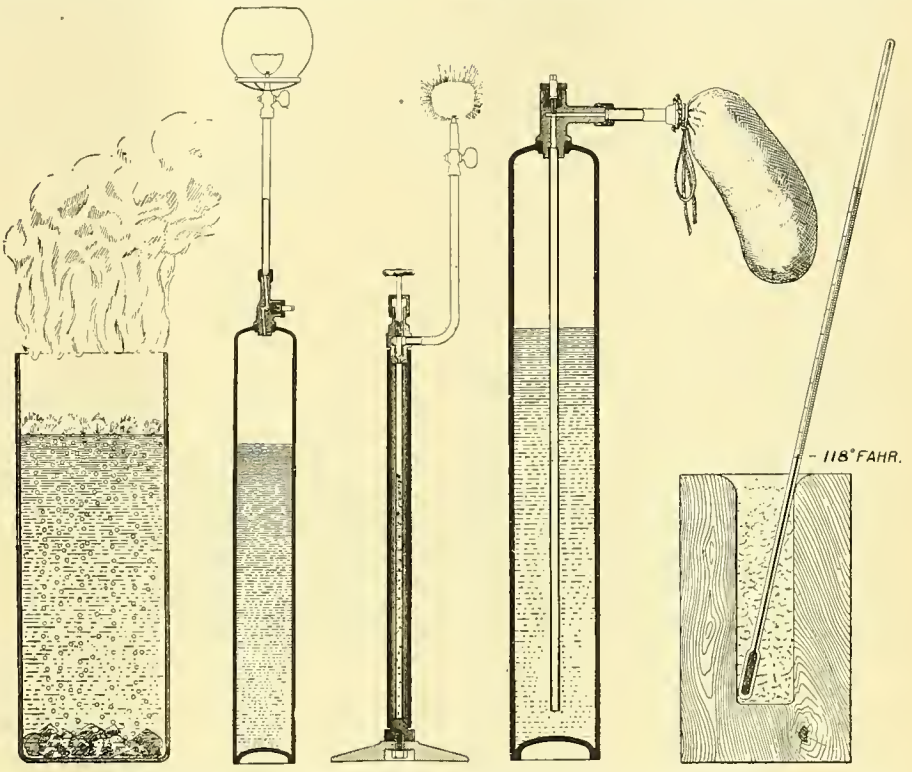
It may be heated to a temperature of 370° F., and under a pressure of 43 atmospheres, without decomposition.

The gas can readily be condensed to a liquid, as is evidenced by the following table, the pressures being considerably less than those required for carbon dioxide:

| ACETYLENE. | | CARBON DIOXIDE. | |
|---|---|---|---|
| *Fahr.* | *Atmospheres.* | *Fahr.* | *Atmospheres* |
| —116.° | 1 0 | —112° | 1.0 |
| — 28.6° | 9 0 | — 29.2° | 12.7 |
| — 9.4° | 11.01 | — 4° | 19.93 |
| + 14° | 17.06 | + 14° | 26.76 |
| 32° | 21.53 | 32° | 35.40 |
| 41 45° | 25 48 | 41° | 40.47 |
| 56 3° | 32 77 | 59° | 52.17 |
| 67.27° | 39.76 | 68° | 58.84 |

The critical point of the gas has been placed by Ansdell at 98.69° F. He also determined the specific gravity of the liquefied gas at various temperatures, placing the density at about one-half that of carbon dioxide; but his results do not agree with those obtained by us in the production and storage of large quantities of liquefied gas. For instance, the small tank to which this connecting pipe and burner are attached, Fig. 2, should contain, according to Ansdell, when filled at 69.08° F., about 2.15 pounds of liquefied acetylene; as a matter of fact, however, we can fill into this tank somewhat more than 2¾ pounds of the liquefied gas. One pound of the liquid, when evaporated at 64° F., will produce 14½ cubic feet of gas at atmospheric pressure; or a volume 400 times larger than that of the liquid.

The odor of the gas has already been made apparent to you while the experiment showing the decomposition of the various carbides with water was being carried on. We will now show you the liquefied gas contained in this glass tube surrounded by a metal casing, Fig. 3. As you will observe, the liquefied gas forms a colorless, mobile, highly refractive liquid, which, when the pressure is slightly relieved, commences to boil and evolves a gas which, ignited as it issues from this gas tip, burns with an intensely white flame. If the liquefied gas be suddenly relieved of its pressure, or allowed to escape in its liquefied state to the atmosphere, a portion evaporates rapidly, thereby abstracting from the remaining portion sufficient heat to solidify it. This tank, which is now shown you, Fig. 4, contains liquefied acetylene, which has been cooled to a temperature of —28° F., in order to prevent the escape of too large a volume of gas during the process of its solidification. Attached to this valve, inside of the tank, is a tube which reaches within half an inch of the tank bottom, and is open at its lower end. We now attach to the valve a flannel bag to receive the solidified gas. Upon opening the valve the liquefied gas escapes, the solidified portion remaining in the bag, while the gas formed escapes through the pores of the bag. This bag will hold about three-quarters of a pound of the solidified gas, and this is about the quantity which is now being emptied on the plate. A portion of this solidified gas will now be passed to you for inspection; another portion is packed into this wooden tube, a thermometer is inserted, Fig. 5, and, as you will observe, the temperature falls to —118° F. Another portion is placed on one pound of mercury contained in this saucer, Fig. 6; the intense cold of the solidified gas almost immediately solidifies the liquid metal. A portion of the solidified gas or "acetylene snow" is now dropped into this vessel, Fig. 7, containing water. Being lighter than water, it floats upon its surface, and when touched with a light the gas surrounding each particle of the solidified gas burns with a sooty flame, and continues to burn until all the solidified gas has disappeared. I will now ignite the gas evolving from the acetylene snow contained in this dish, and you have the interesting exhibit of a solidified gas at —118° F. giving off gas which can be ignited, and which, although evolved at this low temperature, possesses the same illuminating power as at higher temperatures.




FIGS. 1, 2, 3, 4, 5. CARBIDES AND ACETYLENE COMMERCIALLY CONSIDERED.

You have now seen acetylene in its three physical conditions, namely, as a gas, a liquid and a solid; and the mere fact that it readily assumes the gaseous and liquid condition is of vital importance to its commercial application.

### COMMERCIAL APPLICATION.

Having described the physical and chemical properties of calcium carbide and the product of its decomposition with water—acetylene—we will now consider the commercial possibilities of these compounds.

Carbide of calcium, as we have already shown, is a rich source of acetylene, but beyond this we cannot at present definitely designate additional commercial applications of this material.

Extended experiments are now being conducted to determine its commercial value in the production of cyanides and various nitrogenous compounds, in the manufacture of iron, steel and other metals, and their alloys, and in its application to the synthetical formation of various organic compounds.

The results thus far obtained, however, although encouraging, do not as yet justify us in accepting them as commercially applicable.

As the commercial value of any material largely depends upon its cost of production, its purity, and the value of the products and by-products obtained therefrom, our first consideration will be the method of manufacturing the carbide of calcium and the cost of the finished product.

The carbide of calcium originally prepared by Mr. Willson during his first experiments was produced at a cost largely in excess of that for which it can be manufactured to-day, but a description of these original experiments will, without doubt, be of interest to you.

The first experiments were made with a dynamo generating a current of 150 amperes at from 60 to 70 volts. The furnace consisted of a plate of carbon 12 inches square and 1 inch in thickness, along one edge of which an iron rod was bolted and projected beyond the mason work, and to which one terminal from the dynamo was connected. This carbon plate was embedded in brickwork, having only a small central portion exposed, upon which the graphite crucible rested. From one terminal of the dynamo the current was conducted through the iron rod, carbon plate, graphite crucible, the material to be acted upon, and the carbon pencil to the other terminal. To start the furnace the pencil was placed in contact with the bottom of the crucible and the dynamo was started up slowly. As the electromotive force increased the pencil was withdrawn from the bottom of the crucible and the "arc" established.

The material to be acted upon was then introduced through an opening in the cover of the crucible, the cover being either of non-conducting material, or, if of graphite, insulated from the crucible by a non-conducting luting. One of the pencils from the original lot used in these earlier experiments is now before you. This carbon pencil is 12 inches long, 1¼ inches in diameter, copper-plated and has a hole bored through its entire length, the tube so formed being used for the introduction of gaseous agents. With this furnace various metallic compounds, intermingled with pulverized carbon and also surrounded by gaseous reducing agents, were subjected to the intense heat developed by the electric arc.

The success attending the operation of this first furnace in the reduction of refractory metallic oxides justified the continuation of the experiments upon a larger scale, and to this end the Willson Aluminum company was organized and a plant erected at Spray, N. C. This plant was supplied with a dynamo operated by water power, and generating a current of 2,000 amperes at 35 volts. The furnace was constructed as here shown, Fig. 8, namely: *A* designates the outer masonry shed or bench of the furnace; *B*, the carbon or graphite crucible or hearth; *C*, the carbon bar or pencil constituting the movable electrode, and *D* the dynamo for generating the current. From the terminal brushes of this dynamo, one wire, *w*, leads to and communicates with the crucible *B*, while the other wire, *w'*, leads to and communicates with the carbon pencil *C*. The connections are usually made in the manner shown, the wire *w* being connected through a fastening bar *a* to an iron plate *b*, underlying the crucible *B*, and the wire *w'* being connected to a metal socket *c*, embracing the upper end of the carbon pencil *C*. The bench *A* is generally made of firebrick, which is a non-conductor of electricity, and the furnace is covered with a plate, or, preferably, two plates, *EE*, of carbon, having a central hole through which the carbon pencil *C* projects down into the crucible.

For tapping out the resulting product, a tap hole *d* is formed, which in operation is closed by a plug *e* of clay or other suitable refractory material. The carbon plates *EE* rest on the top of the firebrick walls *A*, which project above the top of the crucible, forming an intervening space *f* for the furnace between *B* and *E*. For the vertical adjustment of the carbon pencil a screw-threaded shaft *g* is provided, which may be moved up and down by the engagement therewith of a suitably mounted rotative nut *h*.

The first carbide of calcium produced in this furnace, in accordance with memoranda taken at the time by Mr. Willson, was manufactured as follows: A mixture of lime and tar was boiled in a caldron in the proportion of 60 pounds of lime to 11 gallons of coal tar, and the heating was continued until the mixture was perfectly dry. It was then introduced into the furnace and subjected to the heat of the

electric arc for a period of two hours, gradually feeding the mixture of lime and tar to the furnace as fusion took place. The product obtained consisted of a purplish-yellow mass, which in contact with water evolved acetylene gas. A sample of the calcium carbide produced upon this occasion is now before you and represents the first calcium carbide produced in an electrical furnace.

The experiment was repeated with a mixture of 15 pounds of tar in fused lime and alumina, the time required for the operation being one and one-half hours.

The product obtained was a black, crystalline mass, consisting of a double carbide of calcium and aluminum. A sample of this double carbide is also submittted for your inspection.

Another run, made with a mixture of 10 pounds of lime and 10 pounds of finely divided carbon, operating one hour, resulted in the production of a dark, crystalline mass, showing at its fracture black and blue crystals. A small metallic ingot was found in this mass and a similar ingot of this white metal is now before you.

A fourth test, made with 17½ pounds of lime and 17½ pounds of carbon, resulted in obtaining 11 pounds of almost pure calcium carbide.

The tests described represent but a few of the numerous experiments conducted by Mr. Willson in his efforts to successfully and economically produce calcium carbide on a large scale. Recent results in the application of the alternating current to its manufacture prove conclusively that calcium carbide, of a remarkable purity, can be commercially produced. The product now being manufactured in quantities exceeding one ton *per diem* will readily evolve in contact with water 5¾ cubic feet of acetylene gas per pound of the carbide used, a result closely approaching to that which is theoretically possible, namely $5\frac{8.9}{100}$ cubic feet per pound of carbide.

The theoretical proportions of lime and carbon required for the production of 100 pounds of calcium carbide are 87½ pounds of lime and 56¼ pounds of carbon. Of the latter 37½ pounds combine directly with the metal calcium; and 18¾ pounds combine with the oxygen of the lime and escape from the furnace as carbon monoxide, in accordance with the following formulæ:

$$CaO + C_3 = CaC_2 + CO$$
$$87\frac{1}{2} + 56\frac{1}{4} = 100 + 43\frac{3}{4} \text{ (lbs.)}$$
$$CaC_2 = Ca + C$$
$$100 = 62\frac{1}{2} + 37\frac{1}{2} \text{ (lbs.)}$$
$$CO = C + O$$
$$43\frac{3}{4} = 18\frac{3}{4} + 25 \text{ (lbs.)}$$

A further element of cost in its manufacture is the production of heat in the furnace by means of the electric arc. Extended experiments in this direction have shown that one electrical horse power will readily produce 20 pounds of calcium carbide each 24 hours, and the present indications justify the assumption that with automatically-fed furnaces, properly insulated to retain the heat, and by utilizing the waste heat to increase the temperature of the material acted upon, the production of calcium carbide can be increased on a large scale to 30 pounds per electrical horse power each 24 hours.

By using limestone and coal dust, the latter being practically a waste product (not at present utilized), it is believed that calcium carbide can eventually be produced at a cost of less than $5 per ton. Where bituminous coal is employed, the value of the by-products obtained by its conversion into coke will largely reduce the cost of manufacture.

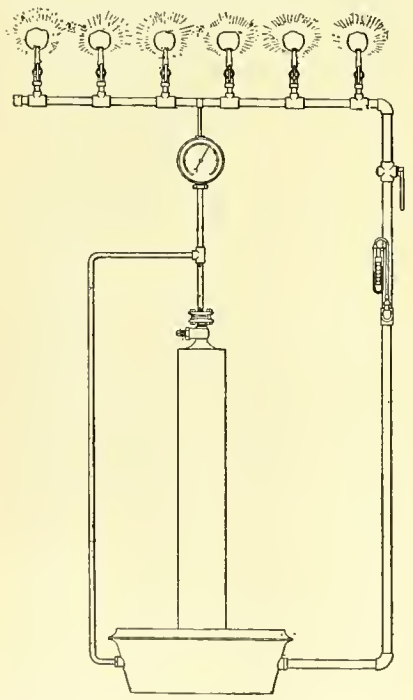


FIG. 10. CARBIDES AND ACETYLENE COMMERCIALLY CONSIDERED.

Arrangements are now being made by the Electro-Gas company of New York, with the Niagara Falls Power company, to apply 1,000 electrical horse power to the manufacture of calcium carbide, which is shortly to be increased to 5,000 horse power, and eventually, we will, without a doubt, see the entire available power the company now possesses converted into electrical energy for the manufacture of this product. The effect of such a production would be far-reaching, and the economies resulting therefrom, it stated to-night, appear exaggerated and visionary. Assuming that but 20 pounds of the carbide are produced per indicated horse power each 24 hours, then the amount manufactured during 300 working days would be 3 tons per horse power per year; and, applying 100,000 horse power to its production, the annual output of such an establishment would be 300,000 tons. From this amount of material 3,300,000,000 cubic feet of acetylene gas should be produced, and as its illuminating power, compared with ordinary illuminating gas of 25 candle power, is as ten to one, it would represent fully 33,000,000,000 cubic feet of this gas—an amount which would probably equal the annual output of the entire gas industry of the United States.

As this is but one of the many applications of the product obtained by the decomposition of the carbide with water, the manufacture of the carbide itself must, of necessity, become a large industry.

The hydrate of lime obtained from the decomposition of the carbide with water can be used again in the manufacture of the carbide, or it can be employed in the manufacture of ready-mixed mortar, which is already quite an industry in this city.[1]

As we have previously informed you, pure calcium carbide contains in 100 parts 37.5 parts of carbon and 62.5 parts of calcium, and when brought in contact with water, acetylene is generated to the extent of 5.89 cubic feet of the gas to each pound of carbide used; or if compared by weight, 100 pounds of calcium carbide and 56.25 pounds of water evolve 40.63 pounds of acetylene gas, and form 115.62 pounds of calcic hydrate, in accordance with the following formula:

$$CaC_2 + 2H_2O = CaOH_2O + C_2H_2$$
$$100 + 56\ 25 = 115.62 + 40.625 \text{ (pounds)}.$$

The acetylene gas so generated contains, in 100 parts, 92.3 parts of carbon and 7.7 parts of hydrogen, or in the 40.625 pounds generated from 100 pounds of carbide, we have 37½ pounds of carbon and 3⅛ pounds of hydrogen. The entire carbon contained in the calcium carbide has, therefore, combined with the hydrogen of the decomposed water to form a new compound of a gaseous nature and extremely rich in carbon.

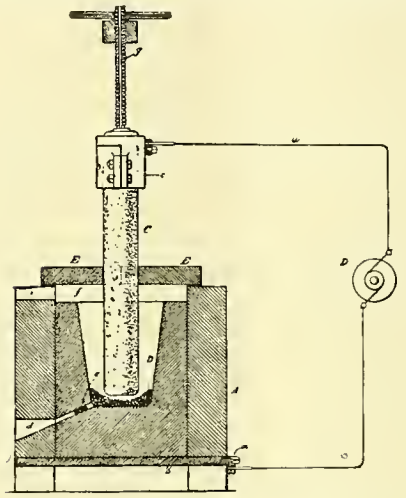


FIG. 8. CARBIDES AND ACETYLENE COMMERCIALLY CONSIDERED.

In its commercial application acetylene can be produced either directly from the calcium carbide by decomposition with water, or it may be evolved from the liquefied gas contained in suitable receivers.

When manufactured directly from the carbide, two methods can be employed; in one, small quantities of water are allowed to flow upon the carbide and the resulting gas is conducted to an ordinary gasometer, from which it can be drawn for use; this method is more or less intermittent. The other method dispenses with a gasometer and permits the continuous generation of either large or small quantities of the gas, and this is accomplished by partially submerging in water a vessel open at the bottom and containing carbide suspended on a screen in the upper part of the vessel, the generated gas being withdrawn from above the carbide. As long as gas is being used the water remains more or less in contact with the carbide; as soon, however, as the withdrawal of gas diminishes or entirely ceases, the pressure of the generated gas forces the water from the carbide into the lower chamber of the vessel, thereby preventing a further generation of the gas. The apparatus is automatic and extremely regular in its operation.

FIG. 7. CARBIDES AND ACETYLENE COMMERCIALLY CONSIDERED.

In the employment of either of the above methods, the only by-product obtained is slaked lime, the amount of gas produced being the same, namely, 5½ cubic feet for each pound of calcium carbide used.

The liquefied gas is manufactured commercially by decomposing the carbide of calcium with water in a closed vessel, and conducting the gas generated under pressure to a condenser, where it liquefies and is then drawn off in tanks ready for distribution.[1] The liquefied gas exhibited this evening has been produced in this manner.

Before entering upon the use of acetylene as an illuminant, we desire to call your attention to the fact that its rapid and extraordinary development in this direction is largely due to the individual efforts of E. N. Dickerson of New York city, who, endowed with a special knowledge of the subject, has labored unceasingly to bring about the successful result which you will see this evening.

As an illuminant, acetylene surpasses in lighting power and economy all other illuminants known; when burned at the rate of five cubic feet per hour, it produces a light equal to 250 candles, whereas the best illuminating gas made from coal, or water gas, rarely exceeds twenty-two candles for each five cubic feet burned per hour. Your Philadelphia city gas is rated at from nineteen to twenty candles. Acetylene gas will, therefore, produce twelve and one-half times more light if the same quantity be consumed, or 1,000 cubic feet of acetylene gas will give you the equivalent in lighting power of 12,500 cubic feet of your city gas; it has, therefore, twelve and one-half times the value. To illustrate more fully the difference, we will first pass your city gas to the tube attached to this stand and ignite the gas as it issues from the burners; we then conduct acetylene gas to a similar row of burners, and light these; the contrast, as you will perceive, is almost marvelous.

The acetylene consumed in these burners has been generated in the apparatus before you in the following manner: Upon the carbide contained in this closed jar, Fig. 9, water is poured in small quantities through the glass funnel communicating with the interior of the jar. The acetylene gas generated passes through this tube to the inside of the gasometer, thereby lifting the holder to the position which it now occupies, and the gas can then be conducted from the holder to the burners by means of this rubber tube. As the gas is being consumed and the holder lowers, the supply is rapidly renewed by pouring an additional amount of water through the funnel upon the carbide contained in the closed jar. We will also light the gas produced from liquefied acetylene contained in this small tank, Fig. 10, and, as you observe, it burns with the same brilliancy and lighting power as the gas produced directly from the carbide.

The liquefied gas contained in the small tank weighs just two pounds, and is capable of generating twenty-nine cubic feet of acetylene gas, which is at the rate of fourteen and one-half cubic feet per pound. The gas produced by the vaporization of the liquid at a pressure, as the gauge now indicates, of forty atmospheres, passes from the tank to a reducing valve upon which the tank stands, whereby its pressure is reduced to that of a two-inch water column, as indicated on this U water gauge, and it is under this pressure that we are supplying the gas to the burners attached to the arm above. Each of the burners supplied with acetylene gas will consume, at the pressure indicated, $1\frac{2}{10}$ cubic feet per hour, each, therefore, emits a light equal to sixty candle power; the total candle power of the six burners in use is therefore 360, and the amount of gas consumed each hour $7\frac{2}{10}$ cubic feet. To obtain this result with city gas would require the consumption of at least ninety cubic feet per hour. The amount of oxygen withdrawn from the atmosphere of this room by the acetylene for the same amount of light, is but one-sixth of that required for your city gas; the products of combustion are, therefore, reduced in proportion and the air of the room is not vitiated to the same extent.

From the appearance of the acetylene flame it would seem as though its temperature was exceedingly high, but recent determinations have shown that the temperature of

1. The following details of the cost of producing 150 tons of calcium carbide *per diem*, as a by-product in the manufacture of 100,000 fire and pressed brick *per diem*, will, no doubt, interest you.

The figures were compiled by a manufacturer who was desirous of commercially utilizing the close proximity of large deposits of coal, limestone and clay. They show an annual profit of $635,640, with a selling price of $7 per ton for carbide:

PRODUCT OF 1,400 TONS OF COAL, 450 TONS OF CLAY AND 270 TONS OF LIMESTONE.

| | |
|---|---|
| 150 tons of calcium carbide, at $7 | $1,050 00 |
| 10 tons of sulphate of ammonia, at $70 | 700 00 |
| 40 tons of coal tar, at $7 | 280 00 |
| 910 tons of coke at 90 cents | 819 00 |
| 50,000 fire brick at works, at $15 | 750 00 |
| 50,000 dry pressed front brick, at $15 | 750 00 |
| | $4,349 00 |

5,445,000 FEET OF RICH ILLUMINATING GAS.

3,240,000 feet of this will produce 12,000 horse power for 24 hours allowing 1¼ pounds coal per horse power, and 9 cubic feet of gas as the equivalent of 1 pound of coal. 1,405,000 cubic feet of gas will burn 270 tons of limestone, producing 150 tons of lime, allowing 1,100 pounds of coal per ton of lime, and 9 cubic feet of gas as the equivalent of 1 pound of coal 720,000 cubic feet of gas will burn 100,000 bricks, allowing 800 pounds of coal per 1,000 bricks.

EXPENSES:

| | |
|---|---|
| Mining 1,400 tons of coal, at 55 cents | $770 00 |
| Mining 450 tons of clay, at 35 cents | 157 50 |
| Mining 270 tons of limestone, at 25 cents | 67 50 |
| Labor on 1,000 tons of coke, at 20 cents | 200 00 |
| Freight on 210 tons of limestone, at 50 cents | 135 00 |
| Labor in grinding 150 tons of lime, at 25 cents | 37 50 |
| Labor in making 1 10,000 brick, at $2 per M | 200 00 |
| Labor in smelting calcium carbide | 150 00 |
| | $1,717 50 |
| Twenty-five per cent. on $1,717.50 for general expenses | 429 37 |
| | $2,146 86 |
| Interest on plant per day | 83 33 |
| | $2,230 20 |
| Income | $4,349 00 |
| Expenses | 2,230 20 |
| Net income per day | $2,118 80 |
| Net income per year (300 days) | $635,640 00 |

1. A full description of this process and of the apparatus required therefor is contained in U. S. Patent, No 535,944, March 19, 1895.

the flame does not exceed 900° C., whereas the temperature of ordinary illuminating gas exceeds 1,400° C. For an equal amount of light the heat developed by the combustion of acetylene gas but slightly exceeds that of the incandescent electric lamp.

We have before us to-night, therefore, an ideal illuminating gas; its presence in a room can readily be detected by its penetrating odor; it emits more light with less heat than any other illuminating compound; it consumes less oxygen and can be commercially reduced at less cost for an equal amount of light. Furthermore, it is capable of being stored either as a solid in the form of a carbide or as a gas, or as a liquid, and these qualities alone are of exceptional value in its commercial application.

As a solid, in the form of a carbide, waste water power throughout the world can be utilized for its manufacture, and it can be shipped long distances without material deterioration. As a gas it can be generated from carbide and applied as such, and in the form of a liquid it can be applied to all purposes of isolated lighting, such as railroads and street cars, carriages, bicycles, steamships, sailing vessels, street lighting (by placing a small tank in each lamp-post, see Fig. 2), house lighting (in both city and country), buoys, lighthouses, lanterns, and to the enriching of ordinary illuminating gas in dwellings. Its application to this latter purpose will permit the gas companies to produce a low priced gas for heating purposes, which can then readily be enriched in each house with acetylene gas generated from a tank of the liquefied gas. To show the value of acetylene gas if applied to the lighting of your city, we will make a comparison which may surprise you. The amount of gas produced by your city works will approximate 4,000,000,000 cubic feet per year of, say, twenty candle power. By the use of acetylene gas the amount of gas required would be reduced in the proportion of 1 to 12.5, or 4,000,000,000 cubic feet of city gas could be replaced by 320,000,000 cubic feet acetylene gas, representing a saving of 3,680,000,000 cubic feet of gas annually.

In addition to its value as an illuminant, acetylene gas can be used commercially for power and heating purposes, and in the form of a liquefied gas it will be invaluable for such use. Its application in this direction is, however, such an extensive one that we are compelled to make it the subject matter of another paper. In conclusion, we desire

FIG. 6. CARBIDES AND ACETYLENE COMMERCIALLY CONSIDERED.

to thank you all for your kind attention, and especially the officers and members of the Franklin Institute for the interest they have manifested in our work.

## Electric Railway Deal for Pittsburg.

An interesting story comes from Pittsburg about an alleged movement to control all the street railway companies of that part of the country by two syndicates. The dispatch says:

Peter A. B. Widener and W. L. Elkins, the Philadelphia Traction road owners, were here to day inspecting the construction of an amusement pavilion to cost $300,000, which the Pittsburg & Duquesne Traction company is building at the entrance to Schenley Park. Widener and Elkins own the Pittsburg Traction company and control the Duquesne, which parallels the Pittsburg, and was built by C. L. Magee and other local political bosses and unloaded on the Philadelphians under the guise of a traffic arrangement. There are eleven traction companies operating in Pittsburg now, their capital and bonded indebtedness aggregating $37,000,000, but they have been branching out into the suburbs so much lately that they have been treading on one another's toes, figuratively. The money that will go into new electric lines in this vicinity in the next few years is placed at over $20,000,000, so it is proposed to make a division of territory, combining eleven companies into two, to gather up every possible right of way, and by a traffic arrangement conduct the transportation business for thirty miles around from only two offices. Without this sixty-mile radius connection will be made with electric roads operating throughout eastern Ohio at the headquarters of the Monongahela, in West Virginia, and up the Allegheny. Widener and Elkins, with Chris Magee, State Senator William Flinn and J. D. Callery are the capitalists principally interested as managers in the big deal. Magee and Flinn are in everything here and so will have a hand in both companies. The first four named will control one company. Mr. Callery will be most in evidence in matters connected with the other, known now as the Second Avenue syndicate. This company will be given the territory along the Monongahela river and south of the Ohio, extending forty-five miles, from Beaver Falls to McKeesport, and tapping many thriving towns by spurs and the hilltops by inclined planes. The Widener-Elkins company will have all the business from Rochester twenty-five miles down the Ohio on the north bank, Alleghany City, the best part of Pittsburg and the Alleghany and East Liberty valleys.

## Extending the Chicago City Railway Company's Electric System.

Much interest is shown in financial circles in the result of the transformation of the horse car lines of Chicago into electric lines. The financial writer of the *Chicago Tribune* last week said:

The City Railway company is so well satisfied with the result of its electric street railway lines that it proposes to extend them wherever possible. Plans of the company contemplate an elaborate extension of its electric system. It is now the intention to cover the Hyde Park section in a way that will make competition by any other surface company simply out of the question. Endeavors are now being made to obtain the consent of property owners to the construction of a complete system of electric lines in that region. The district north of the Midway Plaisance and east of Cottage Grove avenue is not well supplied with local transportation facilities. It has the cable line on Fifty-fifth street, and that is all between the Cottage Grove cable line and the Illinois Central steam cars. If the consent of the property-owners can be obtained the City Railway will build a number of electric lines in this territory, so as to fully serve all portions of the district. The Hyde-Parkers are not particularly anxious to co-operate with the City Railway in its plan. Property-owners on a good many of the streets are making vigorous objection. The company is proceeding carefully and quietly, but some of the objecting property-owners are organizing to defeat the plan. Wherever the company's agents go to secure frontage signatures, petitions are also circulated in opposition to the building of the line. There will undoubtedly be considerable difficulty in obtaining right of way on some of the streets. But in cases where there are large holdings of unimproved property the consent will be more readily obtained. There is little doubt that within a few months a number of electric lines will be constructed in this territory, which will be feeders to the cable.

## Damage Suit Growing Out of the Street Car Encounter on Twenty-second Street, Chicago.

In addition to the chancery suit brought by the Chicago General Railway company to test its right to run over the tracks laid in Twenty-second street, Chicago, the same company has sued the Chicago City Railway company for $300,000 damages for its course in wrecking the car of the plaintiff company on April 4th, as detailed in the WESTERN ELECTRICIAN of April 13th. The following extracts from the complaint in the damage suit, brought in the Circuit Court, are interesting:

And the said plaintiff further avers that the organization of said force by said defendant, and the unlawful and riotous attack upon and destruction of said plaintiff's said property as aforesaid, and the interruption and injury to said business as aforesaid, by the said defendant, with force of arms as aforesaid, instead of appealing to the courts of justice for a remedy for any supposed wrongs or injuries which it might pretend it had suffered, or which it might pretend were impending, constitute a most pernicious and dangerous example of lawless and anarchistic conduct, highly calculated to inflame the public mind and lead other persons to resort to force and violence for the redress of any real or fancied wrongs, instead of seeking a remedy therefor according to the law of the land; and said conduct of said defendant also tends to bring the plaintiff into disrepute, and to injure its credit and business standing.

And the plaintiff further avers that the defendant, a corporation as aforesaid, is possessed of the great wealth, to-wit: about seventeen millions of dollars ($17,000,000); and that said defendant is in the continual receipt of great gains, profits, revenues and income from its business of carrying passengers for hire, and that said gains, profits, revenue and income amount annually to a great sum, to-wit: the sum of about five millions of dollars ($5,000,000) or upwards.

And said plaintiffs further aver that they are entitled, according to law, to recover of and from the said defendant, the sum of to-wit: fifty thousand dollars ($50,000) for injury and damage to their property and business; and are also entitled to recover of and from said defendant the further and additional sum of two hundred and fifty thousand ($250,000) dollars, as exemplary damages for the hatred, malice and ill-will so as aforesaid shown by said defendant; and for the gross and excessive violence, lawlessness and anarchy used by said defendant in and about the destruction of the property of said plaintiffs as aforesaid; and for the disorder and riot caused by said assault and destruction; and also as a proper means of admonishing the said defendant against any repetition of the unlawful and riotous conduct aforesaid; and also as a proper means of deterring other persons who might otherwise feel permitted, excused or justified by the lawless example set by said defendant as aforesaid, in resorting to the like lawlessness, anarchy, force and violence for a redress of any wrongs or injuries or what may be supposed to be such, instead of seeking a remedy therefor in the courts of justice; and that in fixing said additional sum the aforesaid great wealth and income of the defendant should be considered, as well as its wrongful, riotous, lawless and anarchistic acts aforesaid, and the enormity of its wrongful purpose to injure the plaintiff, and anticipate and prevent any competition in said business.

## Beetles Attack Electric Lights.

The following vivid account of the first attack of bugs upon the electric light this season is furnished by the Lancaster, Pa., correspondent of the New York *Sun*:

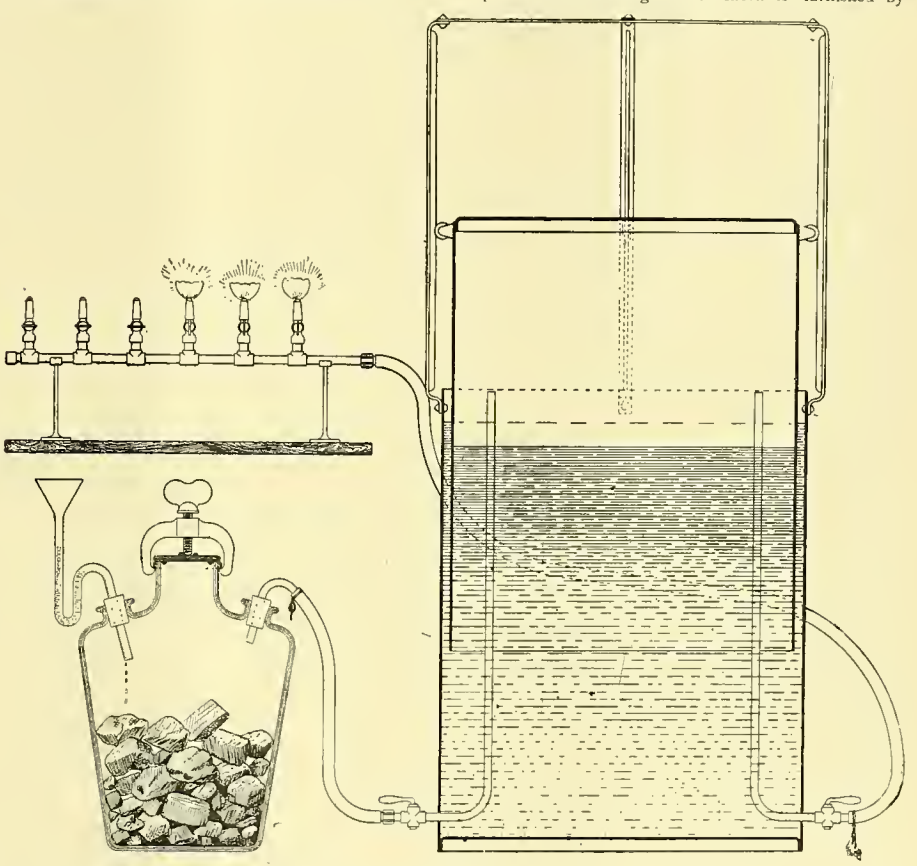


FIG. 9. CARBIDES AND ACETYLENE COMMERCIALLY CONSIDERED.—APPARATUS FOR THE MANUFACTURE OF ACETYLENE FROM CALCIUM CARBIDE.

The pavements of this town early this morning were hidden in many places under masses of bugs bigger than the biggest locusts ever seen here. They swooped down upon Lancaster, literally by the million, during the night, and flying clouds of them filled the humid atmosphere. The electric street lights were the main point of attack, and their glitter brought destruction to the strange nocturnal visitors. The bugs would charge in solid column up against the arc lamps that swing in the middle of the streets or over the sidewalks, and down they would fall dead or disabled. They were gathered up by bushels under all of the hundreds of arc lights in various parts of the city this morning. The interiors of the globes were, in many instances, practically choke-full of bugs. Under the gas lamps they were found in somewhat smaller quantities, dead or dying.

Examination showed that there were two kinds of bugs, but the ones more plentiful were black and green and much larger than the largest species of roaches. They have shell-like backs. The other kind were gray and several sizes larger.

A local entomologist describes these midnight visitors as members of the family of water beetle. They come from the ponds and marshy places, and about this time of the year they are on the move. The present visitation, however, is phenomenal. The bugs do not fly by day. In the ponds they hide in the deep mud.

The stockholders of the Edison Electric Illuminating company of Altoona, Pa., will erect a $75,000 iron fireproof building.

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CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK

CIRCULATION, 16,630.

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OWING to the great interest that is manifested in acetylene, the paper presented elsewhere on this subject, which was read before the Franklin Institute by Dr. Suckert, is particularly timely. Mr. Haskins' article in the WESTERN ELECTRICIAN of April 6th called attention to the experiments which are considered in greater detail by Mr. Willson and Dr. Suckert in this paper, and no doubt this last contribution will awaken renewed interest in the subject. It is certainly a very carefully prepared treatise on this important topic, and it should be carefully studied in all its bearings.

REPORTS from all parts of the country indicate improvement in trade, and the outlook for the coming season is certainly very encouraging. Capital is much more easily obtainable for promising enterprises, and from every section of the country reports are received of the formation of new companies and extension and enlargement of existing plants. Manufacturers of machinery and supplies have been preparing for this revival of business, but the demands have become so pressing in many cases that companies with large capacity are now unable to fill orders on short notice. This activity is particularly noticeable in street railway and power transmission projects, but other departments of the electrical industry are experiencing growing demand and there is general rejoicing over the prospect of an era of prosperity.

DURING the last week several fenders, wheel guards and similar devices to be used in connection with electric and cable cars were patented at Washington, but none of them have any particularly novel features, and it is doubtful if the problem which is puzzling street railway managers has yet been solved. It would seem as if some intelligent mechanic or experienced street railway manager would be able to combine the best features of several fenders with which all are familiar and secure a fairly efficient device. The demand for a practical safety device of this kind is becoming so pressing that it will have to be recognized. In many large cities the advisability of the municipal authorities stopping electric and cable cars not provided with fenders is being seriously considered. It does not seem possible that such a measure is necessary, but in many places the people are prejudiced against the companies, and they will do every thing to hamper them. There is no doubt that fenders are absolutely necessary to insure safety, and a practical device of the kind would be hailed by street railway managers in every part of the country. Fame and fortune await the successful inventor.

AN "electrical house" at the Bordeaux exposition of 1895 will demand the attention of all who desire to know and see how much electricity can do for the housekeeper in the way of substantial assistance, as well as in the line of elegant luxury. In the basement will be installed the generators to supply current for power and illumination, douche baths, an electrical kitchen complete, which, according to the gourmands, is the acme of all cookeries, a bicycle station with storage batteries and motors, warranted not to be beaten by any of treadle form. An electric elevator will serve all the floors, conduct visitors to all the apartments, chambers and retiring rooms fitted with all the modern comforts; there will be an abundance of light most conveniently distributed and readily handled, and bells from everywhere to anywhere else; fire alarms that will ring almost at the sight of a garden hose, and burglar alarms that would make a policeman shudder, and a porch climber weep and turn honest. The bathing apartments, fitted up most luxuriously, will be supplied with all sorts of hygienic electricity, and all kinds of ways of applying it. On the top floor there will be a photograph gallery with artificial illumination, and to crown the whole a huge searchlight will blaze in the tower and shed its powerful rays over the gardens of the exposition.

CORPORATIONS operating under public franchises are not regarded by the public as philanthropic enterprises, although thinking men realize that they are public benefactors as well as money-making institutions. Occasionally, however, one of these corporations suggests a measure for the public welfare that entitles its managers to more consideration than is generally accorded. Our Boston correspondent this week calls attention to an order that has been introduced into the Common Council of that city providing for hospital or ambulance cars to run on the tracks of the West End street railroad. President Little of the company is quoted as saying that the road would find little difficulty in meeting the requirements of an ambulance service. He also suggested the idea of fitting up a number of hospital cars or convalescent cars for the use of patients who would be benefited by a trip in the suburbs during the summer months. The suggestion is a good one. In other cities ambulance service has been discussed, and in St. Louis a finely equipped ambulance car has been in operation for some time. It has proved eminently satisfactory, according to the reports of those interested in the project. But the idea of hospital or convalescent cars as proposed by President Little is a novelty. It seems to be practical and is certainly very creditable to the originator of the scheme. There are many other cities in the country where this plan could be adopted for the relief of suffering humanity, and its general adoption would in a measure be reparation for some of the injuries inflicted by trolley companies.

ON another page this week the annual report of the New England Telephone & Telegraph company is presented. It gives a better idea of what has been done in that territory than any statement that has heretofore been made public, and for that reason it will prove valuable to capitalists contemplating investing in rival corporations. It is evident that the New England concern has anticipated spirited competition and that it has made elaborate preparations to resist any attempted invasion of its field. The reports that are here presented of the improvements and extension of the service clearly indicate that the Bell interests have fortified themselves against attack and that they will have every advantage that experience, expert advice and a well established business can give. The financial statement shows that the company is by no means destitute of funds to carry on this warfare or that it is afraid to spend money to crush out or prevent competition. The territory in which the New England company operates is one of the most desirable in the country, and it will naturally prove very attractive to those desirous of entering the field against it. In preparing for the conflict the company has not overlooked the probability that it would be attacked through legislation, and it has induced some of its subscribers to go before a committee and urge that nothing be done in the way of regulating charges that would affect the present standard of service. The report says that "subscribers in any of the towns of business consequence do not desire the lessening of rates to an extent which would impair the quality of the service." Certainly not. Subscribers want the very best service that the state of the art provides, but it is evident that many of them consider that the present charges could be modified without "impairing the quality of the service."

HERE is a curious condition of affairs, reported in the *Chicago Tribune*, which would scarcely be credited if coming from a friendly source:

West Twelfth is the only street so far discovered where the trolley line is welcome and the inhabitants do not arise in frantic protestation whenever a gang of workmen comes along to plant poles and string wires. The horse car service west of Ogden avenue has been so wretchedly inadequate the trolley is hailed with joy, and the residents are anxiously awaiting the completion of the line. For this reason, no doubt, the work is progressing at a snail's pace. If there was a wild and warlike kick from everybody along the street the company would send workmen and wires before daylight and have everything completed by nightfall. Poles are in place and the cross wires are strung, but the trolley wires are not yet adjusted and the Twelfth street populace is still yearning.

There is no doubt that the people of Twelfth street are very anxious to secure a trolley line and that they are urging the company to complete the work. It is a fact of no little significance, too, that the property owners on streets having horse car line are not now so strongly opposed as formerly to the substitution of the trolley for the horse car. They have come to realize the advantages of having quick and convenient transportation facilities at hand, and they are likewise aware that the earning capacity of property, whether commercial or residential, is materially increased by the establishment of an efficient street railway service. To Chicagoans the time required to go from any place under consideration to the business center of the town is one of the most important points to consider in selecting a residence, and the locality most favored in this respect is the most desirable. The remarkable extension of the trolley system in Chicago during the last two years has completely revolutionized conditions. No wonder it has advanced in public favor.

WE are constrained to reprove our contemporary, the *Electrical Review* of New York, and urge it to be more exact in its statements, especially when these statements concern its neighbors as well as itself. In calling attention editorially to its commendable enterprise in printing data taken from the annual report of the General Electric company, our contemporary said last week: "The *Electrical Review* publishes news. For instance, the General Electric annual report a week in advance of its contemporaries." etc. On another page it says: "A condensed statement of the General Electric company's annual report appeared in last week's *Electrical Review*, and herewith are appended President C. A. Coffin's comments on the report." The article alluded to was printed May 1st and one of the headings, "Abstracts from the Report," more nearly fitted the article than any other name or allusion to it found in the *Review*. Taken separately the statements made by our contemporary are misleading, if indeed they are not absolutely untrue, and taken collectively they are contradictory and confusing. An analysis of the several assertions proves the folly of our contemporary's course in this matter. In relation to the first statement that "the *Electrical Review* publishes the news," it may be said that this announcement of a departure from the policy of that paper, if considered seriously, is really a very important declaration, but the subsequent sentence, which is evidently intended to explain or emphasize the first, raises doubts at once in the mind of the reader. The *Review* did not publish the General Electric report "a week in advance of its contemporaries," nor as a matter of fact has it published that report up to the present time. Again, it had not published "a condensed statement," and what it is pleased to call "President C. A. Coffin's comments on the report" was in reality the most essential feature of the document itself. It grieves us deeply to be obliged to call attention to the failings of a well-meaning and otherwise harmless friend, especially in view of the labored attempt our contemporary is making nowadays to sustain the dignity of its position as "the oldest electrical weekly in the United States," but we feel that it is our duty at this important period of our contemporary's existence, when it appears to be entering a new field, to urge it to be exact as well as enterprising. It would be folly for it to adopt the policy of its more or less esteemed contemporaries of the East, which claim everything in sight. Enterprise is essential in making a newspaper successful, but accuracy is also necessary to inspire public confidence and maintain a standing in the community. In conclusion, then, while renewing our warning to our venerable friend, we extend our congratulations upon the enterprise it has already displayed.

## Plans of the Wisconsin Telephone Company.

[From the Milwaukee Correspondent of the WESTERN ELECTRICIAN.]

Within the next two months the Wisconsin Telephone company will materially reduce its rates in Milwaukee. The reductions are expected to take effect about July 1st. Some time ago the company announced a reduction of about 25 per cent. in the towns throughout the state, and it also announced that it would reduce toll rates. Nothing was said at that time of any intention to reduce telephone rates in Milwaukee and consequently the subscribers here began to protest against what they considered an unjust discrimination. The Merchants and Manufacturers' association demanded a reduction in Milwaukee rates. Business offices here pay from $75 to $120 a year and residences pay from $50 to $75. The resolutions adopted by the association recite the facts that the cost of telephone service has necessarily been reduced by the expiration of valuable patents and that other telephone service, with the very best of underground conduits, and with a central office system, is urged upon the association, the cost to be $25 a year for private residences and $50 a year for business purposes, and the resolutions add that, notwithstanding the unjust charges imposed about Milwaukee, the association has no wish to jeopard the company's large investment here, but if it does not make reasonable reductions in its charges, the resolutions say, the association will be bound to favor the introduction of the new telephone service in Milwaukee. Soon afterward the company made the announcement that it had intended all along to reduce charges in the city and that lower rates would be put into effect about July 1st. Just what the reduction will be is not known, but as rates have been reduced about 25 per cent. in the small exchanges in the interior of the state, it is expected that a reduction of about that amount will be made here. The directors of the company manifest a disposition to make a reasonable reduction, and there is little doubt that everything will be satisfactory.

This matter had hardly been settled when there was a protest against the new toll rates. Under the old schedule it cost $1 to talk five minutes between Milwaukee and Green Bay, for instance, while under the new schedule of 70 cents for three minutes and 25 cents for each additional minute, the cost would be $1.20 for a five-minute conversation. There were other cases of an actual increase in charges for a five minutes talk under the new schedule. When their attention was called to it, the officers of the company at once said that the rates would be changed so that five-minute conversations would not cost any more than they had under the old schedule. In only a few cases, General Manager McLeod said, did the conditions complained about exist, and there had been no intention of charging more for any conversations over the toll line than had been charged under the old rate. He said that in the past the toll lines had not been used enough to pay, and that the company's object in making the changes was to bring the lines into more general use. A close tab had been kept upon all persons using the toll lines and it had been found that almost all of them had talked for only three minutes. One day, of 137 conversations held over the line, only thirteen were of five minutes' duration, the other 124 being under three minutes. The company had concluded that, as a rule, all business conversations could be finished in three minutes. Thus it was thought that by reducing the limit to three minutes, and making a reduction in the charges, toll conversations would become more frequent, charges would virtually be reduced, while the company, while charging less for any one conversation, would nevertheless be a gainer, by reason of its line being in more general use. Careful investigation shows that business men talk at the rate of 150 words a minute, anybody using only 100 words during that time being a very slow talker. Thus, for the amount charged for a three-minute talk, a patron of the company and the person with whom he wishes to talk may exchange 450 words.

The Wisconsin Telephone company is engaged in extending its long-distance telephone lines in the state. The most important extensions are as follows: From Appleton to Stevens Point, via New London, Winneconne and Plover, a distance of eighty miles; Watertown to Whitewater, via Jefferson and Fort Atkinson, thirty-two miles; Whitewater to Lake Geneva, via Elkhorn and Delevan, forty miles; Beloit to Janesville and Janesville to Whitewater, forty miles, with the completion of the extensions along the west shore of Lake Michigan. The demand for extensions is urgent, General Manager McLeod says, and although the financial question is a serious one, the telephone interests having suffered as much as any from the hard times, yet the company will build the new lines. The telephone business is picking up. During the first two months of the present year, for instance, the company did not lose a single subscriber, while of course it got a number of new ones, which is a pretty good indication, Mr. McLeod thinks, of the condition of business in general.

General Manager McLeod says that Milwaukee is more highly developed in the direction of metallic circuits than is any other city of relative size and situation in the United States. Fully two-thirds of the telephones in the Milwaukee exchange have metallic circuits, so that the subscribers can talk with any one of 60,000 stations in the United States, and all of this has been accomplished within the last three years.

## Missouri & Kansas Telephone Company.

On May 1st an important change was made in the telephone system of Kansas City. It was moving day for the Missouri & Kansas Telephone company, which transferred the local exchange from the Wales building, at Sixth and Delaware streets, to the handsome new quarters fitted up for it in the Telephone building at Sixth and Wyandotte streets, one block west. The general offices of the company have been in the latter building for two years and the work of preparing for the consolidation has required ten months of unceasing work. The change was made without any interruption in the service whatever. The switchboard and all the other furnishings of the new exchange are absolutely new and thoroughly up-to-date in every respect. The switchboard accommodates 2,700 telephones and has a capacity without further extension of about double that number. When there shall be 5,000 subscribers the switchboard can be extended around the room and accommodations secured for a great many thousands of subscribers—more than the company anticipates in the next twenty years. In the rear of the room where the switchboard is located is a large, airy, well lighted and well ventilated apartment partitioned off from the switchboard room. This is the lunch room for the girls and it is provided with numerous chairs and tables, and other conveniences. Another convenience for cold weather which has been provided is a steam pipe which will run the entire length of the switchboard. A room has been fitted up with lockers and each girl has a locker assigned to her, marked with her name and designed for her personal use. A bath room and wash room have been provided where the girls can take a bath at any time they desire to do so when their duties do not interfere. The bath room is fitted up regardless of expense, and all the appurtenances are of marble. All modern conveniences are provided.

The fire escapes of the building are iron stairs, with balustrades running from the top to the bottom of the building, and are of easy access from all the rooms. They are as safe as any other kind of stairs, and there is no danger of anyone falling in the attempt to escape from the building in case of fire.

The company has been experimenting for some time past in the effort to get exact figures as to the workings of the system. Exhaustive statistics have been compiled and records kept, with the result that an average table will show that there are in the neighborhood of 40,000 telephone calls per day, or about 1,350 per hour. Each subscriber uses his telephone fifteen times per day, on the general average. The last figures were taken March 11th, on which day the following was obtained among other information: Number of subscribers, 2,675; number of calls per operator, 1,331; total number of calls, 39,942; number of calls per operator per hour, 93. The records were kept from 1 o'clock in the morning till midnight. Between 1 and 2 o'clock there were but fifty calls for the entire exchange. There was a gradual falling off until 4 o'clock, when there were only about ten calls between 4 and 5 o'clock. The rush began about 7 o'clock in the morning. Between 7 and 8 o'clock there were 800 calls, between 8 and 9 o'clock there were 3,400 calls, and between 9 and 10 o'clock there were 4,500 calls, 10 o'clock marking the highest point and the greatest number of calls. By 11 o'clock the number had dropped back to 3,800; between 11 and 12 o'clock there were 3,600 calls, and by 1 o'clock in the afternoon the number had dropped to 2,500 per hour. Then there was a spurt as people got back and the day's business was resumed. The number of calls jumped up to 4,050 by 3 o'clock, and from that time on there was a steady decline, the number for the hour from 11 o'clock at night to midnight being but 100. This gives some idea of the work done in the office, especially when the figures show that each operator must answer about 1,300 calls in the course of the day.

The company disburses about $100,000 every year in wages in Kansas City. It employs sixty-five men and seventy-five girls. Alonzo Burt is the general manager of the company and C. T. Carll is manager of the Kansas City branch.

## Competition Favored at Saratoga.

It is understood that a movement is on foot among a number of Saratoga, N. Y., capitalists toward the incorporation of a new telephone company. It is believed that the establishment of much lower rates than those in vogue will result in a large increase in the number of subscribers, to the extent that the company would soon be placed upon a paying basis.

## Annual Meeting of New England Telephone & Telegraph Company.

[From the Boston Correspondent of the WESTERN ELECTRICIAN.]

The annual meeting of the New England Telephone & Telegraph company was held on May 6th at Boston. Thomas Sherwin, president, submitted the following report for the directors:

Your directors present herewith their report of the operations of the company for the year ended December 31, 1894.

As shown by the treasurer's statement appended, the gross revenue for the year was $2,172,220.38; expenses were $1,673,758.78; net revenue, $498,461.60. As compared with the results of the business for 1893, there was an increase of gross revenue, $129,471.60; increase of expenses, $113,678.46; increase of net revenue, $15,793.14.

The maintenance account shows a large increase over that of any previous year in the history of the company, due in part to the substitution of the underground system in numerous exchanges, in place of aerial construction; and in part to the occurrence, in April and November, of severe sleet storms, which prostrated portions of the toll lines carrying expensive copper circuits, and involved the complete rebuilding of long sections with new poles and wire.

The net increase in the number of exchange and express stations, 1,094, is somewhat better than that recorded in our last annual report, though not equal to that of previous years, when general business throughout our territory has been in more prosperous condition.

The list of metallic circuit subscribers has been largely augmented, now numbering upward of ten thousand, or nearly half of those connected with the exchange systems. The changes requisite to adapt the equipment to this class of service has gone rapidly forward, and eighty-six of the exhanges are now equipped with metallic circuit switchboards. The more general use of this service has contributed, together with the extension of the toll lines, to the considerable increase of toll receipts shown in the treasurer's statement, which would have been still larger but for interruption of the service upon some of the principal routes by the storms before referred to.

The most important addition, in point of distance, to the toll construction has been the extension of the lines beyond Portland, to bring Bangor, Bar Harbor and intermediate towns within the general system which now connects the principal cities and towns of New England, New York and more distant states. While this extension has involved a considerable outlay of money, your directors believe the undertaking to be in accord with the sound policy of providing for our subscribers throughout the territory as good and extended facilities as they can use to their advantage, and with promise of fair return to the company.

During the year a large amount of underground work has been accomplished, in extension of systems already in operation and the opening up of new locations.

The company has now thirteen exchanges in which provision has been made for underground cables, Lynn and Manchester having been added to the number since our last report.

Recent improvements in exchange station system and apparatus enable us to render good service for several stations upon a single circuit, and since the beginning of this year a substantial reduction of exchange rates has been made to the subscribers upon party lines. The present schedule of charges for service of this class meets the requirements of a large and increasing number of subscribers, who have occasion to use the exchange connection to a moderate extent, but not so constantly as to necessitate a special circuit.

The plan of measured service, with rates based upon the number of conversations, has also been introduced in the Boston division, in the interest of subscribers whose use of the telephone is not large. The subscriber who elects this class of service is furnished with the best equipment, and is entitled to call for eight hundred or more connections per year as he pleases, paying upon a decreasing scale as the number increases. The plan has met with favor, and some three hundred subscribers are already connected under this arrangement.

The question of exchange rates has been a subject of some general interest, and it is one to which your officers and directors have given careful study.

The policy of this company has been, from the first, to improve the character of the plant, and to bring the quality of the service to the highest attainable standard, making the rates such as should give a fair return upon your investment, and ensure also a good return to the subscriber in a service of actual and increasing value for the conduct of his business.

To this end a liberal expenditure has been made for maintenance and extension of the plant, the poorer lines replaced by those more substantial, copper wire substituted for iron, underground for aerial lines, improved devices in equipment put in use, and a corps of highly trained employes retained in the electrical, engineering, line and instrument, and operating departments. To illustrate the rate at which the plant must be replaced in order to keep pace with modern improvement, the fact may be mentioned that no less than eighty-nine of the exchanges have been equipped with new switchboards within the past six years.

Within the same time the number of exchange subscribers has increased by 43 per cent., the number of daily exchange connections by 137 per cent. and the number of toll-connections by 200 per cent.

The statistics further show that every subscriber, upon the average, is using his telephone 66 per cent. more than he used it six years ago.

These facts point to but one line of conclusion—that the telephone has year by year, as the system has extended and the standard of service improved, become of steadily increasing value to the individual and to the community.

The man of business now uses his telephone not as an occasional convenience, or as an alternative for other means of communication, but as the usual, constant and effective agent for transactions requiring despatch, accuracy and clear interchange of thought for their accomplishment.

That the telephone system in this country has reached this place of usefulness is evidenced not alone by the number of millions of connections which are made over the lines, but by the unparalleled development in point of number of its regular users.

Statistics which have appeared in foreign scientific journals show that the number of subscribers in the United States exceeds the aggregate number in all of continental Europe. The subscribers in the six New England states outnumber those connected with the entire French system, and subscribers to the Boston and suburban division of this company considerably exceed in number those in London, which has five times the population.

It is evident that with well-trained employes and lines and apparatus of the most approved description, the service cannot be carried to a point of efficiency too high to serve to best advantage the needs of the business community, and with the larger use constantly required by the subscriber, this standard can be maintained only by a large current expenditure for operation and maintenance.

It is equally true that the subscribers in any of the towns of business consequence do not desire the lessening of rates to an extent which would impair the quality of the service.

The expression of this feeling among our subscribers is very general, and both this year and the last numerous subscribers have been before the committee of the Massachusetts Legislature to ask that no law should be enacted which, by the arbitrary restriction of telephone rates, might result in lowering the quality of the service and lessening its value to the users.

The expenditure upon new construction during the year amounted to $445,095.86, of which $63,995.80 was for exchange aerial construction; $216,946.62 for underground work; $72,719.67 for equipment; and $91,433.77 for toll lines.

New exchanges have been opened at Eastport, Livermore Falls, North Berwick and Sanford, Maine; Bristol and Rochester, New Hampshire; Chester and White River Junction, Vermont; Hingham, Lexington, Wakefield, Ware, Wellesley and Winthrop, Massachusetts. The exchange at Windsor, Vt., has been closed and its subscribers connected with the Claremont, N. H., exchange. On January 13, 1895, the Haymarket exchange in Boston, which had been for more than a year in process of construction, was put in operation with about one thousand subscribers, who were transferred from the Milk street exchange. The last named exchange had nearly reached its ultimate capacity, and with the increasing number of subscribers and the steadily growing volume of business due to the larger daily use required of the service by the individual subscribers, a division of the exchange had become a necessity.

The Haymarket exchange is equipped with apparatus having the latest improvements in self-restoring drops, visual signals and trunking devices, and in its appointments is designed with a view to the health and convenience of the operators employed there.

Following is a condensed statement of the construction and reconstruction for the year, not including the work of ordinary repairs, nor the wire connections for new subscribers' stations: On the exchange system of the western division 4,056 poles have been placed, 304 miles of wire and 5,176 feet of cable have been hung. In the central division, 1,831 poles, 133 miles of wire and 17,689 feet of cable have been placed for exchange use. In the eastern division, 1,025 poles, 117 miles of wire and 8,712 feet of cable. In the northern division, 3,031 poles, 215 miles of wire, 1,426 feet of cable. In the Boston and suburban division, 3,213 poles, 318 miles of wire, 55,407 feet of aerial cable.

The underground system in the city of Boston now extends through 158,000 feet, about 30 miles of streets, the total length of duct being 1,172,000 feet, or something more than 220 miles. In twelve of the exchanges outside the city of Boston, the company had, to the close of 1894, constructed 106,200 feet of conduit, containing 575,900 feet of duct; making the total underground system to consist of 264,000 feet of conduit and 1,748,000 feet of duct, with a wire capacity of about 40,000 miles.

During the year 1,968 miles of copper wire and 651 miles of iron wire have been strung for toll line use.

The inventory of supplies purchased during the year includes 1,239 magneto bells, costing $11,151; bell fittings, $5,758.15; backboards and battery boxes, $4,212; batteries and battery material, $9,883.35; 313,970 feet of cable, $94,945.06; cross-arms, pins and brackets, $18,133.24; insulators, $5,512.35; 26,107 poles, $60,101.09; switchboards and material therefor, $57,550.38; 733 tons outside wire, $91,503.07; 500 miles inside wire, $13,683.56; booths, $7,585.57; 528 cabinet sets, $13,214.50; cords, $3,097.53; hardware and tools, $5,986.69; paint, $3,868.43; strong current protectors, $11,329.47; stationery, $11,091.33; office furniture, $4,368.13; 427,150 feet under ground pipe, $38,838; with other material of various kinds, making the total cost of supplies $504,654.34, against $331,154.07 for the previous year.

The expenditure upon plant and equipment during the year has been:

| | |
|---|---|
| For new construction | $ 445,095.86 |
| For maintenance | 676,219.09 |
| | $1,121,314.95 |
| As against an expenditure in 1893 of | 927,955.87 |

The total mileage of exchange wire, December 31, 1894, was:

| | |
|---|---|
| On poles | 27,505 miles. |
| On buildings | 1,234 " |
| Underground | 14,121 " |
| Submarine | 148 " |
| | 43,008 miles. |

| | Dec. 31, 1893. | Dec. 31, 1894. | Increase. |
|---|---|---|---|
| Exchange stations | 21,137 | 22,259 | 1,122 |
| Express stations | 511 | 483 | Loss 28 |
| Private line stations | 3,684 | 3,630 | " 54 |
| | 25,332 | 26,372 | 1,040 |

It is a coincidence that the net gain in the number of stations of all classes during 1893 was exactly the same, 1,040. The number of regular employes of all classes is 1,112. The average number of exchange connections, daily, in all exchanges of the company is 172,727, or an aggregate for the year of about 55,000,000. The average number of calls per subscriber is 7¾, the number varying from less than five in some of the smaller exchanges to thirteen in the principal exchange in Boston.

Dividends amounting to 4 per cent. upon the capital stock have been paid during the year.

To provide funds for new construction the $400,000 of 6 per cent. bonds which remained unissued at the close of 1893 have been sold and the bonded debt now amounts to $2,500,000, less $33,000 of the issue of 1889, which have been withdrawn and cancelled. To meet the future needs of extension, your directors have authorized the issue of a sixth series of $500,000 of debenture bonds, payable at the end of twenty years and bearing 5 per cent. interest. Arrangements have already been concluded for the sale of $150,000 of this series. We estimate that the expenditure for repair and extention of the plant during the year 1895 will be:

| | |
|---|---|
| For new construction | $ 400,000 |
| For maintenance | 720,000 |
| | $1,120 000 |

The following is a comparative statement of the revenues and expenses for 1893–1894:

REVENUE.

| | 1893. | 1894. |
|---|---|---|
| Exchange service | $1,657,312.93 | $1,769,912.65 |
| Toll service | 253,051.47 | 298,670.08 |
| Private line earnings | 80,701.45 | 52,025.33 |
| Messenger earnings | 13,104.50 | 17,570.29 |
| Real estate revenue | 2,374.92 | 2,249.92 |
| Interest | 14,587.68 | 16,576 65 |
| Miscellaneous revenue | 21,615 77 | 15,215.16 |
| | $2,042,748.78 | $2,172,220.38 |

EXPENSES.

| | | |
|---|---|---|
| General, including taxes | $242,047.61 | $261,670.40 |
| Operating | 283,723.06 | 313,864.46 |
| Maintenance | 570,868 08 | 676,219.09 |
| Rental and royalty | 323.263.79 | 253,807.99 |
| Private line expense | 4,136 09 | 7,534 00 |
| Messenger expense | 13,124 72 | 16,992.83 |
| Real estate expense | 1,014 67 | 1,144.68 |
| Interest | 121,902.28 | 142,525.33 |
| | $1,560,080.32 | $1,673,738 78 |
| Net revenue | $482,668.46 | $498,481.60 |

LEDGER BALANCES, DECEMBER 31, 1894.

DEBTORS.

| | |
|---|---|
| Property and franchise, January 1, 1894 | $12,658,793.31 |
| Construction for year 1894 | 445,035.86 |
| Supply department | 200,230 13 |
| Real estate | 25,219 67 |
| Stocks and bonds | 30,000.00 |
| Trustee stock | 231,000.00 |
| Accounts receivable | 443,642.05 |
| Cash | 133,331.55 |

CREDITORS.

| | |
|---|---|
| Capital stock | $10,304.600.00 |
| Surplus | 595,2 2.40 |
| Income account | 218,062.60 |
| Bonded debt | 2,467,000 00 |
| Debt, accounts payable | 122,791.84 |
| Reserve | 368,725.73 |
| | $14,167,312.57 $14,167,312.57 |
| Net loss of private line subscribers for the year 1894 | 54 |
| Net gain of exchange subscribers for the year 1894 | 1,094 |

## More Competition Promised in Wisconsin.

Press dispatches from Madison, Wis., announce that a deal was consummated in that city last week by which the exclusive control of the French-Milne telephone patents in the United States passed to a company headed by Madison capitalists, which has absorbed the Minneapolis company, the Standard Telephone & Electric company, which has held control of the patents for the last five months. The new company, which filed articles of incorporation on May 11th, is headed by P. L. Spooner, brother of ex-Senator J. C. Spooner, as president; B. B. Clarke, ex-state agent of the Aultman company, vice-president; E. W. Batchelder, secretary of the old company, secretary; R. M. Lamp, ex-city treasurer, Madison, treasurer; H. C. Dodge, electrician. Among other stockholders are C. E. Bross, local manager of the Western Union company, and Dr. S. S. Kilvington of Minneapolis

It is the intention of the new company to move the plant from Minneapolis to Madison, and twelve experts employed there are expected to arrive in Madison next week. Messrs. Spooner and Clarke will give their whole time to its promotion, and it is intended to push competition with the Bell company vigorously, not merely in Wisconsin, but over the entire country. Rights to the French patents are for five years, but are subject to renewal.

## Reduction in Telephone Rates in Pennsylvania.

Colonel Francis Jordan, president of the Pennsylvania Telephone company, and General Manager M. H. Buehler of Harrisburg held a conference in Reading, at which it is reported a radical reduction was determined upon in the price of ordinary telephones. Colonel H. S. Huidekoper, Philadelphia, Francis J. Hovey, general superintendent of the American Telegraph & Telephone company, New York, and District Superintendent E. W. Griffin, of the same company of Philadelphia, were in that city, and, it is said, practically agreed also upon a reduction of rates on the long-distance lines.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Supreme Court of Minnesota has handed down a decision on the right of telephone and telegraph companies to eminent domain, the same as railroad companies. The majority opinion by Judges Mitchell, Canty and Collins says that the easement granted by the owners of property for a public highway is not merely to the ordinary uses to which it may be put at the time the easement is granted, but includes any modern improvements that may be made thereafter. Neither is it limited to the transportation of persons and property, but telephone and telegraph lines may come within the grant. Judges Start and Buck dissent, the former saying that the placing of poles is an additional servitude and should be paid for, and that the rights of private property should not be overlooked in the enthusiasm for public improvements. The case is J. O. Cater against the Northwestern Telephone company. Cater is a farmer on the line established by the telephone company from Minneapolis to St. Cloud. He objected to placing the poles in front of his property and took the case to the courts.

The case is an interesting one. The defendant is a domestic corporation authorized to erect and maintain telephone exchanges and lines. It has constructed a telephone line between the cities of Minneapolis and St. Cloud, a part of which is on and along the side of a rural highway, the fee of which, subject to the public easement, is in the plaintiff, who is the owner of the abutting land. The line was built without his consent and against his protest. It consists of poles planted in the soil at a distance of 170 feet from each other, upon which wires are stretched. The defendant claims the right to construct and maintain this line solely by virtue of the Minnesota general statutes of 1894, section 2,641.

This action was brought to compel the defendant to remove its poles and wires from the highway. The plaintiff does not allege or prove that the line is not constructed in accordance with the requirements of the statute or that he has been caused any pecuniary damage. He plants himself squarely upon the proposition that the erection and maintenance of telephone poles and wires is not within the public easement in a highway, but constituted the imposition of an additional servitude upon his land; and that is the question presented by the appeal.

The question is the first of the kind in Minnesota, and the decisions upon it, as well as upon telegraph lines, in other states are conflicting.

"It is assumed that the defendant's telephone line is for the use of the public upon the payment of certain charges," says Judge Mitchell, who wrote the opinion of the majority of the court, "and therefore the use to which the highway has been appropriated by the defendant is a public one. The transmission of intelligence by telegraph or telephone is a business of a public character to be conducted under public control in the same manner as the transportation of persons or property by common carriers."

The question to be settled then, is, What is the nature and extent of the public easement in a highway?

"If there is any one fact established," Judge Mitchell says, "in the history of society and of the law itself, it is that the mode of exercising this easement is expansive, developing and growing as civilization advances, and to-day our urban highways are devoted to a variety of uses not known in former times and never dreamed of by the owners of the soil when the public easement was acquired. No distinction should be made between the nature of these new uses if the public traffic is not interfered with and private rights are not violated. In my opinion the telephone line does not impose an additional servitude upon the land. In short, that it is merely a newly discovered method of using the old public easement."

Dissenting Judge Start, after citing numerous decisions in other states, says: "The *locus in quo* in this case is a country highway, the title in fee of which, subject to the public easement, is in the appellant. Whether or not his claim is valid depends upon what answer shall be given to the question: Is the erection and maintenance, under legislative authority, of poles and wires in a rural highway for a telephone line an additional servitude, for which the abutting property owner is entitled to compensation? I am of the opinion, upon both principle and authority, that the planting of telephone posts upon a public highway in the country the fee whereof is in the abutting property owner, is an additional servitude, an appropriation of private property, and unlawful as to such owner unless the right to do so is acquired by contract or condemnation. In reaching this conclusion I am not unmindful of the fact that the use of the telephone is a beneficial and public use, but private property cannot be taken for public use without compensation first paid or secured, no matter how small the value. This is the constitutional right of the humblest individual, which must not be lost sight of in our enthusiasm over the public benefits conferred by the telegraph and telephone, as in the desire to promote the public welfare."

Judge Buck also dissents and says:

"The great weight of authorities is against the view of the the majority of this court and the late decisions of eminent courts are in accordance with the views which I have endeavored to express." Judge Buck, like Judge Start, asserts that: "The erection of telegraph and telephone poles is not merely a new method of exercising old rights but the addition of a new servitude and essentially a new burden upon the street."

The Marquette County Telephone company is securing contracts for telephones in Negaunee, Mich. The system will begin operations November 1st.

A majority of the subscribers of the Wisconsin Telephone company at Eau Claire and Chippewa Falls, Wis., expressed themselves in favor of a $36 rate and toll on the in-

terurban rather than $40 and a free interurban service. The company, however, made the rate $40, and when asked why it did not stick to its agreement said that Senator Martin of Chippewa Falls wanted the interurban line and that settled it.

It is reported that the Wisconsin Telephone company will spend $10,000 to rebuild the Oshkosh, Wis., exchange.

A. H. Hazen and others have secured 550 subscribers for a new telephone company in Sioux City, Ia., and work on the exchange will begin at once. They hope to have it completed October 1st.

The National Telephone Construction company of Milwaukee has secured a franchise for a telephone system at Waukesha, Wis., and will make a rate of $2.50 per month for business firms and $1.50 for residences.

T. A. Way and T. A. Potter have incorporated a telephone company at Clear Lake, Ia., with $100,000 capital, and will at once begin work on a line connecting with Garner, Hutchins, Stilson, Corwith and Wesley.

The Oskaloosa Telephone company of Oskaloosa, Ia., proposes to begin operations by July 1st.

An extension of the telephone line from Winona, Minn., to Waumandee, Wis., is contemplated. The Winona Telephone company has already placed about 250 telephones.

A dispatch from Yankton, S. D., says that a number of farmers living west of that city have established a telephone system covering eight miles of wire, using barbed-wire fence. Each farmer is supplied with a transmitter at his house, connecting with the middle wire in the fence. The staples have been replaced with insulated fasteners. The farmers are now able to talk with each other without paying tribute to any grasping monopoly. The expense of the entire outfit did not exceed $25, it is said.

The Northwestern Telephone company has secured a franchise at Waukesha, Wis.

Huddleston & Woodin of Chicago propose to put telephone exchanges in at Eau Claire, Chippewa Falls and Menominie, and only await securing a franchise at Menominie before beginning work.

The Northwestern Engineering company of St. Paul will put a telephone system in at Ortonville, Minn., connecting with Big Stone City, S. D.

The E. H. Martin Telephone company has completed a telephone line from Webster City, Ia., to Blairsburg and Williams. Construction on a line to Des Moines will soon begin.

J. A. Malona and F. S. Haines will begin the work of putting in a telephone system in Rochester, Minn., at once and have it completed by July 1st. They will use an automatic switch.

F. H. and Waldo Sweet are soliciting subscribers for a telephone exchange at Fond du Lac, Wis., and have secured about 200 names. They will apply for a franchise at once, and if successful will put in an exchange to cost about $12,000.

About twenty telephone wires, including the long-distance wire to Milwaukee, were cut at Neenah, Wis., recently, in a spirit of revenge, it is thought, as the company has recently been victorious in a contest.

## Recent Advances in American Electrical Work.[1]

In the field of electrical engineering, by far the most interesting enterprise is that of the Niagara Falls Power company, with the general character of which you are all familiar. The problems to be solved in connection with the electric transmission have involved the most exhaustive and painstaking studies of theoretical questions connected with the design and construction of generators to insure the selection of the type and system of transmission which will realize the highest practical efficiency. In the determination of these questions the opinions of men of the highest scientific repute were sought and obtained, and the result of these very thorough preliminary inquiries will shortly be apparent.

Other enterprises of similar character, although of less magnitude, are under way. Of these, a notable one is the electric power transmission plant at the falls of the Willamette river, near Portland, Ore., where a great long-distance transmission is being installed. This plant, when completed, will employ twenty electric generators, each of 600 horse power, and capable, therefore, of delivering the total amount of nearly 12,000 horse power to Portland, 11 miles distant. A similar project for supplying 4,000 horse power to the city of Sacramento, Cal., from a water power situated about 25 miles distant, is approaching completion. The preliminary steps are being taken for the construction of an electric power transmission plant to utilize the water power of the Susquehanna river. The plan is fathered by a corporation called the Susquehanna River Electric company, and contemplates the damming of the Susquehanna river near Conowingo, Md., and the erection of a large electric power house, similar to the one at Niagara Falls. The power obtained in this way will be supplied to Philadelphia, Wilmington and Baltimore, and other intermediate points. It is expected that it will be used extensively in operating street railways and electric lights. The land at the proposed site of the dam has been purchased, the surveys have already been made, and the plans have been made for an immense plant. It is announced that this work will be started in the spring of the present year. Other projects of like character are being industriously mooted in the electrical journals, and it will need only the encouragement of success in the several undertakings now approaching completion to bring a number of others to the fore. It remains only to be added that the advances that have been achieved within the past few years in the solution of questions of dynamo construction have radically changed the aspect of the problems of electric power transmission, and it is now reasonably safe to predict that we are on the eve of a departure from the existing order of things which may profoundly affect our present social and industrial conditions.

The past year witnessed a remarkable extension of the overhead trolley system, not only for city and suburban service, but also on long-distance lines. The most noteworthy of these extensions probably was made in our own city, where the completion and starting in operation of a great network of surface electric railways has taken place. A similar transformation has been made in the street railway systems of Baltimore and New Orleans, and the projects for long-distance electric railways that are under consideration, or in course of completion, are too numerous to mention. Thus, for instance, only a few links are missing in a continuous chain of trolley lines between Philadelphia and New York; while trolley service between Philadelphia and Harrisburg, Baltimore and Washington, Chicago and Milwaukee will doubtless be established during the present year.

While on this subject, the experimental work undertaken in New York by the Metropolitan Street Railway company in the development of a satisfactory underground electric conduit system adapted for city service is worthy of mention; also, the fact that an extensive underground electric system is about to be constructed in Washington. In Chicago, work is well under way on a complete elevated electric railway system.

Of special interest, also, is the fact that a number of the steam railways are seriously considering the electric equipment of short branch lines, which, in several cases, has either been done, or is being undertaken. The much talked-of project of a high-speed elevated electric railway between Chicago and St. Louis, it is understood, has been definitely abandoned.

It would be interesting to have, at this time, the statistics of the electric railway mileage of the United States, to exhibit the remarkable progress that is being made in this branch of our transportation system, but the data are not as yet accessible.

In relation to the storage battery, though no radical improvement in construction has appeared, the experience gained in connection with its auxiliary employment at central stations has demonstrated that there may be opened for it in this direction a wide field of usefulness. The prolonged and almost continual litigation over the question of patent rights has, up to the present, greatly interfered with the proper development of the storage battery in this country. The official announcement has appeared that one of the prominent companies has acquired a practical ownership of the fundamental storage battery patents. As the transfer of these patent rights to a single ownership will put an end to the deplorable legal complications which heretofore have deterred the public from taking any interest in the application of the storage battery, there is at length a prospect that the free development of the industry will be unhindered, and that we may soon learn what are the real capabilities of this interesting type of apparatus.

During the past year a successful trial on the Erie Canal of the method of electric traction for canal towage attracted considerable attention, and led many to believe that steps would be taken promptly to test the efficiency of the system on a more extended scale. Thus far, however, nothing of importance has developed in connection therewith on this side of the water, although it may be of interest to notice the fact that a successful trial of the De Bovet system of electric traction for canal boats recently took place on the St. Denis Canal, in France. A series electric motor actuated the towing pulley, a fourteen millimeter chain, placed at the bottom of the canal, being carried over the pulley to the extent of three-quarters of a turn, although half a turn suffices. A two-wire circuit running along the bank of the canal was connected to a 110 volt generator driven by a locomotive engine. The current was collected by means of two trolleys running along the wires and connected to the motor by a flexible cable, which was passed over a pulley at the top of the mast of the boat. The trial was completely successful, and showed that for an expenditure of 2,000 watts it was possible to make a 300 ton barge move at the rate of 2.8 kilometers per hour. The getting under way took place without shock, and the normal speed was rapidly reached.

The decision of Judge Carpenter, of the United States Circuit Court, in the suit instituted by the attorney-general of the United States against the Bell Telephone company, praying for the repeal of the letters patent No. 463,569, issued November 7, 1891, to Emil Berliner, and assigned to the company named, has brought to a termination a case of unusual importance, not only in reference to its bearing on the telephone business, but also because of its disclosure of methods and usages in vogue in the United States Patent Office which call peremptorily for substantial reform. The decision of the court was favorable to the contention of the plaintiff, and the Berliner patent was accordingly decreed to be void, and was ordered to be deliverec up to be cancelled. The effect of the decision—if it should be sustained on an appeal, which will doubtless be taken—will be to throw open to the public all the essential elements of the art of telephoning.

This litigation brought out most conspicuously one fact which, though familiar enough to those who are versed in the patent law and the modes of procedure that obtain in the Patent Office, the layman will learn with amazement. The record of this now famous case exhibits that the application for the patent was filed June 4, 1877, and that the patent was not issued until November 17, 1891, or more than fourteen years after the date of filing. It is thus shown to be possible, by the dextrous use of legal procedures, which the usages of the Patent Office permit, for an attorney to delay almost indefinitely final action upon, and the issue of, a patent, whenever the interests of his client will be served by such delay. As I have already intimated, this is no news to the fraternity of patent attorneys, any one of whom will be able to state from the experience of his own practice that the record of this case, far from being in this respect exceptional, could be duplicated. Without venturing upon a consideration of the expediency of investing the commissioner of patents with judicial powers capable of such extraordinary exercise, I believe I affirm the opinion of every intelligent and unprejudiced layman in saying that the state of affairs which this case has disclosed constitutes an intolerable abuse which was never contemplated by the framers of the patent laws, and which calls for prompt and radical correction. The decision of Judge Carpenter fortunately paves the way for this much-needed reform, inasmuch as one of the grounds on which he decreed the Berliner patent to be void was the unwarrantable and unlawful delay in the issue of the patent which was intentionally acquiesced in by the Bell company, and which thus constituted a fraud practiced upon the public.

In the field of electro-chemistry there has been an unusual amount of activity, and the application of electrolytic methods in the service of the chemical and metallurgical industries has made substantial progress. During the past year an enormous electric refining plant was erected at the works of the Anaconda Copper Mining company in Montana for refining the entire output of those mines. The electrolytic production, by various processes, of caustic soda and bleach from salt; the purification of sewage by electrolytic means; the electric tanning of leather; the electrolytic production of chlorate of potassium from the chloride; of white lead, by decomposing alkaline salts with lead electrodes in the presence of carbonic anhydride—these and numerous other problems in industrial chemistry have been attacked with considerable success.

The brilliant work of Moissan with the electric furnace has shown the feasibility of producing with this agency most of the rarer metals with comparative ease, in considerable quantities, and in a state of purity. The abrasive material called carborundum—one of the latest and most interesting products of the electric furnace—has already acquired an important rank in the industries and is now manufactured in large quantities. The interesting discovery of a cheap method of manufacturing acetylene in quantity by exposing an intimate mixture of lime and carbon to the intense heat of the electric arc in a furnace of this type has been brought to your notice so recently that extended reference to the very important industrial bearing of the discovery will be unnecessary. * * *

The great problem of converting the potential energy of coal directly into electrical energy without the wasteful intervention of the steam engine has received the thoughtful attention of many investigators, and though its satisfactory solution has not yet been found, so much light has been thrown upon the subject that, at the present time, we know much more about the conditions that govern success or failure than a few years ago. The first serious effort toward the solution of the question was made about ten or twelve years ago by Mr. Edison with his thermo-electric generator, in which he sought to attain the desired end by apparatus of highly ingenious construction, in which the operative feature was the magnetization and demagnetization of iron by rapid alternations of temperature. By the well-known law of induction these alternations of magnetic intensity were utilized to generate induced currents in surrounding coils. This idea, promising as it appeared when first announced, its originator does not appear to have made any further attempt to develop in practice. What the estimated efficiency of this machine was I do not at present recall, but it is tolerably safe to infer that it was considerably below that realized from coal through the agency of the steam engine, otherwise something more would have been heard of the invention.

The improvement of the older and better known thermo-electric generators, in which a series of compound bars or plates formed of dissimilar metals and heated at their points of union, is caused to generate a current, appears also to have been abandoned as a practicable means of solving the problem.

In view of the fact, therefore, that the problem seems to be hopeless of solution from the physical side, it is particularly interesting to note that within the past year the opinion has gained ground that we may reasonably hope to solve it from the chemical side. The correlation between chemical and electrical energy is a well-established fact of science, and in the case of many substances—carbon among them—is capable of being expressed quantitatively and with as great accuracy as the relation between heat and mechanical force, which finds its mathematical expression in the figures representing the mechanical equivalent of heat. In the voltaic cell, as is well known, the electric energy developed is derived from the direct conversion of the energy of chemical combination, and the quantity of the one, which it is possible to realize from an electrolytic cell formed of any pre-determined elements, may be calculated, in terms of the other, with the same accuracy as the possible mechanical energy which can be developed from the combustion of a ton of coal. The solution of the problem of converting the potential chemical energy of coal directly into electrical energy resolves itself, along this line of research, into the construction of voltaic cell in which the "cold" combustion of carbon shall be effected with an efficiency approximating nearly to that which theory demands.

Theoretically, this mode of solving the problem is attended with no difficulties; practically, it presents many, but not insuperable, difficulties. Indeed, although this field of investigation has only recently attracted serious attention, substantial progress has been made toward the actual accomplishment of the object in view. I will refer you, in substantiation of this statement, to the recently published experiments of Dr. W. Borchers of Duisburg, Germany, who has devised a cell for the purpose in which 27 per cent. of the energy of combustion of the fuel (in this case the combination of CO and O) is converted into available electrical energy. When it is considered that these experiments represent, practically, the first serious attempts at the solution of the problem by this method,

1. Abstract from the report of the secretary of the Franklin Institute, Philadelphia.

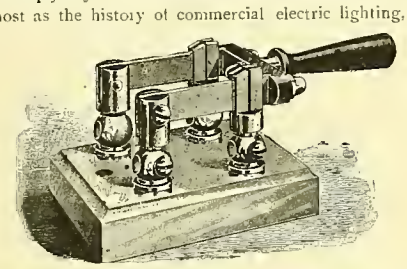
these results must impress themselves upon thoughtful persons as very encouraging: especially significant do they appear, when it is remembered that the best results which it has been possible to realize by the indirect method of generating electric currents from coal by the intervention of the steam boiler and engine represent only about 15 per cent. of the stored-up energy of the fuel.

In a paper before the German Electro-chemical society, Dr. Borchers described and illustrated two practical forms of electrolytic cells, one for using carbonic oxide gas, and the other for coal dust, and concluded by affirming his belief "that the problem of the cold combustion of the gaseous products of coal and oil, in a gas battery, and its direct conversion into electrical energy, can certainly be accomplished," a statement which, in view of what he has already demonstrated, appears to be quite reasonable.

In the aluminum industry no pronounced advance may be reported. The electrolytic methods of production, represented by the Hall process in America and the closely related methods of Herault-Kiliani and Minet in Europe, still afford the cheapest means of producing the metal. The outlook for any material cheapening of the cost of producing this metal is not very promising. The present electrolytic methods are susceptible of very little improvement, and the prospect for cheaper aluminum depends either on the discovery of some radically new mode of generating electric current, or of some very greatly improved method of producing the metal by chemical-metallurgical means. As the utilization of the energy of our great water powers promises to afford power at a cost of less than one-eighth of a cent per electric horse power per hour, there would seem to be very little hope for reduction of cost in this direction. The probability that a chemical method will be discovered that will be capable of yielding the metal at lower cost than the present electrolytic process, it must be confessed, is extremely small. The possibility that such a discovery will ultimately be made, however, exists, and those who are best qualified to pass an opinion on this interesting subject incline strongly to the view that the cheapening of the cost of producing aluminum will be brought about by chemical methods which will enable us either to make the commercially pure metal directly from its ores by a furnace process, or which will enable the electric manufacturers to produce the pure metal from the crude ores without the expensive preliminary purification which is now a large item in the cost of manufacture.

## Bryant Baby Knife-switch.

The increased demand for electricity in all walks of life has made the new things and the good things to grow and to multiply. Jaw-switches and knife-switches are as old almost as the history of commercial electric lighting, but



BRYANT BABY KNIFE-SWITCH.

the introduction of a midget knife-switch in an innovation on the regular order of things. The Bryant Electric company manufactures a small switch as complete in all its details as the 50, 100 or even thousand ampere switches of large plants. The Bryant baby knife-switch has a capacity for 10 amperes and can be used on 50, 100 or 200 volt circuits. It is mounted on regulation slate base, as shown in the cut, and is handsomely finished. Grier Bros., managers of the western office of the Bryant Electric company, will have a stock of these switches at their storeroom in Chicago.

## Electric Potential Club, Boston.

The annual meeting of the Electric Potential club was held at Young's Hotel, Boston, on the evening of May 9th. Thirty-one members attended. C. W. Holtzer presided and an informal discussion upon "Alternating Currents" took place. Mr. Holtzer was elected president and J. H. Farnham treasurer for the ensuing year.

## Rothschild Plant Inspected.

On the afternoon of the 10th instant, on invitation of William Sharpe and C. M. Barclay, of the Chicago office of the J. H. McEwen Manufacturing company, a small party of gentlemen inspected the new electric lighting plant in the large department store building of A. M. Rothschild & Co., Chicago. This is the first installation of the widely-discussed Thompson-Ryan dynamos, and one of the inventors, Milton E. Thompson, was present. The working of the machines elicited much praise. In addition to the gentlemen whose names have been mentioned, there were present A. M. Rothschild, H. Lazarus, John McAuley, Carl Kammeyer, R. St. John, W. A. Remington, W. J. Phelps, James Boyd and C. W. Forbrich.

The Seventh street division of the Columbia avenue line and the Market street ferry line of the Philadelphia Traction company have been changed to trolley roads, the expensive cable equipment being abandoned.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, May 11.—Of much importance to the people of Brooklyn is the decision of Justice Smith of the Supreme Court, handed down on Monday, declaring the franchise granted to the Nassau Electric Railroad company void. The aldermen who gave the company its authority to operate are declared to have been guilty of fraud. The company applied for a franchise in the spring of 1893. Its president was P. H. Flynn. Previously the Kings County Electric Railroad and the Coney Island, Fort Hamilton & Brooklyn companies had sought municipal approval for their undertakings, but they pooled issues in Mr. Flynn's company, and the consolidated franchise was granted on June 19, 1893. It included about all the available streets in the city not occupied by the trolley or protected by special statutes from its invasion. Mayor Boody vetoed the ordinance. William J. Gaynor, who was elected a justice of the Supreme Court later, hastily organized the Union Street Railroad company and sought to prevent further action by the aldermen, but in the end the Nassau people got what they wanted by a vote of 13 in the Common Council. Mr. Gaynor continued to interest himself in the case, and at his instance John Adamson, a taxpayer, brought suit to declare the franchise void. The case was tried in Brooklyn before Justice Smith and he has now rendered the decision. Its immediate effect will be to prevent the company from operating its road from the Broadway ferry, in Williamsburg, to Canarsie. Preparations had been made to open the road yesterday. The justice, in his opinion, denounced the 13 aldermen who voted for the grant in vigorous terms. He said:

For what purpose were the aldermen there? They were trustees of the city of Brooklyn, charged by their trust to make most profitable to the taxpayers the disposition of a valuable property. They refused to give any terms of sale that willing bidders might make bids thereon. Private trustees have suffered the severest censure of the court for acts less flagrant. In every act of the aldermen who voted for these franchises there is an apparent determination to grant the defendant valuable rights for as small a sum as they dare. False to their trust, they endeavor to sell the property for as little as they could get. The evidence of their fraudulent purpose is both direct and circumstantial.

The case will be appealed to the General Term. It is asserted that the Flynn company has already expended nearly a million dollars. The franchise covers nearly forty miles of track.

Its promoters say that the New York, Elmsford & White Plains electric railroad will be in running order between Elmsford and Silver Lake Park, in Harrison, by July 2d. Although the work of grading has been begun in Greenburg, where it is proposed to construct a turn-out, the authorities have little faith in the immediate construction of the line. The opinion is general that those foremost in the road's management are putting forth these efforts to have an excuse to oppose any rescinding of the franchise. H. T. Montgomery and James H. Moran, who are active in the preliminary arrangements, are sanguine that they will be successful in their efforts to have the road in running order before the County Fair in September.

W. F. O.

## New England News.

BOSTON, May 10.—Edwin Evans of this city, general manager of the Citizens' Gaslight and Willimantic (Conn.) Electric Light companies, says that the dispatches from Willimantic in connection with the defalcation are untrue in every particular where they speak of the companies named. Mr. Evans further says: "The reporter writes that Mr. Risley was using the bank's funds in order to conduct the gas and electric light companies. Now, we never borrowed a dollar from the bank or elsewhere in Willimantic. We were simply depositors. Mr. Risley was our treasurer, and we never had a note discounted in our lives. Our firm was composed of Judge Hill, General Boss, Mr. Risley and myself. The published report speaks of the two companies consolidating; this is also untrue. In 1890 we bought out the Willimantic Gas company, paying cash for the works. In 1891 we purchased the Willimantic Electric Light company, also paying cash. Our capital stock is only $60,000, and according to our charter we have authority to issue $60,000 worth more. On the first of January last we had a surplus of $11,699, so that we did not have to borrow. The statement that we tried to float $600,000 in stock is not true. We have never offered any stock for sale, although certain people have tried to get it. We are a close company, holding all the stock ourselves."

The West End Railroad corporation has purchased a tract of land containing 180,000 feet, fronting the Mystic river on the Boston-Somerville line with the ultimate intention, it is said, of erecting a large power station. Its close proximity to the river makes it a very desirable location, as all of the coal used at that point could be landed from vessels right at the door of the power house.

An order has been put into the Common Council of this city providing for a hospital or ambulance cars to run on the tracks of the West End street railroad. President Little of the road is quoted as saying that the road would find little difficulty in meeting the requirements of an ambulance service. He also suggests the idea of fitting up a number of hospital cars or convalescent cars for the use of patients who would be benefited by a trip in the suburbs during the summer months, and he believes also that the time will soon come when the road will furnish transportation for funerals, making up trains on exactly the same system as is in vogue in Chicago.

The work of equipping the Nantasket Beach branch of the New York, New Haven & Hartford steam railroad with electric appliances for running the trains this summer is rapidly being pushed to completion. The work of erecting the poles for the trolley wire on the sands of Nantasket Beach was begun a day or two ago. The poles are pine, square in shape, and are being set in a solid and substantial manner. The base of the poles are being encased in wooden boxes, which are in turn enclosed in an iron box set in the sand. To make them firmer the poles are set in cement, which is pressed into the space between poles and the wooden boxes inclosing them. All telegraphic and telephonic communication with Hull village has been cut off by the removal of the poles and wires which were on the line of the railroad and interfered with the extensive improvements going on. The walls of the power house have begun to show the labors of the workmen and are daily rising higher and higher. The iron corner posts have been raised and the outlines of the big structure are now well defined.

In the Superior Court at Bridgeport, Conn., Judge Robbins has made an order for the sale of the patents in this country and Europe of the Waddell-Entz Electric company, whose plant is in Bridgeport. The sale will take place from the Bridgeport court house on May 22d. The concern spent a large sum of money on a storage battery that operated electric cars on the Second Avenue line in New York city. It worked well, but it was said to be too expensive to be practicable. Recently receivers were appointed for Connecticut and New York, where the principal backers of the enterprise live.

The following electric supply dealers in this city have agreed to close their places of business during the months of June, July and August and September at 1 P. M. Saturdays and 5 P. M. other days: Pettingell-Andrews company, Holtzer Cabot Electric company, Anchor Electric company Gillis & Gleason, Zeigler Electric company, Thompson-Brown Electric company and the Electric Gas Lighting company.

The committee on electrical control of Fall River, Mass., from which body must come the first decision or recommendation for the burying of wires has agreed upon a report to submit to the city government. For the rights of locations for buried wires in the streets the following conditions are imposed: The Globe street railway to reduce its fares from 5 to 3 cents during the hours from 5:30 to 7 A. M. and from 6 to 8 P. M., to accommodate the mill operatives, which is practically the same reduction that was imposed upon the Fall River street railway some weeks ago when locations to build and equip were granted; the Southern Massachusetts Telephone company to rent telephones to the city at 50 per cent. of the sum charged to others; the Thomson-Houston Electric Light company to furnish free the lights on the South Park, which means under the present rate, $375 per annum.

Hon. John R. Murphy, wire commissioner of Boston, delivered a very interesting lecture before a local society on "Electrical Forces" on the evening of May 3d. In the course of his lecture Mr. Murphy took occasion to refer to the placing of all wires in Boston underground and said that while the department has been given until 1900 to complete the work, so hearty had been the co-operation of the companies having lines in this city that he thought the work would be completed a year or two before the limit set. A new duty lately added to the department is the supervision of all posts and poles and their insulation, the commissioner of wires being made sole judge of what constitutes proper insulation.

The New England Telegraph & Telephone company has been granted a franchise to erect poles and wires along the highways of the town of Hull. Formerly the company used the railroad, but when the New York, New Haven & Hartford company decided to equip this branch with electricity the Telegraph & Telephone company was obliged to remove its poles.

C. S. G.

## PERSONAL.

President and General Manager George W. Russell, Jr., of the Russell & Officer Electric Construction company of Denver, Colo., passed through Chicago last week on his way east. Mr. Russell tells some interesting stories about a recent trip along the coast of Africa.

Israel Lovett, electrician of the Omaha & Council Bluffs Railway company, Council Bluffs, Iowa, visited Chicago

last week. Mr. Lovett was on a combined business and pleasure trip and spent the greater proportion of his time in an inspection tour of Chicago's extensive street railroad systems.

## NEW INCORPORATIONS.

Monmouth Telephone Exchange company, Monmouth, Ill.; capital stock, $10,000; to operate a telephone exchange; D. S. Hardin, Monmouth, Ill.

Baird Electric Conduit company, Chicago; capital stock, $5,000,000; to build and operate street railroads; F. E. Baird, G. E. Baird and W. H. Craig, Chicago.

Automatic Long-distance Telephone company, Chicago; capital stock, $5,000,000; for general telephone business; Cleaveland F. Dunderdale, John F. Pershang and Stephen W. Groesbeck, Chicago.

Charleston Electric company, Charleston, Ill.; capital stock, $5,000; to generate electricity and operate telephones and street railways; Richard Cadle, Frank A. Brooks and W. A. Highland, Charleston, Ill.

## ELECTRIC LIGHTING.

Knoxville, Tenn., proposes to erect a municipal electric lighting plant.

Lockport, N. Y., will own its own municipal lighting plant after the present contract with the Lockport Electric Light company has expired.

Contract has been let for the Consolidated Electric Light company's new power plant at Birmingham, Ala. The building is to be of brick and stone, two stories high and the entire plant will cost $200,000. The machinery will include five engines of 2,500 horse power each.

## ELECTRIC RAILWAYS.

The Gallipolis, O., electric street railroad has been ordered sold by the court in receivership proceedings.

The Portsmouth, Va., street railway property has been sold to Major John Finney and others of Pottsville, Pa., for $60,000. The road will be improved, converted into an electric road and the tracks extended to all parts of the city and suburbs.

The Fort Clark electric street railway of Peoria, Ill., has been sold by order of the court, the price realized being $275,000. The railway passed into the hands of F. W. Horne of Chicago as receiver some time since. The sale will make no difference in the running of the line, which will be operated as before.

The Cleveland, O., & Painesville Railway company has been incorporated with a capital stock of $200,000 by John J. Shipherd, M. H. Solloway, Nelson Moses, J. S. Casement and C. O. Child. The company is formed to build an electric road from Cleveland to Painesville, to transport passengers, freight and mail.

The Washington and Baltimore boulevard electric line ordinances have been approved by Mayor Latrobe of Baltimore, Md. The company will construct as near an air line as possible between Baltimore and Washington. Contractors have received orders to push the work with all possible haste. The road will cost about $2,000,000.

## MISCELLANEOUS.

A vibrating helmet for the cure of nervous headaches has been devised by a French physician. It is constructed of strips of steel, put in vibration by a small electric motor, which makes 600 turns a minute. The sensation, which is described as not unpleasant, produces drowsiness; the patient falls asleep under its influence and awakes to find that the pain has ceased.

In Siegel, Cooper & Co.'s new department store in New York electrical power will be extensively used. The building will contain eight large passenger elevators and at least an equal number of freight elevators. All of these will be operated by electricity, as will be the dumb waiters also. The lighting will also be by electricity. A unique device for lowering packages from the various floors to the delivery wagons below will be a revolving screw, worked by electricity. The package, which may be as large as three feet each way, is placed upon the thread of the screw at any floor. The screw revolves slowly, and a partial partition prevents the package from traveling around the shaft with the screw. As the screw revolves the package descends to the ground level.

## TRADE NEWS.

A. & J. M. Anderson of Boston, Mass., manufacturers of the pivotal Boston trolleys, are crowded with work and state that indications point to the busiest season in street railway work for several years.

The last price list for "electrical mica" issued by Eugene Munsell & Co. of New York is the most complete pamphlet of the kind that has yet appeared. It contains a full description of the firm's stock and a code word for each size.

The George L. Colgate company of New York reports an unusual amount of orders on hand for the Keystone instruments for future delivery. This concern has recently been obliged to add to its working force in order to keep apace with the business.

The Electric Storage Battery company of Philadelphia is issuing pamphlets exploiting different applications of storage batteries that will be appreciated by the general public. Recent examples are: "Storage Batteries for Yacht Lighting" and "Electric Appliances for Carriages."

The price made on the Upton arc lamp, by the Standard Thermometer company of Peabody, Mass., has brought a large amount of inquiries and orders, especially for the direct current lamp. This concern, it will be remembered, is the original manufacturer of the Simplex, Ward and Knight lamps.

The Metropolitan Electric company, 186–188 Fifth avenue, Chicago, reports a good demand for the Dayton electric ceiling fan, for which it is the Chicago agent. The company has already closed some nice orders this season. The Metropolitan company has secured the exclusive agency for the United States for the Ayer self-locking windlass. This windlass has several important improvements and commends itself on first sight to all practical station men.

The firm of Belden & Seely of New York reports that they have nearly three times the amount of business to look after at present as they had a year ago and that nearly every mail brings information regarding some new extension of a street railway or electric lighting business and that they have largely increased their operative force in order to complete the contracts now under way. This firm also has an office located at Syracuse, N. Y., and business at that office is very brisk.

The Boudreaux Dynamo Brush company has appointed R. Leo Van der Naillen western manager. Mr. Van der Naillen, a Californian by birth, has for a long time held important positions on the Pacific Coast. Connected for two years with the San Francisco Edison Light & Power company, testing engineer of the Edison underground system, assistant chief of the San Mateo Railroad, he possesses scientific attainments as well as practical knowledge. The Boudreaux Dynamo Brush company is to be congratulated upon having placed the Chicago office in Mr. Van der Naillen's hands.

E. F. Draper, general manager of the Globe Electric Light company of Boston, Mass., has recently severed his connection with that company and expects to locate in New York. Mr. Draper was the original promoter and organizer of this company, which has recently been fitting up a large factory at Clifton and Shirley streets, Roxbury, with the latest improved apparatus for the manufacture of incandescent lamps and already has a large amount of orders for immediate delivery, with enough work on hand to keep a large force busy for some time to come.

James C. Hobart of the Triumph Electric company, Cincinnati, in company with Walter H. Whiteside, the Triumph company's Chicago manager, called at the office of the WESTERN ELECTRICIAN last week. Mr. Hobart reports a most satisfactory business for his company. The Triumph company entered the field only a comparatively short time ago, and the Triumph machines are now seen everywhere. Mr. Hobart's genial manner, along with his energy in pushing for business, have no doubt had a great deal to do with the rapid advance of his concern's business.

The Eddy Electric Manufacturing company of Windsor, Conn., reports a large amount of work on hand and that the prospects for business are better than they have been at any time within the last year; that the call for direct-connected apparatus far exceeds that of previous years. Secretary A. D. Newton of this company recently met with a painful accident. In boarding a street car in Hartford he slipped and sustained a severe pain of the ankle and muscles of the foot, which confined him to the house for several days. He will be obliged to carry his foot in a plaster cast for some time.

The demand in the electrical trade for the Boudereaux dynamo brush has exceeded all the anticipations of this company. Testimonials recommending its efficiency have been received from the leading concerns of the country which testify to its excellent qualities. The brush requires no trimming or greasing, and the guarantee of the company that it will eliminate sparking and cutting commends it to practical men. The Boudereaux Dynamo Brush company has recently established its principal office in the Postal Telegraph building, New York, with a branch in the Mallers building, Chicago.

As the electrical business becomes more settled, the profession of electrical engineering is continually taking to itself increased dignity and importance. The attention now paid to engineering advice is well indicated by the elaborate printed specifications issued for the proposed municipal electric light plant at Owensboro, Ky., by Pierce & Richardson, 1409 Manhattan building, Chicago, who have been retained by the city as consulting engineers. A complete steam and electrical plant is required for a station having a capacity for 120 arc lamps and 2,000 incandescent lamps, the latter on the alternating system. The bids must be in by May 30th.

The Clonbrock Steam Boiler company of Brooklyn, N. Y., has been obliged to add a large force of help in order to meet the extended business. It has been unusually good of late and will tax the works to the utmost. Preparations are now being made to run a night shift. A large share of the business of this company is being taken from electric lighting and power station, and the letters in testimony of this boiler are very numerous. They have recently gotten out a new catalogue with illustrations, which will be sent upon application. The following are a few of their recent sales: The Clearfield Traction company, Phillipsburg, Pa., three 400 horse power boilers; the Pennsylvania Railroad company, Mt. Holly, N. J., for the Burlington & Mt. Holly division, two 300 horse power boilers; the Upper Lehigh Coal company, Upper Lehigh, Pa., one 400 horse power boiler.

Mr. Yerkes has just closed a contract with the Siemens & Halske company for two direct-connected 750 kilowatt railway generators for the Cicero & Proviso company's new power house, Chicago, which is to be equipped with new material throughout. The list of Siemens & Halske railway generators put out or under construction by the American company now foots up 23 machines, with a total capacity of 16,020 kilowatts. The names of the users follow: Garden City Construction company, Chicago, Ill.; Toronto Street Railway company, Toronto, Ont.; City Railway company, Dayton, O.; Ringing Rocks Street Railway company, Pottstown, Pa.; Cincinnati Street Railway company, Cincinnati, O.; D. McCartney, Ft. Howard, Wis.; West Chicago Street Railway company, Chicago; Citizens Street Railway company, Detroit, Mich.; People's Traction company, Philadelphia, Pa.; Cicero & Proviso Street Railway company, Chicago.

The Electric Appliance company tells of an amusing experience had by one of its salesmen in an Indiana town a few days ago. The salesman was exhibiting a pair of improved Hunnings telephones manufactured by the Electric Appliance company, which had been installed for exhibition purposes. A large committee of citizens was present to witness the test and was very much pleased and surprised at the wonderful power which the instrument developed, talking up so very much louder than anything they had been accustomed to. One of the committee present happened to be a man who for a number of years has been almost deaf, so much so that conversation could be carried on with him only by means of considerable shouting. More for the purpose of a joke than anything else the salesman asked this gentleman to try the telephone, which he proceeded to do, to the amusement of all present. It is hard to tell whether the man himself or those watching the proceedings were the more surprised when he who had been called deaf was able to carry on a conversation with the other end of the line without any apparent difficulty. The old gentleman himself was so highly pleased that he entertained the triumphant salesman royally that night and the next day, and said goodbye with tears in his eyes, when the salesman took his departure. The Electric Appliance company considers that the improved Hunnings telephone scored a point in that town which will not soon be forgotten.

## BUSINESS.

The General Electric company has just secured an additional order from the West Side Street Railway company of Chicago, for 100 double car equipments with G E 800 motors and 200 K 2 controllers.

Samson spot cord is the trade name for that excellent material manufactured for arc light and trolley cord by the Samson Cordage Works, Boston, Mass., who will be pleased to send samples and prices upon application. They report a large demand for their material.

The Partrick & Carter company of Philadelphia is making a decided push for business in its telephone and house goods departments and looks for an exceedingly busy summer, as the increase in building construction has made a very perceptible improvement in the electrical supply business.

R. B. Corey, general sales agent for Incandescent Arc Light company of New York, has been so pressed to take care of the large amount of business of late that he has secured the services of W. H. Mackay, who is favorably known in the electrical trade for his push and energy as a salesman.

An attractive catalogue of electrical goods, including telephones, batteries, telegraphic supplies, house goods, induction coils for medical purposes, linemen's tools, etc., is issued by the Manhattan Electrical Supply company of 32 Cortlandt street, New York. It forms a volume of over 200 pages, copiously illustrated, and is sent upon application.

The desk set offered by the M. & B. Telephone company of Philadelphia is having a large sale for office and manufacturing buildings and is said to be one of the most complete things of its kind manufactured. This concern also manufactures complete exchange plants with either metallic or grounded circuits and is prepared to deliver switchboards of any size or design, which they stand ready to guarantee.

T. H. Brady of New Britain, Conn., pioneer in the manufacture of mast arms, is working his entire force overtime in order to fill orders. The pole swinging hoods, house brackets and other specialties manufactured by Mr. Brady are of the best construction, and central station managers who are considering the extension of lines will be furnished with catalogues and prices upon application.

The Jewell Belting company of Hartford, Conn., has recently completed what is known to the belting trade as the "mammoth" belt for the Washburn & Moen Manufacturing company of Worcester, Mass. This belt is 78 inches wide, 118 feet in length and made of selected hides one inch thick. It is stated that it is the largest belt ever manufactured in the world and it reflects great credit upon the Jewell Belting company.

The Standard Paint company of 2 Liberty street, New York, has no reason to complain of the trade for '95 in its familiar P. & B. insulating compounds, as may be judged from the following extract from a recent letter: "Notwithstanding the various changes in the methods of manufacture, which would naturally decrease the use of our preservative paints, insulating compounds, etc., we are every day finding new uses for our goods. In the last few months our orders show an unprecedented record for the sale of our electrical materials. Many unscrupulous supply houses offer their customers who ask for P. & B. "something just as good," for we know of many instances where parties have taken their entire orders for supplies from one supply house to another on account of such dealers trying to substitute some bogus material for P. & B. The public will not be fooled. Ten years of experience and satisfactory results with our products have fully proven their merits. We note in reading an article on motor repairs by W. E. Shepard that he several times mentions P. & B. In speaking of field coils he specially states that the coils will give no trouble at all, either by being charred or by overcurrent or by grounding if given a coat of P. & B. once in six months; they are then practically waterproof. It is very evident from the remarks throughout the article that he considers our material just as standard as any of the old and well-known electrical goods, which is very gratifying to us. We are constantly striving to keep our materials to the front, and find no great effort in doing so. We invite electrical men everywhere, who are not fully acquainted with our materials, to send for our latest advertising matter, samples, etc., which we will gladly furnish gratis."

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued May 7, 1895.*

538,648. Alternating Current Motor. Engelbert Arnold, Zurich, Switzerland. Application filed July 10, 1894.

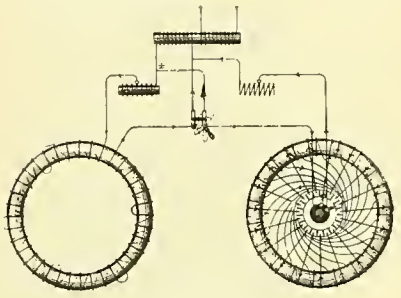
A method is described of starting and operating motors for alternating currents by supplying current to the field coils in a manner to produce poles at certain fixed points, and current of different phase in a manner to produce poles at an angle with the first poles, thereby producing a rotary field, and thereafter diminishing the angle by commutating or changing the field connections and diminishing the difference of phase. The cut shows two sets of field windings, two sets of field connections, each arranged to produce poles at an angle with the poles of the other set, means for commutating or changing the electrical connections and thereby altering the angular position of the poles produced by one set of field connections, means for varying the current phases in the two sets of field windings, and an armature inductively operated thereby.

538,649. Closed Conduit Electric Railway. George E. Baird, Chicago, Ill. Application filed April 30, 1894.

The combination with the track, the conduit, the main conducting wire and the contact devices of the curved guide rail, lying at the outer side of the center of a curved track section, the rollers arranged at suitable intervals along the inner side of the center of the section, the car moving on the track and propelled by a suitable electric motor, the arms dependent from the car and in electrical connection with the motor, the hinged sections supported by the arms, the contact wire supported by extensions and the rollers mounted at the ends of the extensions and adapted to move along the guide rail as the car moves along the curve, the rollers being adapted to receive and guide the wire during such movement.

538,650. Closed Conduit Electric Railway. George E. Baird, Chicago, Ill. Application filed June 11, 1894.

The combination with a track and a car moving thereon, and provided with a suitable motor, of the arm dependent from the car, the parallel contact bars supported by the arm, the lines of pipe sections, and chambers and conducting wires lying within the pipe section and chambers, respectively, and insulated except at points of exposure within the chambers, the contact brushes attached to the wires, the oscillating levers provided with the contact blocks, adapted to be brought into contact with the brushes, and members attached to the levers and lying outside the chambers, the members being adapted to be actuated by the contact bars, respectively, as the car moves along the track, whereby the wires may be brought into electrical connection with the motor.



NO. 538,648.

538,651. Telegraph Key. Charles W. Bradford, Clinton, Me. Application filed January 24, 1894.

The essential parts of this instrument are a base, a key lever and a pivoted bar or lever carried by the key lever and adapted to normally make contact with the contact post. A stem is loosely connected with the inner end of the bar, a button on the key lever through which the stem passes, a disk at the upper end of the stem, and a pin passing through the disk and button to prevent the former from turning independently of the latter.

538,669. Safety Device for Electric Motors. Rudolf Eickemeyer, Yonkers, N. Y. Application filed July 13, 1892.

The arrangement illustrated includes a shunt motor, a safety device including both branches of the circuit of the motor and arranged to short-circuit the motor on disturbance in the balance of the circuits.

538,670. Electric Transfer Switch. Axel Ekstrum, Lynn, Mass. Application filed September 7, 1893.

A set of terminals are connected respectively with the positive wires of a work circuit and two or more sources of current. A corresponding set of terminals are connected to the negative wires of the work circuit and the sources of current, all positive terminals being in the same plane and all negative terminals being in another plane parallel thereto, a switch-arm or connector in the plane of the positive terminals adapted to vary the connections, a second switch-arm in the plane of the negative terminals adapted to correspondingly vary the connections between them, and an operating device for simultaneously moving both switch-arms and thus connecting the work circuit to any of the sources of current.

538,686. Electric Time Alarm Clock. Max Leibecke, St. Paul, Minn. Application filed February 28, 1895.

In an alarm clock, the combination with the clock mechanism, the hands, the dial, and the face plate, of a metal ring surrounding the dial and divided in a plane at right angles to the axis of the hands into outer and inner halves having a slot between them, blocks sliding in the slot, contact pins sliding through the blocks radial to the shaft and having their inner ends turned at right angles to their bodies, and a spring carried by the hour-hand and adapted to make electrical contact with the inner end of any pin which is moved inward.

538,695. Electric Soldering Iron. William H. Osborne, Prince's Bay, N. Y., and George R. Meitzler, Cincinnati, Ohio. Application filed February 13, 1895.

There are included a soldering head, a heating core for it, a hollow shank carrying electric conductors and provided with a shoulder, a hollow handle on the shank, a nut on the latter and within the hollow part of the handle, whereby this latter in conjunction with the shoulder is held and confined in position on the shank.

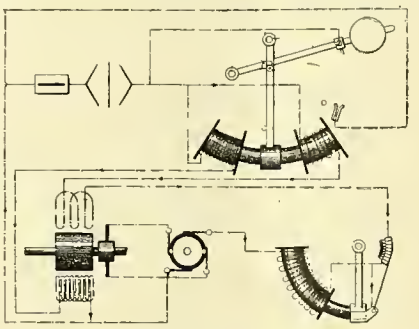
538,700. Electric Elevator. George H. Reynolds, New York, N. Y. Application filed January 27, 1890.

A traveling trip is arranged to rock on its carriage and is provided with arms, a pivoted switch is also provided with arms, the switch being mounted in the path of the arms of the traveling trip, and mechanism for producing the combined traveling and rocking motion of the trip.

538,744. Speed Regulator for Electric Motors. Frank B. Rae, Detroit, Mich. Application filed August 28, 1894.

The combination illustrated includes an electric motor for an organ, a rheostatic switch for controlling the motor, a friction drive mechanism for actuating the contact hand forwardly, and devices controlled by the pressure or volume of the motive fluid or gas for returning the hand.

538,757. Dynamo-electric Machine. Addison G. Waterhouse, Pittsburg, Pa. Application filed February 4, 1889.



NO. 538,669.

A field-magnet having two poles, each derived through three or more pole-pieces, two contact brushes connected with each other through the work-circuit and through the coils of those pole-pieces of opposite polarity, from the magnetization of which the revolution of the armature tends to detract, and a third brush applied to the commutator in advance of the line of maximum commutation, and connected with a point on the commutator of different potential through the coils of those pole-pieces the magnetization of which the revolution of the armature tends to augment.

538,758. Preventing Electrolysis of Street Pipes. Richard Watkins, Sacramento, Cal. Application filed June 25, 1894.

The method described consists in connecting the pipes with the return conductor proper by means of metallic conductors, and also connecting the pipes with the generator forming a part of the electric circuit, whereby the pipes receive and conduct the surplus electricity, which would otherwise indirectly charge the earth adjacent to or surrounding the pipes.

538,764. Electro-therapeutic Apparatus. Franz Borsodi, Magyar-Banhegyes, Austria-Hungary. Application filed October 22, 1888.

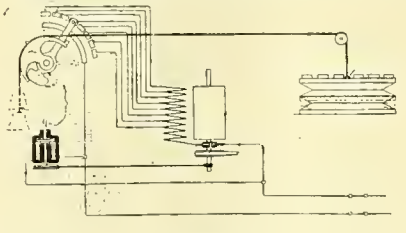
The claim follows: In an electro-therapeutical apparatus, the combination with the plates secured together, to form a recess, a voltaic pile located in said recess, and a bail secured to the plates and electrically connected with the voltaic pile by wires.

538,773. Electric Tower Clock. James H. Gerry and Frederick M. Schmidt, Brooklyn, N. Y. Application filed November 15, 1894.

An electric motor and train for driving the clock hands are provided as well as means controlled by a distant master clock for operating the motor at pre-determined intervals, means for arresting the movement of the clock hands and simultaneously disconnecting them from the motor and breaking communication between the motor and its operating means, whereby the shock of arresting the momentum of the motor is avoided.

538,777. Electric Watchman's Clock. Otto E. Hausburg, New York, N. Y. Application filed April 17, 1894.

A watchman's time detector system consisting of the combination of a generator of electricity, a main conducting line connecting the poles of the generator, electro-magnetic circuit interrupters at sub-stations, an electric recorder at a sub-station, all in circuit with the line, and a manual circuit closer in the line for controlling the circuit of the interrupters and the recorder is described.



NO. 528,744.

538,786. Electric Railway. Henry R. McLean and Gustav A. Kornetzke, Schenectady, N. Y. Application filed August 3, 1894.

There is described a conduit formed in or adjacent to a rail upon which the vehicles travel and containing an electric conductor, in combination with a vehicle wheel provided with a concentric insulated spring mounted metallic disk projecting into the conduit and making electric connection with the conductor therein.

538,816. Telegraphic Sounder. Jesse H. Bunnell, New York, N. Y. Application filed April 19, 1893.

In a telegraphic sounder the combination of its vibrating armature, a trunnion yoke in which the armature is pivotally mounted, a co-operating electro-magnet also carried upon the trunnion yoke, and a resonator upon which the anvil of the armature is mounted.

538,825. Commutator. Jonathan P. B. Fiske, Alliance, Ohio. Application filed February 9, 1895.

The combination is claimed with an armature and a commutator, of cross connections for the commutator, projecting within the end of the armature winding.

538,838. Supply System for Electric Railways. William Lawrence, New York, N. Y. Application filed April 28, 1894.

A series of junction boxes is provided, each consisting of a rigid wall or casing, and a movable portion as a diaphragm constructed and arranged to support a service conductor, and an intermediate air-tight flexible joint; and a superimposed sectional bar service conductor; one box being located near each end of a section of the working conductor and arranged to hold it in normal position.

538,844. Trolley Bar. Clarence Parker and Arthur R. Trepagnier, New Orleans, La. Application filed July 13, 1894.

A trolley comprising the lower wheel at the end of the main bar, the supplemental bar pivoted on the main bar and the upper wheel carried at the forward end of the supplemental bar, and bearing on the top of the wire or conductor.

538,871. Electrically Operated Switch. Henry A. Hartman, Philadelphia, Pa. Application filed January 12, 1895.

The features of this invention are a box, two sets of magnets therein, a frame secured to the box, guides on the frame, a rod mounted on the guides, an armature for the magnets, secured to the rod, a switch connected by a system of toggle levers with the armature and mechanism on the car being adapted to complete the circuit.

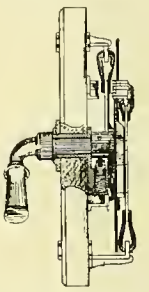
538,904. Electrical Connection. James M. Faulkner, Philadelphia, Pa. Application filed February 28, 1895.

This is an electric bond comprising the curved conductor with bent tapered ends and the perforated securing ears at the bends.

538,919. Absorptive Material for Storage Batteries. Edward R. Knowles, Brooklyn, N. Y. Application filed October 15, 1891.

The method of forming an absorptive material for storage batteries consists in first making a mixture of red oxide of lead and yellow oxide of lead, and then subjecting such mixture to a complete process of sulphation before its application to battery plates.

538,971. Cautery Electrode. Michael F. Laughlin, New York, N. Y. Application filed March 7, 1894.



NO. 538,670.

In combination the platinum wire loop, the loop handle, the resisting bar sliding on the loop, and the electric circuit wires.

538,975. Telephone System. James W. McDonough, Chicago, Ill. Application filed May 21, 1891.

An automatic telegraphic or telephonic exchange system is claimed, comprising subscribers' circuit wires, means at the will of the subscriber for connecting any two of them together, a locking apparatus for maintaining such connection, and a time limit apparatus for unlocking the locking mechanism at a predetermined time independently of the subscriber or operator.

538,983. Interior Conduit. Oliver G. Traphagen and Francis W. Fitzpatrick, Duluth, Minn. Application filed February 4, 1895.

An improved conduit for electric light, telephone and telegraph wires, pneumatic tubes and similar elements is described, comprising a flat strip having channels therein, a molding secured to the flat strip at each side and a glass face or plate held in place between the moldings.

538,999. Electric Arc Lamp. Samuel S. Allin, London, England. Application filed October 29, 1894.

In this lamp the carbon holders are connected by a chain passing over guide pulleys and a sprocket wheel geared to an escapement which is governed by a brake in combination with a lever having one arm linked to the core of a solenoid and having mounted on its other arm the guide pulley from which the chain leads to the lower holder. A lever or equivalent connection from the lever to the brake lever is provided so that the escapement is released when the lamp is not in circuit.

539,000. Electrical Hose Signaling Apparatus. William Fowler, Colorado Springs, Colo. Application filed June 20, 1894.

One claim reads: In a hose signaling apparatus, the combination with the coupling part of the insulating ring located in the part and provided with a recess, a spring actuated bevel-faced contact plug located in the recess and having a lug engaging a groove in the wall of the recess, whereby the plug cannot be turned therein, an insulating locking collar inserted in the outer extremity of the recess around the plug and adapted to engage the lug thereon whereby the plug is secured against accidental removal, and a circuit wire carried by the hose and passed through a longitudinal aperture formed in the plug and secured to the outer extremity thereof.

539,017. Electrically Arranged Hose Coupling. William Fowler, Colorado Springs, Colo. Application filed November 30, 1894.

In an electrically arranged coupling having an insulating ring attached thereto, the gasket having dovetailed projections adapted to engage counterpart recesses formed in the face of the insulating ring.

539,019. Electric Lighting System. Rufus N. Chamberlain, New York, N. Y. Application filed October 22, 1894.

This system includes a source of mechanical power, an alternating current generator, a direct current generator, a translating circuit connected to the alternating current generator, storage batteries connected with the direct current generator, means of disconnecting the alternate current generator from the source of mechanical power and means for mechanically connecting the direct current machine as a motor to the alternating current generator.

# Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, MAY 25, 1895. No. 21


## Electrical Equipment of A. M. Rothschild & Co.'s Store, Chicago.

In Chicago no other recent electrical installation has excited such general interest as the plant in the great department store of A. M. Rothschild & Co. at State and Van Buren streets. This is partly due to the fact that public attention has been attracted to every feature of this imposing establishment, which has been launched fully equipped in the keen contest for retail trade in Chicago, but principally because of the lavish use made of the electric light as an advertising attraction, and also because this is the first plant to be equipped with the new Thompson-Ryan dynamos.

An exterior view of the buildings constituting the present store, showing the light tower on the corner, the lofty glass globe and the adjacent lamp-studded sign and "lightning-flash" is given in Fig. 2. The engines and dynamos in the basement are illustrated in Fig. 1, while Fig. 3 shows the automatic switch by which the exterior changing lighting effects are obtained. This switch is in a fire-proofed room in the base of the tower.

Two engine-dynamos of the same type and capacity supply the current. Simple McEwen engines, with cylinders 15 by 16 inches, operating at 80 pounds steam pressure and 275 revolutions, are directly coupled to two 100 kilowatt, 110 volt, ten-pole Thompson-Ryan dynamos in the compact manner shown in the illustration. The dynamos are connected in parallel, and, with the feeder circuits, are controlled from the white marble switchboard shown in the picture. Weston instruments are used. The generating units were built and installed by the J. H. McEwen Manufacturing company of Ridgway, Pa., which has entered the electrical field.

The principal interest in the generating plant centers in the new dynamos, which were installed under the personal supervision of one of the inventors, Milton E. Thompson. These dynamos are constructed upon the principles and embody the improvements described in a paper recently read before the American Institute of Electrical Engineers by Prof. Harris J. Ryan, Mr. Thompson's associate. They are the direct outgrowth of the experimental and scientific researches there described, and involve many radical departures in detail of construction, as well as in principles of design, from the ordinary types of this class of machinery.

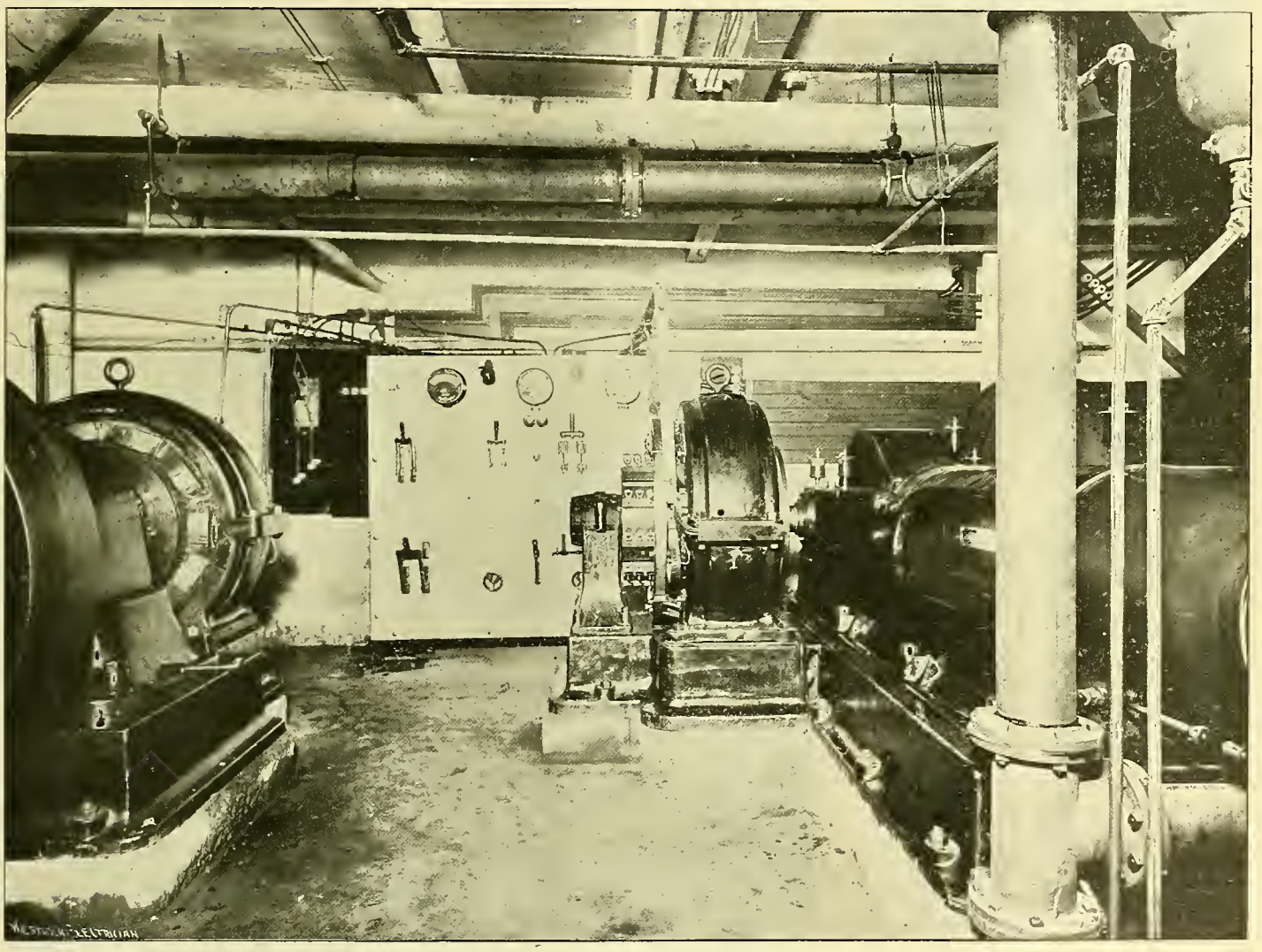


FIG. 1. ELECTRICAL EQUIPMENT OF A. M. ROTHSCHILD & CO.'S STORE, CHICAGO.—ENGINE-DYNAMOS IN BASEMENT.

One of the most striking features of the design is the great depth of copper on the armature. The depth of the slots for armature winding is unusually great and is more than double that usually allowed for an armature of this diameter. Thus the amount of copper on this armature is, as claimed, much greater than on the ordinary type of armature of the same size, and accounts for the large output of these machines per pound of weight. The armatures are wound with a four-circuit, drum winding, connected on the wave system. The winding is built up of bars, which are thoroughly taped and shellacked and further separated from each other by means of micanite strips. These bars are wedged immovably in the slots, and are riveted and soldered together at the ends. The ventilation is effected principally by the peculiar style of armature connection used, which leaves hundreds of small air ducts between the armature conductors, through which the air circulates as through a fan blower. The hollow space inside the armature is large and extends through the commutator.

The fields are of steel and consist of but three pieces. The pole ring is one single steel casting, and contains the principal distinguishing feature of this dynamo—the balancing coils. These coils are wound through slots cored in the ring and are connected in series with each other and with the armature. They serve the triple purpose of balancing the magnetic effects of the armature currents, of producing a field of just the requisite strength for proper commutation, and of affording what little compounding is needed. The field ring proper is made in two pieces, separating in halves, and is of such a shape as to entirely enclose and protect the field coils. The field coils are wound on wooden forms and afterward slipped off and thoroughly taped, no metal spools being used. This method of entirely enclosing the field coils is a decided advantage in this type of machine, since the field losses are so small that all the heat is radiated directly from the field castings without any difficulty.

The arrangement of brush-holders also presents some novel features. The yoke ring is supported by four small brackets bolted directly to the field casting. This yoke ring carries two brass rings, to which are bolted alternately the brush-holders. The whole arrangement is simple and effective, and no part of it interferes in any way with the accessibility of brushes and commutator. The brush yoke is bolted rigidly fast to the fields, and the brushes are never shifted under any changes or conditions of load. The compounding may be changed some-

what by shifting the brushes, but this once properly adjusted there is no occasion for their ever being moved again.

The machines are noticeably small and compact, the outside diameter of the field being less than 50 inches, and the armature but 30 inches in diameter. The total weight of the dynamo is but 6,000 pounds, which is an output of 16⅔ watts per pound. On looking at this machine one is inclined to doubt its high capacity, and yet it has an armature cross-section of over 1,000 circular mils per ampere at its full rated capacity of 900 amperes. The machines have not been run long enough to afford

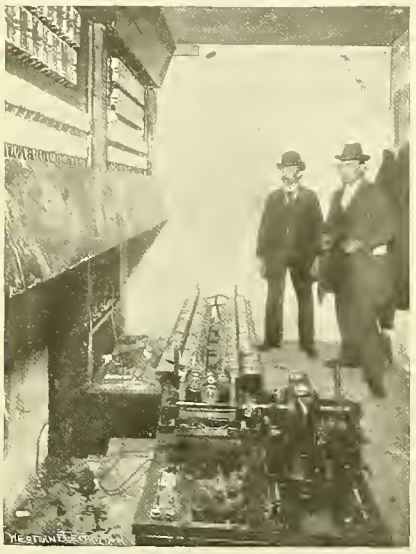


FIG. 3. ELECTRICAL EQUIPMENT OF A. M. ROTHSCHILD & CO.'S STORE, CHICAGO.—AUTOMATIC MOTOR SWITCH FOR TOWER LIGHTING.

a thorough test, but are said to have satisfactorily carried a load of 1,500 amperes.

The general electrical equipment of the store was placed in charge of the Louis K. Comstock company. The lighting system comprises about 400 Brush incandescent arc lamps and about 500 incandescents. In addition to this there is the exterior tower, which is equipped with about 2,900 ten candle power incandescent lamps. The tower itself is surmounted with a glass sphere provided with 60 incandescents. Across the top of the building is a sign "A. M. Rothschild & Co." and a streak of "lightning," in all of which there are about 500 lamps.

The construction throughout the building was not planned or executed as a whole, owing to the fact that the corner building was erected first, and the equipment provided for it alone. Then the next building to the corner was erected and provided with its equipment. The third building is an old one remodeled and was provided with its own equipment. The three were afterward thrown together, so that there are three systems brought together at one switchboard. The convertible system was used throughout in the wiring, and each outlet was so wired that arc lamps burning two in series or a bunch of incandescent lamps could be used.

The tower, Fig. 2, forms the novel part of the construction work. It consists of an iron framework, around which is built a galvanized iron sheathing, built up in sections, diamond shaped. Each section is provided with one lamp. Two horizontal rows of lamps form one circuit, which is carried to a rotary switch in a room in the basement directly underneath the tower. The multiplicity of wires in the tower is taken care of in the following manner: A casing of wood extends from top to bottom of the tower inside and is fastened securely to either side of an iron ladder extending from top to bottom. All the positive wires in the tower are in one casing and all the negatives in the other. When the circuit leaves the casing to pass around the tower horizontally, it is protected from contact with the wood by a diminutive porcelain bushing. The wiring is so arranged that every circuit finds its way ultimately to its appropriate binding post on the rotary switch.

The sockets used for the lamps in this tower were especially designed for this work by J. H. Stahley and made by the Bryant Electric company, the principal feature being that no part of the socket is exposed in any way to the weather, except the outside porcelain surface. Each socket is fastened by means of two bolts to a galvanized iron cup similar in shape to the cover of an ordinary tin pail. This cover is made to fit tight on the outside of a collar of galvanized iron soldered to the center of each diamond section. The socket and its cup are then put in place and the socket protrudes through the opening in the center of the diamond-shaped section. Every socket is capable of removal from within, so that all lamps can be replaced by a trimmer from the interior of the tower. The manhole entrance to the tower is just above the roof of the building.

The rotary switch which operates the column, Fig. 3, is quite novel in design. It consists essentially of two long shafts, connected by a train of gears to a small Crocker-Wheeler motor carrying a fiber pinion. The shafts are thus made to revolve. The speed of the motor is about 800, and the train of gears reduces the revolutions of the motor in the ratio of 250 to 1. The shafts of this rotary switch are each provided with 75 cams, which are capable of adjustment with set screws. The direction of the adjustment is, of course, the direction of the rotation of the cam. Each cam in the course of one revolution raises and then releases a lever which operates a knife switch, this switch controlling the circuit which is connected into its binding screw. The capacity of this switch is 75 cams on each shaft, and therefore the switch controls 150 circuits, each circuit carrying 20 ten candle power lamps disposed on the column in two rows, of eleven and nine lamps each, arranged alternately. The motor actuating the rotary switch is provided with a removable pinion, and other pinions are provided, which give different speeds. The original intention was to send a band of light consisting of about eight rows of lamps from the bottom to the top of the column in 30 seconds. This was found to be too slow and the speed of the switch was doubled, sending a band of light to the top of the column in 15 seconds.

After this switch was built the owners decided to erect on the roof of the building a sign, to be operated also by a rotary switch. The capacity of the switch as installed was fully taken up by the column, so that it was necessary to increase its capacity by building an addition to the switch of 20 cams. The cams were built up exactly as the first set and the shafts were connected with the first shafts by flange couplings. This method of increasing the capacity of the switch at once testified to its excellent design, since it can be readily seen that any other additions could be made in the same manner and at very small expense, the limit being only the space in the room. The switch itself is built up on a cast-iron bed-plate, which gives great strength and solidity to the whole machine. The shafts are steel, the cams brass, knife switches copper mounted on slate, the gears bronze and the motor pinion fiber, the whole mounted on cast-iron, making an absolutely non-combustible piece of apparatus. This switch is the work of W. E. Sinclair of Goltz & Sinclar of Milwaukee, who own the patents covering it. Its successful operation from the very first moment that it started reflects great credit upon the ability of the patentee and upon the conscientious way in which his work was carried out.

At the public opening of the store on the evening of the 18th instant, the lighting features excited the admiration of a crowd made up of many thousands of people.

The store is to be extended, and it is said that an order has been placed with the Brush company for 600 additional arc lamps and two 125 light arc dynamos. With 1,000 arcs the establishment will be lighted on a more extensive scale than any other retail store in the country.

FIG. 2. ELECTRICAL EQUIPMENT OF A. M. ROTHSCHILD & CO.'S STORE, CHICAGO.—ELECTRIC LIGHTING TOWER, GLOBE AND SIGN.

## Affairs of the Milwaukee Street Railway Company.

[Special correspondence of the WESTERN ELECTRICIAN.]

MILWAUKEE, May 20.—Henry C. Payne of this city and George B. Sheldon of New York, were today appointed receivers for the Milwaukee Street Railway company. Judge Jenkins required each of the receivers to filed a bond of $50,000.

The company has never paid any interest upon its bonds, and on June 1st, for the fourth time, it will default interest upon these securities. The bondholders have been very indulgent heretofore, surrendering their interest coupons for the first 18 months. The company's bonded indebtedness amounts to $11,275,000. It is stated on good authority that the company could have paid the interest which will be due June 1st, but that no way for paying the interest due next December could be seen, and hence it was determined to have a receivership at once.

More than 90 per cent. of the bondholders agreed to the receivership proceedings, the step being considered not only wise but necessary. The North American company, which owns $5,180,000 of the bonds, has assented to the step in

the belief that it will ultimately increase the value of its assets. The suit for receivership was entirely friendly. The purpose, it is stated, is to effect a reorganization of the company on a basis favorable to the bondholders. There is a general impression that when the receivership proceedings are wound up, it will be found that the holders of stock have lost everything that they had invested in the lines. To a very great extent, however, the stockholders and the bondholders are identical, so that the freezing out of the stockholders will not be much of a hardship.

Next to the North American company the Deutsche Bank of Berlin, Germany, is the largest holder of the street railway bonds. Washington Becker of this city, who sold the West Side Street Railway company to the Milwaukee Street Railway company, and Charles F. Pfister, who sold the old Milwaukee electric railway to the company, are each the holders of about $500,000 of the securities. Henry C. Payne of this city is said to hold about $75,000 of the bonds and a like amount of stock. The rest of the stock and the rest of the bonds are held in the East.

The $11,275,000 of the company's bonds bear interest at the rate of 5 per cent. per annum. The value of the coupons which have been surrendered without the payment of interest is estimated at $836,250, being the interest upon about $10,000,000 of the bonds for eighteen months. The first issue of bonds was $10,000,000. When the Becker or West side lines were bought additional bonds to the amount of $1,175,000 were issued. It is understood that the coupons on all the bonds except $37[illegible],000 of the issue of $10,000,000 and on the bonds issued to pay for the Becker lines, representing $1,275,000, have been surrendered. The interest due upon the bonds for the six months ending May 31st is $300,000, which, with the back interest due upon the bonds whose holders retain their coupons, makes a total of $416,250. The bonds are quoted at 65 cents upon the dollar, and it is said that they will all be surrendered at 50 cents on the dollar in order to effect a reorganization. With all the old bonds surrendered and new ones issued to the amount of about $7,000,000, representing the real value of the road it is estimated that the system could be made self-sustaining. The net earnings of $420,000 during 1894 would more than pay the interest on $7,000,000 bonds.

The receivership brings to light a wonderful system of wheels within wheels. The North American company is of course the biggest wheel. It owns the Milwaukee Street Railway company of New Jersey, with a capital stock of $5,000,000, which owns the Milwaukee street railway of Wisconsin, with a capital stock of $1,000,000, which owns the street railway lines and the Badger and Edison lighting plants. The "promotion" of the Milwaukee Street Railway enterprises under the manipulations of Villard were conducted on a very liberal scale. For instance, shortly after Peter McGeoch had sold the old Milwaukee City lines for $1,300,000, the new owners found no difficulty in disposing of it to the Villard people for the huge sum of $3,100,000. For the West Side lines the syndicate paid $1,480,000, for the Cream City lines $1,080,000, for the Hiosey lines $345,000 and for the Whitefish Bay dummy line $90,000, making a total of $6,095,000 for the street railway systems of the city. In addition the sum of $380,000 was paid for the Badger lighting plant and about $200,000 for the work done up to 1890 upon the Edison power plant. Nearly $2,000,000 was expended in converting the lines into an electric system and in equipping them. The power house and the subways, etc., were put in by the Edison General Electric company, which at that time was under the control of Villard, who was likewise the head of the North American company as well as the controlling spirit of the Milwaukee street railway enterprise. Some features about the purchase of the properties and the equipment of the line have always been the subjects of considerable comment. It is understood that for some time Villard has not been interested in the street railways here.

The sale of the road under foreclosure proceedings will of course wipe out the present stock. It is certain that the road will be bid in by the bondholders, who will reorganize the company. The stock may be placed at as low a figure as $6,000,000, and under the reorganization there may be no bonds whatever, the present bondholders becoming stockholders as a result of the foreclosure.

The company has a monopoly of the street car business of Milwaukee and the property is very valuable and the whole system is operated by electricity.

## New Officers of the Institute.

The annual meeting of the American Institute of Electrical Engineers was held on the evening of the 21st instant, and officers were elected as follows:

President—Louis Duncan, Baltimore.

Vice-presidents—M. I. Pupin, New York; W. F. C. Hasson, San Francisco; Angus S. Hibbard, Chicago.

Managers—Carl Hering, Philadelphia; B. J. Arnold, Chicago; Chas. F. Scott, Pittsburg; Cary T. Hutchinson, New York.

Treasurer—Geo. A. Hamilton, New York.

This is an admirable ticket, representative of the various branches of the industry, well distributed geographically and made up mainly of young and progressive men. The WESTERN ELECTRICIAN herewith presents portraits and brief biographical sketches of the new officers.

LOUIS DUNCAN, Ph. D., the new president, although one of the youngest men ever elected to the position he holds, is widely known to the electrical engineering profession. He was born in 1862, educated in the United States Naval Academy and at the Johns Hopkins University. Mr. Duncan graduated at Annapolis in 1880, after which he went for a two years' cruise, the greater part of the time being spent at the South Pacific and China stations. In 1882 he was ordered to the Johns Hopkins University, Baltimore, on special duty. Two years later he was stationed in Philadelphia at the International Electrical Exhibition held by the Franklin Institute. He was there made chairman of the committee which made competitive tests of dynamo-electric machinery and electric lamps. In 1885 he was given the degree of Ph. D. by the Johns Hopkins University, and in the fall of that year was ordered to sea by the Navy Department. In 1887 he was requested to organize a department of applied electricity at the Johns Hopkins University, and resigned from the navy to accept the appointment of associate professor of electricity in that institution. Dr. Duncan is the author of a number of papers which have appeared in the different magazines during the last few years. He was elected an honorary life member of the Franklin Institute, is past vice-president of the American Institute of Electrical Engineers, and a member of the Mathematical Society of France. In addition to his work at the Johns Hopkins University, Dr. Duncan has done a considerable amount of work in electrical engineering. Among other things, he, with Frank J. Sprague and Dr. Cary T. Hutchinson, designed and built a 1,000 horse power electric locomotive for the North American company. He is acting as electrical engineer for the Baltimore & Ohio Railroad company in the installation of a plant designed to draw the trains of that system through a tunnel running the entire length of the city of Baltimore. He has also acted as engineer for the Baltimore Traction Syndicate and a number of other large electric railway corporations.

NEW OFFICERS OF THE INSTITUTE.—LOUIS DUNCAN, PRESIDENT.

MICHAEL I. PUPIN, Ph. D., professor of mechanics in Columbia College, New York, is one of the foremost authorities in the country in the investigation and demonstration of the pure science of electrical phenomena applied to mechanics. He was born in 1858 on the military frontier of Austria, but came to the United States at the age of fourteen. In 1879 he entered Columbia College, graduating in 1883 with honors in the classics and in mathematics. He continued his studies in physics and mathematics under von Helmholtz at the University of Berlin, and in 1889 he obtained the degree of Ph. D., with high honors, from that seat of learning on a dissertation in thermodynamics entitled "Osmotic Pressure and Its Relation to Free Energy." This dissertation forms a continuation of von Helmholtz's investigations of the thermodynamics of chemical processes. Dr. Pupin was appointed instructor in mathematical physics at Columbia College in 1889, and three years later he was made professor of mechanics in the same institution—a position he still holds. Dr. Pupin has been a member of the Institute since 1890 and was elected a manager in 1892. He is vice-president, also, of the New York Electrical society, and has taken out several patents for inventions in long-distance telephony and multiplex telegraphy. He has contributed freely to scientific and technical periodicals, and his articles always secure respectful attention.

W. F. C. HASSON, like Dr. Duncan and several other eminent American electricians, is an ex-naval officer. He was born in Cincinnati in 1857, and graduated from the Woodward High School in 1876. In the same year he entered the United States Naval Academy at Annapolis as a cadet engineer. During the course at the Naval Academy Mr. Hasson enjoyed the distinction of being a "star" member of his class, the name being derived from a gold-embroidered star worn on the collar of uniforms, this honor being conferred by the academy authorities for brilliant class standing. He graduated in the engineering force in 1880. In 1882 he was commissioned assistant engineer of the United States Navy. He resigned from the navy February 1, 1893, to enter into private practice in San Francisco, and since that time has been a consulting electrical engineer. He is a director of the Technical Society of the Pacific Coast and a member of the American Institute of Mining Engineers, of the American Society of Naval Engineers, and was a late associate in applied mechanics in the Johns Hopkins University. His prominent position in electrical circles on the Pacific coast caused Lieut. Hasson to be selected as chief of the electrical department of the California Midwinter Exposition, held in San Francisco last year. Lieut. Hasson has also been connected with several important power transmission projects on the coast.

ANGUS S. HIBBARD is one of the leading telephone men of the country. At the head of a company possessing an exchange doing a larger business than any other in the United States, he is a recognized authority on all questions pertaining to this branch of the electrical industry. Mr. Hibbard was born in Milwaukee on February 7, 1860, and was educated in the Milwaukee Academy and Racine College. In 1878 he was chief clerk to the general superintendent of the Northwestern Telegraph company, who, as agent of the Bell Telephone company, began the introduction of telephones in Wisconsin. In this connection young Hibbard went into telephone work exclusively in 1881 as superintendent for Wisconsin, and built 54 exchanges and 2,800 miles of toll line in that state. In 1886 Mr. Hibbard went to New York as general superintendent of the American Telephone & Telegraph company and opened the New York and Philadelphia lines of that company for the first long-distance business. He continued in charge of that company's lines in its extensions throughout the eastern and central states, and opened the New York-Chicago line for business in October, 1892. He came to Chicago February 1, 1893, as general manager of the Chicago Telephone company, since which time that company's exchange has advanced to first place in the country, having 11,000 subscribers, and its traffic has grown to the handling of over 250,000 messages per day.

CARL HERING, B. S., M. E., is a native of Philadelphia, his present home. He was born in 1860, his father being the late Dr. Constantine Hering, founder of homeopathy in America. In 1880 he graduated from the University of Pennsylvania with the degrees of bachelor of science and mechanical engineer. From 1881 to 1883 he was connected with his alma mater as instructor and assistant professor. Mr. Hering has been particularly active in work connected with electrical expositions and international deliberations connected therewith. In 1883, at the age of 23, Mr. Hering was elected commissioner of the Franklin Institute

of Pennsylvania to the International Electrical Exhibition at Vienna, where he was an active member of the international jury which undertook the scientific tests of the exhibits. He then continued his studies at the Polytechnikum in Darmstadt, Germany, under Prof. Kittler, which was at that time one of the very few colleges where electrical engineering was taught as a special course, and shortly after beginning his studies Prof. Kittler appointed him his assistant. In 1884 he became active electrician for the Philadelphia International Electrical Exhibition and member of the scientific commission appointed to make the tests and reports. In the latter capacity he urged the importance of a comparative life-test of incandescent lamps, which, though at first opposed and ridiculed by many members of the commismission, was finally started and was afterward carried out by Prof. Marks for the Franklin Institute. In 1885 he was electrical engineer for one of the large manufacturers in Germany, and afterward for a company in Philadelphia, after which he commenced practicing as consulting electrical engineer in the latter city. In 1889 Mr. Hering was sent to Paris by the United States government to make the report on the electrical exhibits at the Paris International exposition and was appointed a member of the jury in class 62 (electricity). He was also elected delegate from the Franklin Institute to this exhibition for the class electricity, and was representative of the American Institute of Electrical Engineers at the International Electrical Congress in Paris. At the close of the exhibition he received the decoration known as the "Gold Palms" from the French government. In 1891 he was chairman of the delegation of the American Institute of Electrical Engineers at the Electrical Congress held in Frankfurt, Germany, at the time of the electrical exhibition in that city, in which capacity he urged the

NEW OFFICERS OF THE INSTITUTE.—M. I. PUPIN, VICE-PRESIDENT.

adoption of the "henry" and the magnetic units proposed by the Institute. He took an active part in the deliberation of that congress, and was elected vice-president of one of the sections. He was active in urging and preparing the proposed preliminary programme for the Chicago Electrical Congress of 1893, as published by the American Institute of Electrical Engineers. Mr. Hering has long been a prominent member of the Institute and is the author of a number of papers on electrical subjects and of two books on dynamos. He is the inventor of several improvements in dynamos and storage batteries.

B. J. Arnold, with Mr. Hibbard, represents Chicago in the list of Institute officers. He is a consulting electrical engineer, who has devoted particular attention to railway practice. Mr. Arnold has had much to do with the local branch of the Institute, giving his time as honorary secretary, and his personal popularity is largely responsible for the success of the meetings. Mr. Arnold was born in 1861 at Grand Rapids, Mich. Removing to Nebraska, he entered the University of Nebraska in 1879, taking the civil engineering course for one year. Then he returned to Michigan, entering Hillsdale College, from which he graduated with the degree B. S. in 1884, taking a mathematical prize for a six years' course. Later the same institution conferred on him the degrees of M. S. and M. Ph. for subsequent work. Mr. Arnold also took a post-graduate course in electrical engineering at Cornell University. Mr. Arnold has a pronounced aptitude for mechanics and for practical electrical application. He has led a busy life, and his work as a railway engineer has attracted wide attention, particularly the station at Little Rock, Ark., and the great intramural plant at the World's Fair. He is a member of several engineering societies and has made valuable contributions to technical literature.

Chas. F. Scott was born at Athens, Ohio, in 1864. He attended the Ohio University at Athens, and then entered the Ohio State University, Columbus, where he graduated in 1885. He then took a course of graduate work at the Johns Hopkins University, and in the summer

NEW OFFICERS OF THE INSTITUTE.—W. F. C. HASSON, VICE-PRESIDENT.

of 1887 entered the electrical field with a construction company in Philadelphia. In August, 1888, he entered the employment of the Westinghouse company in Pittsburg, beginning work in the dynamo room on night duty. He was soon transferred to the laboratory, and was assistant to Mr. Tesla during the latter part of that inventor's work on alternating current motors at Pittsburg. After the departure of Mr. Tesla, Mr. Scott was placed in charge of the experimental work on the Tesla motor, which he continued for about a year. He was then appointed assistant electrician. Subsequently he was made chief electrician, when Mr. Shallenberger gave up the position for that of consulting electrician to the company. Mr. Scott continues as electrician of the Westinghouse Electric & Manufacturing company, and is closely identified with the electrical work of that company in its new factory at East Pittsburg.

Cary T. Hutchinson, Ph. D., was graduated in 1886 by the Washington University at St. Louis with the degree of Ph. B. From 1886 to 1889 he studied at Johns Hopkins University, under Prof. Rowland and Dr. Duncan, following the courses in physics and electrical engineering; he was appointed fellow in physics, and received, in 1889, the degree of Ph. D. and the certificate of the electrical engineering course. He was with the Sprague Electric Railway & Motor company and the Edison General Electric company for about two years. In January, 1892, the firm of Sprague, Duncan & Hutchinson, of which he was a member, began business. Since the dissolution of this firm in May, 1894,

NEW OFFICERS OF THE INSTITUTE.—ANGUS S. HIBBARD, VICE-PRESIDENT.

he has been practicing as consulting electrical engineer, with offices in New York. He is a member of the American Institute of Mining Engineers and the American Society of Mechanical Engineers, as well as of the Electrical Engineers. Under Dr. Duncan, he and Mr. Wilkes made the first experimental determination of the form of alternate current curves by the instantaneous contact method which has come into such extensive use. He has written various articles for the technical journals.

George A. Hamilton, the new treasurer, who succeeds the late George M. Phelps, was for years identified with the telegraph business of the country. Born in Cleveland, O., in 1843, Mr. Hamilton began service as a messenger in 1860, and for the next thirteen years worked up as operator and manager in Salem and Ravenna, O., and Pittsburg and Meadville, Pa. In 1873 he became assistant to Prof. Farmer at Boston, and he served in this capacity for two years. From 1875 to 1889 he was first assistant electrician and then electrician to the Western Union Telegraph company in New York. For the last six years Mr. Hamilton has been the electrician of the Western Electric company in New York. He is widely acquainted in electrical circles.

The secretary of the Institute, Ralph W. Pope, has filled the position he holds most acceptably for ten years. His is not an elective office, and he will undoubtedly be re-appointed by the council. A portrait and sketch of Mr. Pope were published in the Western Electrician of June 11, 1892.

## The Beecher Single-rail Electric Railway.

The unique elevated single-rail electric railway which is projected and partly constructed in Orleans county, in Western New York, was tested on May 4th. The Medina correspondent of the Rochester *Post-Express* gives this description:

The experimental track is 760 feet long. At the top the width is only about eighteen inches, an ordinary steel rail being set in the center and two guard rails at either side. The track is supported now on trestles about four feet above the ground and only occupies about four feet wide of the right of way.

The car sets close down to the rail, with the wheels boxed

NEW OFFICERS OF THE INSTITUTE.—CARL HERING, MANAGER.

in and is only three feet wide, the passengers sitting two in each seat. When the car started with twenty-four passengers there was a grinding at first of the guard wheels at the side, but as soon as the car got under speed of about ten miles an hour the car seemed to right itself and balance on the center wheels and skimmed along like a cycle, the guard wheels at the side scarcely touching the guide rails. Only fifteen miles of the proposed 100 miles per hour were run, but this was explained as owing to the small drive wheels and the impossibility of getting up a great speed on the present short track without great danger.

A storage battery, which is charged from the water power at Waterport, furnishes the motive power and makes the weight of the car up to about three tons. A speed of tweoty-three miles an hour, it is claimed, has been made with the present equipment for very short distances. Most of the business men from Medina who went to Waterport went fully prepared to see at least a comparative failure, but they expressed themselves as being surprised and a little dazed at the success of the bicycle principle. A dinner was tendered the guests at the Johnson House in Waterport at which an elaborate menu was discussed. Later in the afternoon at Electric City Hall speeches were made by Captain Beecher, the inventor of the system, the Hon. Edmund L. Pitts and Irving L'Hommedieu.

The plan of the enterprise is very wide in its scope and includes besides the construction of a road from Waterport to the summer resort of Lakeside and Oak-Orchard-on-the-Lake this summer a continuation of the road later on to take in Medina, Albion, Oakfield and Batavia, and the utilization and development of the immense water power at Waterport by means of a storage dam to furnish electricity for power and light to the whole section. Work is to be commenced soon to furnish the line through to Lakeside and put the cars at work on the regular summer traffic. The novelty of a ride on the queer road, it is thought, will bring a good many excursionists to the pretty resorts. It is intended that the motors shall be placed in each car.

The most peculiar feature of the invention is that the car cannot get off the track without either breaking three of the wheels or tearing up the track bodily. The advantages

claimed are that for short cross lines there is no danger from snow blockade: there are no grade crossings; the right of way is narrow and cheap and grading is almost entirely done away with by the trestle plan.

## The Water Power of the Orbe, Switzerland.

Electrical industries in Switzerland stride onward with the step of a giant. So great are the facilities for hydraulic power, so rapid the descent of the streams, and so constant

NEW OFFICERS OF THE INSTITUTE.—B. J. ARNOLD, MANAGER.

and abundant the supply, that everything combines to encourage the application of water power to the dynamo, and thence to every form of electrical development.

The river Orbe, in the canton of Vaud, is favorable to such enterprises. With a feeble flow it empties into the Lac de Joux, a rectangular lake ten kilometers long by one wide, which has no visible outlet. The waters reappear below the barrier forming the foot of the lake, and again become the river Orbe.

Some little use is made of the waters of the lake, the waste being drained away by fissures in the rocks leading from the bottom of artificial pits 10 to 15 meters deep.

The proposition was made to close up these small drains and force all the water through a tunnel beneath the rocky barrier at the foot of the lake, utilizing this at a central station, which would thus be enabled to centralize and distribute 7,000 horse power. The lake would thus form an immense water reservoir from which to draw as required.

The river here describes an arc as far as the town l'Orbe, forming a succession of cascades of various dimensions, variously utilized. It then crosses a marsh near the middle of Lake Neuchatel.

Three kilometers farther down a large electrolytic estab-

NEW OFFICERS OF THE INSTITUTE.—CHARLES F. SCOTT, MANAGER.

lishment has existed for a long time for the production principally of chlorate of potash. The process of manufacture is secret, and its product is largely sold in foreign markets. This industry distributes, after adding liberally to its reserve, from 10 to 15 per cent. among its shareholders.

The next chute is seventy meters wide by five kilometers in length. A grand dam was projected by M. Ritter, engineer. This was to be fifty meters in height, and would have created a reservoir capable of furnishing 2,100 horse power for 24 hours, and form an additional attraction in the shape of a handsome lake. The tourist is always a liberal contributor to the Swiss budget and nibbles gladly at Alpine baits.

But the fears of the people in the valley below proved an obstacle, as they doubted the solidity of such a structure. Their doubts defeated the project. This was the third similar proposition thus defeated for like reasons.

To-day the natural raceway is all utilized; 300 horse power lights the neighboring villages; 1,500 horse power goes to Yverdon and St. Croix and other little industrial towns 15 to 20 kilometers away, and about 300 horse power is absorbed on the ground.

This enterprise, carried on by the municipalities interested, has fixed the following scale of prices for current:

| | Price in centimes per lamp hour of 10 c. p. | Annual price in francs. |
|---|---|---|
| Incandescent lamps for a total of 800 hours per annum | 1.5 | 12 |
| Lamps of 25 c. p. (800 hours per annum) | 3. | 24 |
| " " 10 " 2,000 " " " | .75 | 15 |
| " " 25 " " " " " | 1.50 | 30 |
| Arc lamps of 1,000 c. p., 1,500 hours | .17 | 255 |

| | Horse power, year. |
|---|---|
| 1 horse power motor | 240 francs |
| 2 " " " | 220 " |
| 4 " " " | 210 " |
| 6 " " " | 200 " |
| 10 " " " | 190 " |
| 15 " " " | 180 " |
| 20 " " " | 170 " |

Waterworks for various localities are under consideration, but not yet constructed. The next following four kilometers deliver 3,000 horse power with a fall of 100 meters—a discharge of 3,000 liters per second, with an efficiency of 75 per cent. on hydraulic motors. The motors here are used for water works, electric power and lighting the plateau of Echallens, the center of which is 15 kilometers distant, and a surrounding territory within 20 to 30 kilometers radius, including the city of Lausanne.

A uniform rate schedule has been arranged between the communities and the electric company. The principal clauses are as follows:

WATER RATES.

For fire purposes no charge is made for water used. Public fountains will be supplied at an annual price per liter. Individuals will be furnished at the following rates:

| | |
|---|---|
| 300 liters per day | 25 francs |
| 300 to 500 " | 35 " |
| 500 to 700 " | 45 " |
| 700 to 900 " | 55 " |
| 900 to 1,000 " | 60 " |
| and amounts above this last by the 1,000 at 60 | " |

ELECTRIC POWER.

| Power at the terminals of the motor in h. p. | Price per 11 hours per day. Total. | Rate per h. p., yr. |
|---|---|---|
| 0.25 | 150 francs | 600 francs |
| 0.50 | 250 " | 500 " |
| 1 | 350 " | 350 " |
| 2 | 660 " | 330 " |
| 3 | 930 " | 310 " |
| 5 | 1,350 " | 270 " |
| 10 | 2,200 " | 220 " |
| 100 | 17,000 " | 170 " |
| 500 | 75,000 " | 150 " |

ILLUMINATION.

For incandescent lamps burning to 10 o'clock (in the rural districts):

| | | | | | | |
|---|---|---|---|---|---|---|
| Candle powers | 10 | 16 | 25 | 32 | 50 | 100 |
| Yearly cost in francs | 20 | 28 | 35 | 56 | 85 | 170 |

ARC LAMPS PER ANNUM.

| | | |
|---|---|---|
| Each (estimated) | 500 candle power | 1,000 candle power |
| Price | 150 francs | 300 francs |

For public lamps burning until 11 P. M. the price is as already stated; all night lamps double price.

The last fall of the river is one of 10 meters, and is utilized by a company in the city of Orbe for a trolley line four kilometers in length, running to the railway station, and for lighting in the city.

## Legal Credibility of Telephonic Conversations.

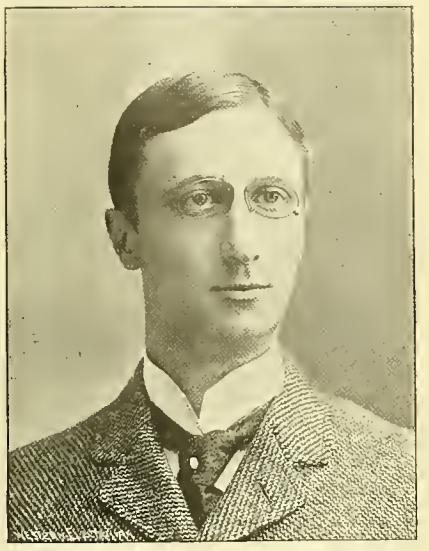
Apropos of the announcement that testimony taken over a telephone was recently admitted in a Michigan court, the *Chicago Tribune* recently collected the following opinions from lawyers of standing:

Ex-Justice Shope: "I never knew this to be done before, but I see no objection to it. Of course in taking testimony by telephone special means should be employed to secure proof of the identity of the witness. But if there are witnesses present with him when he testifies, or they hear what he says, it seems to me the practice is safe enough. I have no doubt whatever that the telephone is to take a place in judicial proceedings. Of course as the law now is, this would not apply to criminal proceedings, as the accused has the right to be confronted with his accusers."

T. W. Packard: "I never before heard of testimony through a telephone and I am unable to see how it ever can be a safe or fair proceeding, or how the courts can ever sanction it. There is absolutely no way to identify the witness unless you resort to arrangements which would cost as much time and trouble as a deposition would. I do not believe anything can ever change these elements of uncertainty."

Charles S. Holt: "The telephone has been coming into judicial proceedings for a long time, and there have been numerous suits in which contracts made by telephone have figured. But I never heard before of testimony by telephone being admitted by a court. I am sure it must have been done by agreement. It seems to me the objections to such a practice are insuperable. There is absolutely no way of knowing who is speaking, and then you cannot see how he looks and what his manner under examination is."

Norman Williams: "I am a thorough believer in the utility of the telephone in legal proceedings. I never heard before of testimony by telephone being admitted by a



NEW OFFICERS OF THE INSTITUTE.—CARY T. HUTCHINSON, MANAGER.

court, but an Evanston justice of the peace not long ago held a man to a contract made by telephone, and I am perfectly sure our contract law will have to include the telephone at an early day. I have transacted legal business of the greatest importance through the long-distance telephone to New York. Even at that distance voices are perfectly distinguished from each other. As to seeing the appearance and manner of a witness, they cannot be seen either when a deposition is taken."

## Lighting the Parliament House.

The British Parliament is to have the benefit of electrical illumination throughout. The statement of this advance in civilization has brought out some curious bits of history.

In Cromwell's time the lighting of the chamber was positively forbidden. It was but a few years previous to that era that Messrs. Catesby, Winter and others engaged one Mr. Fawkes to light up the establishment with a few barrels of gunpowder, and the consensus of opinion was decidedly against fire in the premises.

NEW OFFICERS OF THE INSTITUTE.—GEORGE A. HAMILTON, TREASURER.

William Waddington, who was gifted with more bravery than discretion, dared to carry a couple of lighted candles into the Parliament house one evening, and created a sensation which was not exactly in line with his expectations. He was condemned to 24 hours' imprisonment in the Tower of London.

Previous to 1717 traveling tipstaffs were not permitted to carry lanterns. Gas was installed in Parliament about the middle of the present century, and now this will be discarded for the incandescent, or, as the Englishman terms it, the glow lamp.

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CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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## HIGH WATER MARK

CIRCULATION, 16,630.

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THE newly elected officers of the American Institute of Electrical Engineers, whose portraits are given in the preceding pages of this week's issue, represent well the profession of electrical engineering in the United States. Like the industry they seek to advance, they are young, forceful and progressive—not settled in the ruts of conservatism, but eager for advancement. The ticket is singularly well balanced, both in representing the varied aspects of electrical development and in the geographical location of its members. We extend congratulations to the new administration and wish it every success.

THE ruler of all the Russias, it seems, is one of "us electricians." A European correspondent asserts that one of the fads of the young czar is the study of electricity. His majesty is reported to be intensely interested in everything pertaining to electrical science, and reads eagerly descriptions of the latest experiments and applications in that line of endeavor. He is said to have made several ingenious contrivances himself in the simpler lines of electrical manipulation. Perhaps, then, this old-world autocrat will soon learn a thing or two by bowing his head in submission to the methods of our own Patent Office, and it may be, indeed, that he has in contemplation a book on "The Electrical Industry in America; or, What I Know About the Relations of Manufacturing Companies, Incandescent Lamp Production and the Telephone Situation, with a Comparison of Monopolies in Rulership and in Business."

TO OUR mind there is something confusing in the claims of our esteemed eastern contemporaries in relation to their age. Placing these self-characterizations together, they appear to conflict. Thus:

*Electrical Review:* "The oldest electrical weekly in the United States."

*Electrical Engineer:* "The oldest electrical journal in America."

*Electrical World:* "The pioneer electrical journal of America."

Now, it can hardly be that these assertions are so ingeniously worded as to be all true. At least one of our venerable contemporaries is seeking to deceive its readers by a false statement. Which one is it?

SOME time ago the reformers in the Milwaukee City Council declared that the charges made for lighting the city by the local company were excessive, and they determined to put in a municipal system. Accordingly the city engineer was instructed to prepare plans and secure estimates of the cost of such a plant. The result of his investigations has been published and the people are very much surprised to learn that the local company, which has been giving excellent service, has not been charging much more than the city engineer estimates the municipal plant would cost if the city, like the commercial companies, is obliged to bury its wires. The council has insisted upon all wires being placed underground, and, of course, the city must bury its wires, too, if these commercial companies are to be held to the strict letter of the law. If the city should decide to go ahead with the work of putting in a plant it will in all probability be found that its service will be something of a luxury. Conservative business men are not as favorably disposed toward the scheme as they were before they learned the amount of capital required and the estimated cost of maintenance.

AS SHOWING the great importance and extent of the legal questions growing out of the application of electricity to industrial affairs in the United States within the last quarter-century, it is interesting to note that an Albany law publishing firm is bringing out a series of reports of "American Electrical Cases." Two volumes have already been published, and these cover the important electrical cases from 1873 to 1889. The decisions of the courts in all portions of this country are collected in chronological order, with annotations. At first Western Union telegraph cases largely predominated in numbers. But telephone cases and those involving the use of electricity for lighting and motive power have rapidly increased with each succeeding year, until they have come to occupy much more space upon the calendars and much more time of the courts than the telegraph cases. The tremendous legal battles that have marked electrical development in this country have been a great drag on the industry, but they have been a great thing for the lawyers, who will doubtless find the new reports very useful. But the record presented is not one of which the electrical fraternity is proud.

GENERALLY speaking, the impression prevails that the great electrical corporations of the country are far more enterprising than other industrial concerns. This assumption is no doubt based upon the really phenomenal progress that has been made in an incredibly short time and the wonderful perfection that has been attained in the many applications in which electricity plays a part. Glancing over the field, it is not to be wondered, in view of the great strides that have been made, that electrical concerns should be credited with displaying great enterprise, yet one of the most prominent electrical men in this country asserts that this is really not the case. The gentleman in question has been closely identified with the management of a great electrical manufacturing concern, and he says that very little encouragement is given inventors and very little inducement is held out to them to work upon improvements to existing apparatus or develop new ideas. He says, too, reviewing his own experience and that of his associates, that "the world is slow to appreciate merit, and it would seem as though some of the large electric corporations were slower in some respects than the world generally." Coming as it does from a man who has had an unusual measure of success, this statement will be received with some surprise.

STREET railway enterprises when carefully managed are paying investments, as a general rule, but they are not gold mines and their earning capacity is limited. It would seem that projectors of some of these enterprises failed to recognize these facts. An illustration of this is found in the present condition of the Milwaukee Street Railway company, which, it has been determined, must be reorganized in order to put it on a paying basis. This company was one of the enterprises that attracted the attention of Henry Villard, and his brilliant methods of financiering have made it necessary to secure the appointment of a receiver and effect a thorough reorganization. It is promised that the "water" will now be squeezed out of the stock and that the new deal will be in the line of a legitimate commercial transaction and not a stock jobbing arrangement. The city can support a well managed system of electric railways, as is shown by the fact that the earnings of the old company last year were about $420,000 more than the expenses. In spite of these earnings during a period of financial depression, the management found it unwise to continue under the old form of organization. The chief cause of the troubles of the company was the manipulation of the company's securities in the interests of Henry Villard and the companies in which he was interested. Villard, it is reported, is no longer interested in the Milwaukee company.

IN the decision handed down at Boston last Saturday by the United States Circuit Court of Appeals in the now famous Berliner case, the court declared the patent in litigation valid and ordered the lower court to reverse its judgment. The importance of this decision is fully realized by telephone men, but as the opinion of the court has not yet been filed, the grounds upon which the decision rests are not known. The patent in litigation was considered one of the most valuable grants secured by the American Bell Telephone company, and the manner in which it was hung up in the Patent Office created a great public scandal. Now that the Bell company has gained a victory, it is believed it will proceed to assert its rights and if possible regain its former control of the telephone business. In this, however, it is not expected that it will have everything its own way. Competition has become so general that it will find considerable work on hand, as the rival companies in other districts than that in which the decree was granted on Saturday will without doubt interpose strong opposition to any attempt to close their business. The legal controversy promises to be interesting and exciting. In the meantime the development of the telephone will hardly be benefited by litigation.

Advices from Boston indicate that the government has not given up the contest. It is said that the government has on file a motion to amend the bill, and to allege that in addition to the illegal delay in the prosecution of its application for a patent, the Bell company had a tacit understanding with the officials of the Patent Office not to issue the Berliner patent pending the determination of the suits then pending over the Drawbaugh patent, which was claimed to be an interference.

WHEN the Chicago City Council recently granted franchises to several companies that had no commercial standing and whose backers were unknown in the community an indignant protest was made against the action of the aldermen in passing the ordinance and the mayor in approving it. It was a costly experience and impressed upon the people the necessity of enacting laws that would prevent a repetition of this outrage. Accordingly in compliance with the popular demand for legislation upon this line, a bill was passed by the Legislature making it necessary for a gas, electric light or street railway company to secure permission of a majority of the frontage in every block of a street upon which it was proposed to erect a pole line, lay gas pipes or conduits or put down tracks. This measure, it was shown, would act as a check upon future councils that might be inclined to speculate in valuable franchises. The bill had many excellent features to commend it, and as it disposed entirely of any possible future attempts to use franchises of this character for the purpose of extorting money from established corporations, it was supported by existing companies, and business men generally favored it, appreciating the necessity of protecting capital invested in public enterprises. But all these considerations did not prevent Governor Altgeld from vetoing the measure. In his message returning the bill to the Legislature the governor said it was evident that the sole purpose of the measure was to perpetuate the monopoly now enjoyed by the gas trust, the electric lighting companies and the street railway companies of Chicago. Of course there is no justification for such a sweeping statement, but it is a characteristic of the governor to deal in generalities. There is no doubt the bill might be improved—most bills presented at Springfield will stand amendment—but in the main the object of the measure was commendable and it was aimed against one of the most pernicious practices that have disgraced the administration of public business in American cities. On Tuesday the bill, somewhat notified, was again introduced in the lower house.

## Berliner Patent Valid.

[Special correspondence of the WESTERN ELECTRICIAN.]

BOSTON, May 20.—The American Bell Telephone company won a great victory here on Saturday when the United States Circuit Court of Appeals reversed the decision of Judge Carpenter of the Circuit Court and sustained the validity of the Berliner patent, which has occasioned so much controversy. The case in question was that of the American Bell Telephone company against the United States, and the judges in the Court of Appeals sitting on the case were Colt, Putnam and Nelson. At 12:30 o'clock Saturday afternoon this order was sent down:

The decision of the Circuit Court is reversed, and the case is remanded to that court, with directions to dismiss the bill. Ordered that the appellees have leave to file their motion as to the form of judgment now on clerk's list, and also brief in support of the same, on or before the 25th inst. The appellants to file brief in reply on or before the 31st inst.

The opinion giving the reasons for the reversal of the decision has not yet been written and probably will not be filed for several days. This is a decisive victory for the Bell company. Judge Carpenter on December 18, 1894, decided that the Berliner patent was invalid and ordered it to be delivered up for cancellation. The company appealed and the result of the appeal is in its favor. The Berliner patent is No. 463,569, and was issued on November 17, 1891. The inventor is Emile Berliner and the instrument covered by the patent is a device commonly known as a telephonic transmitter.

The United States relied upon two grounds to show that the patent was void. The first was that there was illegal delay in its issue. The second was that a prior patent was granted upon the same application, to the same applicant for the same invention. This prior patent referred to was one granted to Berliner in 1880. The application for the patent in suit was filed June 4, 1877, and the patent was issued November 17, 1891. The proposition of the government was that the Bell company intentionally delayed the prosecution of the Berliner application and the issue of the Berliner patent, for the purpose and with the result of prolonging their controlling of the art of telephoning, which would cease with the expiration of the Bell patents in 1893, and that they did this by submitting to delays on the part of the officers of the patent department, which delays the Bell company had power to prevent, and that the company refrained from preventing for an unlawful purpose. This conduct was alleged to have constituted a fraud practiced on the public through the commissioner of patents and his assistants. It was claimed that the patent so obtained may and should be annulled by the decree of the court. The decision of Judge Carpenter sustained the two grounds of attack made by the government against the patent and held that it was void and should be delivered up to be cancelled. The counsel were the most eminent in the country. Hon. Causten Browne of Boston and Judge Robert S. Taylor of Indiana acted for the government and Hon. W. G. Russell, J. J. Storrow, F. P. Fish and C. H. Swan for the Bell Telephone company. The case was argued before Judge Carpenter for six days in June, 1894, and for four days ending April 19th last before the Circuit Court of Appeals.

The government has on file a motion to amend its bill and to allege that in addition to the illegal delay in the prosecution of its application for a patent, that the Bell company had a tacit understanding with the officials of the Patent Office not to issue the Berliner patent pending the determination of the suits then pending over the Drawbaugh patent, which latter patent was claimed to be an infringement. It is in view of this motion to amend that the Court of Appeals gives the government leave to file its motion as to the form of judgment in this particular case. The United States is given until May 25th to file its brief as to the form the judgment should take, while the Bell company is given until May 31st to file its brief upon the same subject. The opinion of the court will probably not be ready until about June 10th.

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Until the opinion accompanying the decision is printed little can be said upon the subject by way of comment. It is pointed out that one of the results of the decision may be to transfer phases of the litigation to Chicago or a comparatively nearby point. The United States Circuit Court of Appeals in Boston, in reversing the findings of Judge Carpenter and sustaining the validity of the patent, gave a judgment operative only in the territory within its jurisdiction, that is, the first judicial circuit. Of course this decision will be used as a precedent, but the same course will have to be followed in this case as in the incandescent lamp litigation. A Chicago patent lawyer is quoted as saying:

The Bell company, to procure a complete certification of the validity of the patent, must either have a similar decision from each of the remaining eight Circuit Courts of Appeals in the country or else get a decision from the United States Supreme Court. In patent cases the United States Circuit Court of Appeals is the court of last resort unless at its own instance it sends the case to the supreme tribunal. I don't know what the Appeals Court at Boston will do in this matter, but it would seem likely from such accounts of the proceedings as I have received that it will not certify the case up. The Bell company, it may be supposed, now that the patent is confirmed, will proceed against concerns which it believes are infringing upon it. In this part of the country the competition to the Bell, such as it is, is strongest. Therefore it is among the possibilities that the United States Court of Appeals in this circuit or another adjoining may be called on to pass on the patent. The United States Courts of Appeals follow each other closely, but they are not bound absolutely by the decisions of co-ordinate tribunals. They do not reverse each other often, however.

FIG. 4. HANDLING COAL BY ELECTRICITY.—DERRICK HOIST.

On the other hand the fight is not over, as the competitors of the Bell company declare they will contest every step with the old company. General Manager Hanford of the Harrison company, for instance, said: "We are opening exchanges in Indiana, Illinois and elsewhere. We have had numerous suits with the Bell, most of them dismissed by the latter. Our transmitter is a make-and-break instrument. Theirs is on the constant contact system. We are hoping the Bell company will attack us and are not afraid to test our claims and patents in court."

## A Lawsuit over Wasted Power.

The Louisiana Electric Light company has sued the New Orleans Traction company for $27,775.71. The petition alleges that the plaintiff agreed to furnish to the defendant all the light and power required by it; that the traction company agreed to construct its lines in a complete and workmanlike manner, so that the loss of power transmitted through its lines should not be more than the like loss in the best constructed electric railroads, and that the insulation should be kept up to the best standard; that under the contract the traction company was to use in running its cars no more power than was reasonably required for that purpose on lines operated under conditions similar to those prevailing in New Orleans, and at the rates of speed allowed by the ordinances of the city. But it is charged that when incompetent, ignorant, and untrained employes in charge of the running of the cars have control of the power they waste it unnecessarily; that such employes did not properly apply the power, and have used and wasted more power than was contemplated under the contract; that the traction company has also put on its cars motors and appliances different from those first used under the contract, and such as required the expenditure of much more power. The electric light company therefore sues for the amount of the power it alleges the traction company wasted under the above conditions.

## Handling Coal by Electricity.

An extensive coal handling plant, operated entirely by electricity, has been running in San Francisco since February 4th. The owners, R. Dunsmuir & Sons, were confronted with the problem of unloading coal rapidly from the steamships and colliers at the wharves and distributing it to the wholesale and retail trade most economically. They found the solution in the adoption of electrical apparatus, and the contract was awarded to the General Electric company. The plant consists of an electric hoisting and haulage system for unloading the coal-carrying ships and steamers and distributing the coal into wharf and house bunkers for local and wholesale distribution. It is located on the water front of San Francisco, about four blocks from the ferry entrance to the city and within a half mile of the business center.

The bunkers consist of two parts, the wharf bunkers and the yard or house bunkers. The former are built out upon the pier by the side of which the colliers are moored for discharging. The yard bunkers are located in the main yard, on the side of East street and are connected with the wharf bunkers by means of a trestle and bridge 204 feet long and 35 feet above the level of the street. The main yard consists of a dock 350 feet by 300 feet; and here the main bunkers, screening bunkers, power house, offices, stables and the storage yard are located. The wharf bunkers are 290 feet long by 36 feet in width and have a capacity of 1,100 tons of coal. The yard bunkers are 241 feet long by 60 feet in width and have a capacity of about 5,000 tons.

The power house is a frame building 81 feet long by 88 feet in width. The boiler plant consists of three 66 inch by 16 feet boilers, each of which contains 64 four-inch tubes and is rated at 100 horse power. In the dynamo room are two tandem compound McEwen high speed 135 horse power engines, running at 265 revolutions. Belted to these engines are two 90 killowatt, 250 volt, compound wound, multipolar General Electric dynamos, running at 700 revolutions and over-compounded 10 per cent. The load on the dynamo is variable, often changing from no load to 75 per cent. of full load in from five to ten seconds and from full load to no load in about the same time.

The hoisting plant consists of three special electric hoists, each having a capacity of 2,000 pounds lifted at a maximum

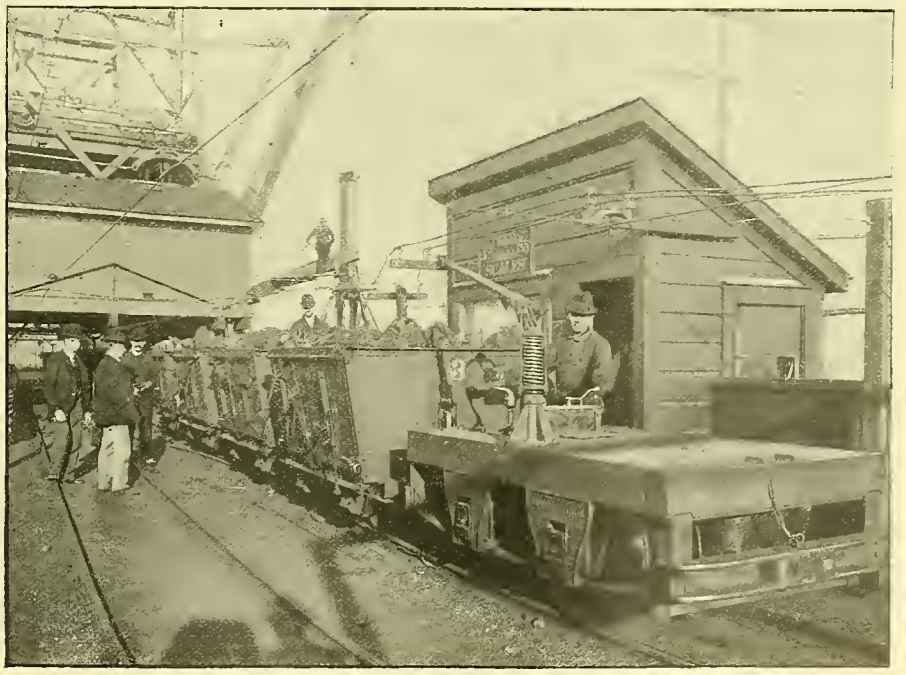


FIG. 1. HANDLING COAL BY ELECTRICITY.—LOCOMOTIVE AND TRAIN.

rope speed of 800 feet per minute. An excellent idea of these hoists is given in Fig. 4. The motors are of the General Electric L. W. P. 20 type and the armature shaft is geared to an intermediate shaft by special gears with a very slight reduction in speed. The intermediate shaft is in turn geared to the drum shaft by means of eight groove "V" frictions. On the end of the intermediate shaft is also a single groove wheel driving the hauling-in drum which serves to haul in the bucket over the chutes when it has been raised to the proper height. The hoists are controlled by means of K. R. controllers and are mounted in derrick houses, as shown in the illustration.

Fig. 2 shows the steam collier Costa Rica lying alongside of the bunkers, and unloading partly into the cars for distribution into the yard bunkers and partly off shore into the ship George Skolfield moored beside her. The bucket is just about to be unloaded into the chute by which the coal will pass into the cars. These buckets have a capacity of 1,200 pounds of coal each and are raised from a depth of 60 feet to 80 feet, according to the state of the tide and the portion of the hold from which they are taken.

The derricks are mounted on a track raised about six feet above the floor of the bunkers and are so arranged that they can be moved along the wharf to accommodate themselves to the position of the hatches of the ships. The capacity of each derrick is 400 tons in nine hours, although they have, under favorable conditions, worked up to 450 tons in nine hours. A portion of the coal is unloaded directly into the bunkers on the wharf and is distributed from them into the retailers' wagons. By far the larger portion, however, is discharged into cars and hauled into the house bunkers, to be distributed as needed.

Fig. 1 shows one of the electric locomotives, of which two are used for this haulage work, with a train of four cars being weighed on the scales before delivery to the house bunkers. The locomotive is of the well-known "T. M. F." type and is equipped with General Electric motors. The locomotive has a draw-bar pull of 800 pounds and is required to haul from four to six loaded cars, each car weighing 3,600 pounds and having a capacity of 4,700 pounds of coal. The train in Fig. 1 represents a gross load of 40,670 pounds. The tracks are perfectly level and on the return trip the locomotive frequently brings back eight to ten empties.

All the coal is weighed before being delivered to the house bunkers—track scales being made a portion of the track and each car being weighed independently. Fig. 1 shows the interior of the house bunkers, with locomotive, cars and coal. The capacity of these bunkers is about 5,000 tons of coal.

On the bridge the usual overhead railway construction has been adopted, while on the wharf a special construction, shown in detail in Fig. 2, was rendered necessary on account of the limited head room underneath the derrick.

FIG. 2. HANDLING COAL BY ELECTRICITY.—VIEW IN WHARF BUNKS.

These bunkers handle the output of the Wellington mines at Wellington, B. C., which is estimated at about 450,000 tons per year. Of this about 250,000 tons is handled through these bunkers, the balance being shipped direct to wholesale dealers. The plant has been in continuous operation since the 4th of February and has given the most perfect satisfaction throughout.

## Thawing by Electricity.

Mr. Edmunds informs us that he has been making some experiments lately with most complete success, in what we think is a new and important application of electricity to domestic use, says the *Electrical Review* of London. He, like many others, has suffered the inconvenience of having his gas and water service frozen during the severe winter weather. It occurred to him that a resistance, suitably protected, might be introduced into those pipes which were most exposed, and least easy of access with flame or hot water, or other ordinary method of thawing. He had a special wire made, in which the current was conducted through a highly resistant metal, insulated with a fireproof medium that was also a non-conductor of electricity. The whole was enclosed in a metal tube, which could be drawn down to make a compact wire or tube that was externally a conductor of heat, but not of electricity, thus preventing loss of current and electrolysis. The results were most satisfactory. This "thermic" wire was introduced into the waste pipe from a bath room at the north side of his house, which entered a fall pipe some 20 feet from the ground, and which was easily frozen. On Saturday last the thermic wire was introduced from the outside. At night a small stream of water, trickling down, froze, forming an icicle some 12 inches long and 1½ inches thick, completely blocking the waste pipe. The thermic wire having been previously connected with Mr. Edmund's electric light circuit, at 50 volts pressure, when current was turned on four amperes flowed through it; and in four minutes a complete thawing was effected, and the waste service was cleared. This is a method of thawing which might be worth the consideration of gas and water companies. Certainly it is one that highly merits the attention of prudent householders.

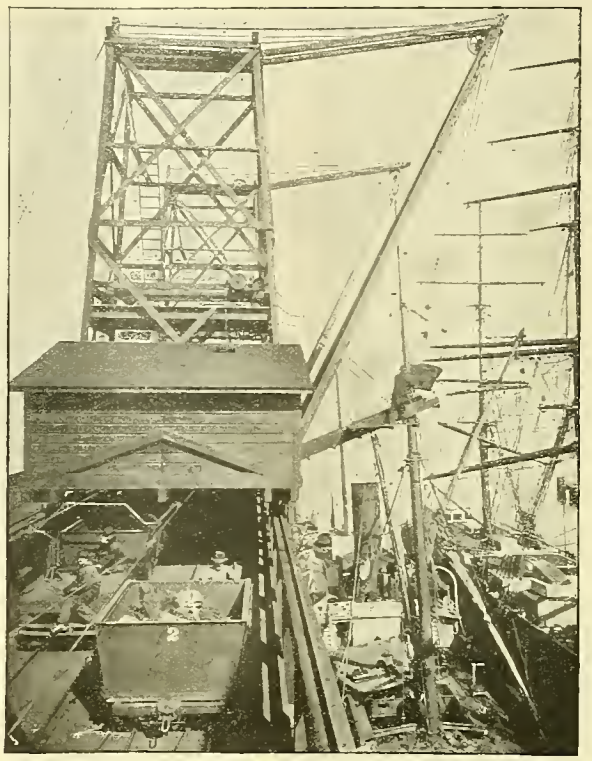


FIG. 3. HANDLING COAL BY ELECTRICITY.—DERRICKS AT WORK.

## Production of Platinum.

The increasing demand for platinum, more especially in the manufacture of incandescent electric lamps, gives great importance to this metal and its sources of supply, says the *Mining and Scientific Press*. It is widely diffused, being found in almost every mining region in the world, usually minutely disseminated in serpentine rocks or their debris, but only in the Ural mountains, Russia, does it occur in grains, and only in those mines is it thus secured in any considerable quantity with accompanying profit. In Brazil and Columbia, South America, Sinaloa, Mexico, various counties in California and Oregon, and other localities on this continent, native platinum occurs, almost invariably in gold sand or gravel. So far as known, no determined effort has been made in California to mine it, though the continued advance in its price and the occurrence of the metal in so many instances suggest the possible profit of such enterprise. Thirty years ago platinum was quoted at $4.50 an ounce; it steadily appreciated in price till "a corner" in '89 sent it up to $17.50 an ounce. That enormous figure, of course, occasioned tremendous activity, and three years ago the price went down to $7.50 an ounce. Since that there has been the usual rebounds and reactions that have affected everything made or mined in the world except gold; platinum is worth to-day about $10.50 an ounce, and it is not likely that it will ever be less, as the practical supply seems limited while the demand must necessarily increase.

On the Demidoff estate and the government Goro-Blagodat district, in the Ural mountains, platinum is mined for itself alone. It is found in a ten-inch "streak" of sand resting upon a serpentine bedrock at a depth varying from ten to forty feet from the surface. A shaft is sunk to the bedrock, a drift run and the sand hoisted, fed with water into a conical revolving screen and sluiced. The industry furnishes employment to about 6,000 men and women, the former earning about 60 cents, and the latter 35 cents a day, this low wage being a part of "the European level" regarding which the California miner and manufacturer hear so much nowadays. The cost of washing these Ural platinum sands is about $16.75 per kilo of native metal, about 40 cents per metric ton of sand washed. It is said that sand containing less than three grammes of platinum per ton cannot be profitably handled. The average is about four grammes per metric ton. On this there is a government tax of three per cent.

It is believed that the present annual consumption of platinum in electrical and other industries in this country approximates 50,000 ounces, nearly all of which is imported. It is found in connection with iridosmine in Butte, Plumas, Siskiyou, Trinity and Tuolumne counties in California, and its great present value (about one-half that of gold) gives it proportional importance.

## Electric Grain Transportation.

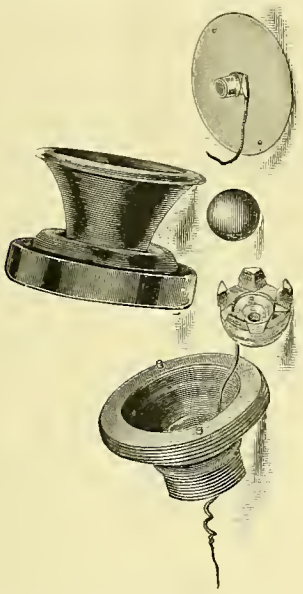
Thomas Lowry, in the course of a chat with an eastern newspaper man, said: "We propose to increase Minneapolis lines so that they will be freight as well as passenger lines. Experience has proved that electricity is, next to water, the cheapest method of transportation. Our plan is to extend our lines to the great belt of the Northwest, of which Minneapolis is the center. Cars built for the purpose, lighter than an ordinary freight car, and more durable, will be put on. They will be essentially grain car

with chutes for quick loading and unloading. They can be backed into an elevator and unloaded with less red tape than is now in vogue among railroads. They will hold fully as much as the regular grain car now in use and be much smaller, because they will be loaded to the top and loaded through the top. The plan for this is now under consideration. Each car will carry a set of buckets that will load and unload it. These will be worked by electricity. Of course the plan at present is only under discussion, and it will take some time for its perfection. I expect, however, before two years to see the major portion of the grain carried to Minneapolis by trolley."

## M. & B. Transmitter.

The accompanying illustration of the M. & B. transmitter gives a good idea of its construction. The diaphragm is of India mica, a highly resonant material which gives great efficiency. Attached to the center of this diaphragm is a small aluminum cup holding a carbon or other suitable point. In front of the black rubber shell is shown the basket or runway of aluminum or other metal. The sphere shown in the cut may be of carbon or other material, eleven-sixteenths of an inch in diameter, which normally lays in the basket or runway, which is so constructed that no matter which side of the transmitter is up, the sphere rests on a plane which is always inclined toward the diaphragm. When these parts are assembled the point on the diaphragm comes about on a level with the center of the sphere which, owing to the angle of the side of the basket or runway, is kept against the point by gravity. The distance between the point on the diaphragm and the back of the basket is about three-quarter of an inch, which allows the sphere a maximum movement of a little under one-sixteenth of an inch.

With every oscillation of the diaphragm a movement of



M. & B. TRANSMITTER.

this sphere takes place, which breaks the battery current, hence the name "Make-and-Break" and the well-known sign "M. & B." The principle is set forth in the first claim of the broad method patent No. 361,124, under which these transmitters are constructed. The claim reads:

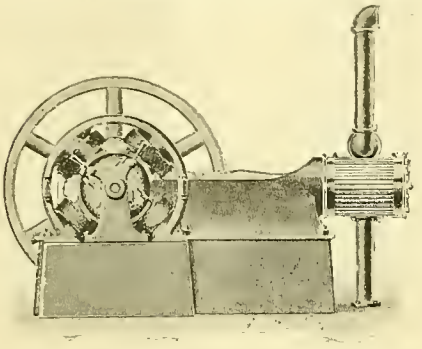
Claim 1: The art or method of transmitting vocal or other sounds telephonically by causing intermittent or pulsatory currents of a uniform volume or intensity, and of durations corresponding to the phases of the oscillation of the diaphragm.

The practical results claimed for this form of transmitter are:

First, articulation, which is claimed to be better and more perfect. Every syllable, whether a shout or a whisper, is transmitted clearly and distinctly. There is no running together of words nor confusion of sound. Second, volume. While the volume of sound is great, yet there is no sputtering, snapping or frying sound. Third, long-distance transmission. Every M. & B. transmitter is a long-distance instrument. Fourth, simplicity of construction. There is nothing to get out of order; no adjustments to be made; no springs to give out; no "packing" and no plastic material to change in density. The United States Telephone Construction company, which controls the M. & B. transmitter, invites competitive tests. These transmitters are covered by over ten construction patents, with others pending, besides the broad method patent mentioned, which was issued April 12th.

## Directly Connected Dynamo.

The cut shows the direct-connected generator of the Commercial Electric company of Indianapolis, Indiana. The dynamo is of the multipolar type made by this company. It has soft cast-steel field magnets and a smooth Gramme ring armature. It is claimed that this type gives more perfect regulation, greater freedom from sparking and less tendency to heat than the ironclad type commonly used. The maximum rise in temperature is guaranteed to be less than 75° Fahr. and regulation within one volt from no load to full load. The armature is commonly mounted on the extended shaft of the engine and the frame upon the extension to the engine sub-base. The armature and commutator are mounted on the same spider, so that the complete armature may be removed



DIRECTLY CONNECTED DYNAMO.

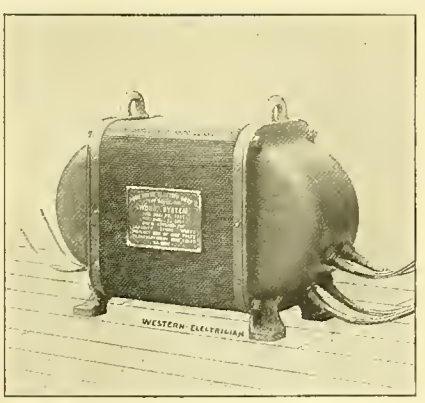
from the shaft without disturbing any of the connections. The machine illustrated is a 40 kilowatt lighting dynamo, connected to a Ball engine.

## Fort Wayne Electric Corporation's New 750 Light Transformer.

The accompanying illustration represents a new type 37½ kilowatt transformer designed by James J. Wood for substation use. It is constructed so as to be used on either 1,000 or 2,000 volt primaries, of from 60 to 140 periods, and the secondaries are arranged for connection to either a two or three-wire system. This transformer presents a very substantial appearance, while the design and construction and of the simplest as well as the neatest possible character. The ventilation is so perfect and the radiating surface so large in proportion to the output that the rise in temperature is very low, even when run for eleven hours on full load. The regulation is within 2¼ per cent., while the efficiency at full load is 98.33; ¾ load, 98.39; ½ load, 98.33; ¼ load, 97.30; ⅛ load, 95.09; 1-16 load, 90.82. The Fort Wayne Electric corporation is making these transformers, and at present two sizes are ready for the market, 375 and 750 lights respectively.

## S. K. C. Spark Arrester.

The illustration shows an attachment for arc lamps to prevent the escape of sparks. The device not only answers this purpose, but is an admirable protection from storms and bugs. The arrester is strongly but lightly constructed, the base or reflector being of heavy pressed tin, and the chimney of perforated tin, thoroughly reinforced. Each half is mounted on cast brass hinges, designed to automatically hold




FORT WAYNE ELECTRIC CORPORATION'S NEW 750 LIGHT TRANSFORMER.

the halves (when the lamp is being trimmed) in a horizontal position. Simple but effective catches assure the proper shutting of the halves, and hold them securely together. All joints lap, consequently the arrester is spark, storm and bug-proof. The chimney and exterior of base are finished in black enamel, thoroughly baked, to withstand the action of the weather; the interior of the base, being finished in white enamel, acts as a reflector. This device is manufactured by the S. K. C. Specialty company of Pittsfield, Mass., and is sold in Chicago by the Wallace Electric company.

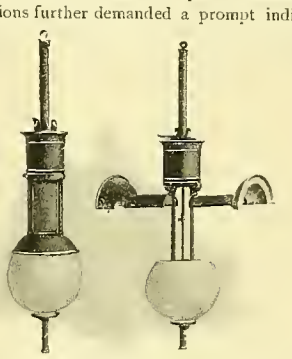
## The Question of Street Railway Track Ownership.

The suit of the Chicago General Railway company to secure the right to operate over the tracks of the Chicago City Railway company will probably be heard upon its merits within a short time. It is assigned to Judge Tuley. The answer just filed admits that the McGann road leased the lines owned and operated by the West and South Town companies and has been operating them since July 22, 1894, but it denies that the rights and privileges which the ordinances granted the West and South Town company were ever transferred to the McGann road. According to the answer, if any such transfer has been made it is only a pretended one and is of no force or effect, for the reason that the rights so attempted to be conferred by Section 13 of the ordinance were not in law capable of being assigned or transferred. The trouble that arose over the attempt of the McGann people to run a car over the Twenty-second street line, east of the Twenty-second street bridge, is admitted. The defendant, however, upholds its opposition by force on the ground that it had a perfect right to use force to preserve inviolate a right and privilege granted to it by the City Council. The defendant claims that the complainant's charges are without color or right of law and the court is asked to dismiss the bill.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, May 18.—The people of Brooklyn continue to manifest a deep feeling of resentment to the trolley companies. On Wednesday evening an anti-trolley mass meeting was held, and denunciatory speeches were listened to by an audience estimated at 5,000. The companies were pleasantly referred to by resolution as "incorporated manslayers," and the resolutions further demanded a prompt indictment



S. K. C. SPARK ARRESTER.

of the officials of the companies by the district-attorney's office and criticised the district-attorney for his inactivity. Trained and licensed motormen were also demanded. A piece of music called "The Trolley Dirge," prepared especially for the occasion, was played. Part of the selection was a clang of a trolley gong, followed by a chorus of childish shrieks. This delectable composition was very effective in stirring up the people. Many wild and foolish statements were made, but the strong and abiding opposition to the companies' management was made very evident.

Alexander Graham Bell appeared in the Jefferson Market Police Court on Monday afternoon as the prosecuting witness against a man who fraudulently claimed to be his agent in this city.

A large number of car fenders were exhibited to the railroad committee of the Brooklyn Board of Aldermen on Thursday. One of the inventors present was a woman, Miss Marguerite Maidhof. The type used on the Newark trolley roads seemed to impress the committee very favorably. In that city, however, it is generally agreed that the "scare element" in the car fenders has been more efficacious than anything in the mechanical construction, and that this would be still further enhanced by painting all of the fenders in the brightest colors procurable. This fender is a menace which prevents people taking risks. It sticks out in front of the car three or four feet and threatens the shins.

In the case of Simon Sterne, who sought to restrain the Metropolitan Telephone company from removing his instrument from his office because he refused to pay an increase in rental of $115 per year, Mr. Sterne's attorneys took the position that the company is a common carrier, and as such, liable to regulation by the courts, and when its rates are unreasonable—the company being a monopoly—the courts should interfere to prevent injury to the public. Judge Ingraham remarked that there was no doubt that the Legislature could correct the rates, but the power of the courts seemed less certain. He gave the counsel permission to submit briefs and reserved his decision. During the argument it was shown that in 1881 the net earnings of the company were $11,000; in 1882 they were $86,000; in 1883,

$241,000; in 1884, $355,000; in 1885, $642,000; in 1886, $576,000, and in 1887 a 20 per cent. dividend had been paid. Other years showed dividends averaging ten per cent.

The annual meeting of the stockholders of the General Electric company was held in Schenectady on the 14th instant. Ten thousand more shares of stock were present than at last year's meeting. No action was taken, nor was any proposition or report made relative to a reduction of capital stock. The board of directors for the following year was elected thus: Oliver Ames, 2d, T. Jefferson Coolidge, Jr., C. R. Coster, Thomas A. Edison, Eugene Griffin, Gordon Abbott, F. S. Hastings, Henry L. Higginson, George F. Gardner, J. Pierpoint Morgan, Robert Treat Paine, 2d. Thomas J. Cummins, Jr., and C. A. Coffin. H. McK. Twombly and D. O. Mills retired from the board. Their places are filled by George P. Gardner and Thomas J. Cummins, Jr. Officers for the ensuing year are to be elected by the new board of directors. It is understood that First Vice-president Griffin is to retire, to enter upon the management of a business concern in this city.

W. F. O.

## Milwaukee, Wis.

MILWAUKEE, May 18.—City Engineer Benzenberg has submitted to the Common Council an estimate of the cost of erecting and equipping a municipal lighting plant. The estimated cost of the plant is $345,153. These figures are very liberal and in several cases are close to the actual cost. The annual cost of maintaining the system, in the opinion of the city engineer, will be about $89 a lamp for 1,000 lamps. The city now pays $110 a lamps a year.

The plant which the city engineer had figured upon is one suitable for lighting the city in the way that it is lighted at present, but it is to be arranged that its capacity may be increased from time to time. In considering the economy of an underground conduit distributing system, the report states it becomes preferable to locate an electric lighting plant as centrally as possible along the river, where sufficient territory may be provided to permit the storage of fuel and to allow room for the extension of the station. But dock property in the central part of the city is very costly and the city engineer says that it becomes a question whether the cost of the additional copper wires and conduits necessary to convey the current from a more remote portion of the city is not outweighed by the cost of the more expensive ground, especially in view of the fact that it is admittedly practicable to increase the pressure of the current to 5,000 volts and thereby increase the number of lights on a circuit to 100. On this account, and because the city owns property south of the special sewage pumping works on Jones' Island, which may be made available, and because the fuel, which becomes a very large factor in the annual cost of lighting, can be most cheaply delivered at that point, the city engineer recommends the establishment of the city lighting plant on the island. This site has some disadvantages, as, for instance, it is not accessible by road, so that until a bridge to the island is built the lamp department would have to be located at a more accessible point.

Next in the report comes a statement which shows what a great difference it makes whose ox is gored. It is required by ordinance, states the city engineer, that all electric wires shall be placed underground. This provision adds so largely to the cost of the plant, it is declared in the report, that if allowance from the start were to be made in the construction of the conduits for an extensive increase in the number of lights in every direction, the interest and sinking fund on the increased cost due to such provision, added to the cost of operating, divided among 1,000 lamps, would increase the annual expense per lamp to very nearly the price paid by the city at the present time. The city engineer has therefore estimated the cost of the underground and conduit system to cover not much more than the territory and streets now provided with arc lights, leaving the extensions to be made in such directions and districts as may be determined hereafter.

If on all the unpaved streets on the East Side north of Knapp street, on the West side north of Walnut street and on the South Side west of Fourth avenue and south of Greenfield avenue the light wires could be strung overhead, instead of being buried, the immediate cost of distribution could be reduced $34,000; while if in the additional territory in the underground system thus laid out, the wires could be strung overhead through alleys, instead of conduiting them in the streets, the immediate cost would be reduced further by $11,000. In most of the other cities of the country, the engineer states, this is done, or the underground system is restricted only to the business section of the city or to the section of the city lying within half a mile of the center. The present law, it is interesting to note, requires a very general burying of all electric wires, but that law was enacted before the city had any idea of going into the lighting business itself.

The highest type of engine efficiency and the largest practical unit of dynamos, states the city engineer, have been determined upon as offering the best results, the generators being either directly connected to each end of the engine shaft or by connecting them in series, the arrangement in the engine room depending upon the combination selected, but to be such as to permit an increase in the machinery in series, the boilers adjoining in an adjacent building to permit of the serial extension, the fuel room to run lengthwise with the boilers and if possible to feed automatically to the boilers.

The buildings, while not necessarily ornamental, are to be substantial and suitable to the purpose. The foundation, building and walls to be entirely independent of the engine and dynamo foundations.

For the conduits the estimate of the city engineer provides for either a three-inch iron pipe, glazed on the inside, or square vitrified tile having a circular duct of three inches in diameter, laid and imbedded in concrete in such number as may be required to distribute the current, with not more than two cables to a duct; while for the single circuit distribution, simply a two and one-half inch glazed iron pipe, laid without concrete, is provided to receive the lead-covered cables, contemplating the best cable that can be obtained under a safe guarantee to conduct the current at a pressure of 5,000 volts. For such overhead wires as may be strung a No. 6 copper wire, well braided, with poles 40 feet long, is recommended.

The city engineer's estimate in detail is as follows: Docking, $2,500; buildings complete, $29,500; extra foundations for machinery, $5,000; three triple expansion engines, 350 horse power complete, with boilers equipped with down-draft furnaces, steam piping, feed pumps, condensers, belting, etc., $34,500; twelve 100 light dynamos, $25,000; switchboard, wiring, tubing, etc., $3,500; armored cables and river crossings, $3,700; multiple conduit system, including manholes, $30,940; single circuit conduit system, including manholes, $47,728; relaying of pavements, $4,200; 156 miles of lead-covered cable, laid, $116,585; 1,000 mast arms on lamp posts, complete, $22,500; 1,000 double carbon lamps, $19,500. Total, $345,153. In addition to the total operating expenses a year, the city engineer estimates the interest and depreciation at $34,515.30, making a total of $89,895.30. The matter is now in the hands of the Common Council. There is considerable sentiment in favor of a municipal lighting system and it is not unlikely that the city will decide to engage in the enterprise. The city engineer points out the fact that if the number of lamps were increased to 1,400, as they undoubtedly would in a short time, the cost of each lamp annually would be reduced to at the most $78 a year, as very few more employes would be needed and the other additional outlay would be light. The city engineer adds that this is a most opportune time to contract for the engines, boilers and the electrical equipment for a lighting plant, as the prices are low and the competition exceedingly lively. Labor is also low and so is the price of building and other material, and the distributing system could be erected at a lower figure than it could at any previous time in the history of the city.

The directors of the Waukesha Beach Railway company have some very ambitious projects in view. They propose to extend their electrical line, which now runs from Waukesha to Pewaukee, so that it will tap Oconomowoc and the points between there and Pewaukee, and also to extend the system to Wauwatosa, one of the suburbs of Milwaukee, where it will connect with the line of the Milwaukee Street Railway company. The original plan of the company contemplated an extension, should the line prove at all profitable, through Hartland, Lakeside, Nashota, Nagowicka and Gifford's to Oconomowoc. The idea of giving Milwaukee service did not enter the minds of the directors until the Milwaukee & Wauwatosa Motor Railway company recently asked for a franchise into the city of Milwaukee with the avowed intention, in case it got such a franchise, to extend its lines to Waukesha and convert its whole system into an electrical one. The idea of both companies, of course, is to catch the summer travel by means of lower rates. The Wauwatosa company announces its determination to begin work at once upon the Waukesha extension in case it gets a franchise into the city, and it has already taken steps to secure the right of way through the territory lying between this city and Waukesha. Now comes the Waukesha Beach Railway company with the announcement that it intends without delay to build the proposed extensions to Oconomowoc and Milwaukee without delay. An important factor in the matter is the Waukesha franchise. The Waukesha company, it is believed, will have a decided advantage in this matter. It is composed of Waukesha men, with the indefatigable "Long" Jones, formerly of Chicago, at its head, and the directors do not seem to be seriously alarmed about any other company's getting a franchise from the village board of Waukesha. Moreover, the Waukesha Beach Railway company is on friendly terms with the Chicago, Milwaukee & St. Paul and Chicago & Northwestern railroads, and in case it extends its lines to Milwaukee it is said that it would be allowed to cross the tracks of those corporations upon the terms which obtain with the Milwaukee & Wauwatosa electric line. The Milwaukee & Wauwatosa Motor Railway company, which at present is a "dummy" system, is opposed by the Milwaukee Street Railway company, whose influence in the Common Council is very powerful, and it is doubtful if it will ever get a franchise to lay tracks within the corporate limits of Milwaukee. The Waukesha Beach Railway project promises to be a profitable investment. The line from Waukesha to Pewaukee is completed with the exception of laying a few rails, the power house is ready for service and six cars are now on their way from Pullman. In a few weeks the line will be opened with considerable ceremony.

It was just a few days ago, at a meeting of the directors, that the Milwaukee and Wauwatosa Motor company decided to equip its system with electricity. The change will be made in the original line from the city limits to Wauwatosa, in the line from Fifty-second street to the state fair grounds and in the extension from the state fair grounds to the village of North Greenfield. The company expects to run cars every three or five minutes during the state fair in September. If the company gets a franchise to operate cars in the city limits it will run direct from some down-town point to the state fair grounds. There is some talk of the company's going ahead with the Waukesha extension scheme without regard to the action of the common council of Milwaukee upon its application for a city franchise.

The sheriff of Milwaukee has served papers in a suit brought for the appointment of a receiver for the Kaukauna Electric Light company. The action is brought in the Outagamie Circuit Court. H. B. Tanner, F. Charlesworth and H. C. Tanner of Kaukauna are the plaintiffs and John Earles of Kaukauna and Dr. William H. Earles and A. Runke, together with the company itself, are made defendants. The defendants are conducting the plant, which is valued at $30,000. It is alleged that they have been conspiring against the defendants and other holders of stock with a view to rendering the stock valueless and that after obtaining possession and control of the corporation and of its books they have been guilty of fraudulent and illegal acts in the management of the company. In particular it is alleged that in consideration of a certain bond alleged to have been illegally transferred to John Earles as security for the payment of certain money, the said Runke as president and the said William H. Earles as secretary executed a chattel mortgage whereby they transferred the entire plant to John Earles. There were debts due to various persons at the time, it is alleged, and it is also charged that at the time the mortgage was given without authority. The plant, it is further charged, has been allowed to run down and become inefficient. Dr. Earles, one of the defendants, is dean of Milwaukee Medical College. He is the principal stockholder in the only rival of the Badger Illuminating company of this city.

The La Crosse, Black River Falls and Neillsville Electric Railway company has filed articles of incorporation with the secretary of state. The capital stock is $300,000 and the incorporators are Nathan Clark, Paul McHugh, William H. Polleys, T. J. McHugh and William Burns. The capital stock is divided into 300 shares of $1,000 each. The company proposes to build an electric railway between the three cities named, a distance of about eighty miles, for passenger, freight, mail and express business. The general offices of the company are to be in La Crosse. The line is the longest electric line that has yet been projected in Wisconsin and further developments in regard to it will be awaited with interest.

C.

## New England News.

BOSTON, May 17.—An act relating to the transmission of electricity for heating and cooking has just passed the Massachusetts Legislature. It reads as follows:

In any city or town where a person or corporation, not a railway company, is lawfully engaged in the business of transmitting electricity for lighting or power through wires legally located on poles over, or in conduits under, the streets and highways of this commonwealth, said person or corporation may sell such electricity for operating heating, cooking and kindred apparatus as well as motors, upon such terms as may be agreed upon.

Officials of the Bell Telephone company have held several important conferences in the Milk street building last week relative to a new switchboard, the introduction of which is contemplated and which it is understood the Bell company has patented. It is said to involve a complete change from the system now in use, but is a return in some ways to first principles. The present switchboards are built on the multiple system, by which each wire can be connected with any other wire on the same switchboard. The multiplication of telephones has made this arrangement very complicated, and required an enormous number of wires, and it is sought to simplify matters and reduce the size of the switchboards

by arranging the wires in groups, each board caring for one group and a trunk line being used to connect one group with another, something on the same principle as the several exchanges are now connected. The introduction of this system and the arrangement of the new board are based on a series of statistics as to the connection of one line with another gathered during several years.

The new directors of the Wells Beach & Oguuquit Electric Railroad company have been elected as follows: C. N. Tibbetts of Dover, N. H., William H. Eaton, Oscar J. Hubbard, Joseph P. Mildrum, C. O. Chamberlain and W. S. Wells of Wells, Me.; Joseph H. Littlefield, Carson H. Littlefield and Josiah Chase of Oguuquit, Me.; F. M. Boyre of Manchester, N. H., O. J. Bagley, of Somersworth, N. H., and Capt. J. D. Whidden of Melrose, Mass.

The new law providing for greater safety from electric wires, in Boston and placing responsibility of proper insulation upon the wire department of which Hon. John R Murphy is the head, went into effect May 4th, and upon that date Commissioner Murphy sent out a circular to all electric companies in Boston using poles and posts for the transmission of electricity informing them of the fact and requesting that they send to his office statements of their poles and posts and the methods of insulation. The responses show that with the exception of the railroad companies, the electrical companies used wooden poles, insulated in the usual way with glass caps on wood points. The New England Telephone & Telegraph company has some iron poles with wooden arms and pins, with glass insulators, and in addition uses rubber covered wire either singly or in pairs. The poles used by the railroad companies are identical in their method of insulation. A wooden block with a cast-iron head is used for the top of the pole, the block serving as an insulator. The guard wire is also insulated where it is made fast to the guard span. The trolley spans are fastened to the pole with strain insulators and made fast to the pole with iron clamps, while at the trolley connection with the span is another insulator. This gives two insulators between the trolley and the poles. Cement is used around the base of the poles, which to a certain extent serves as an insulator. The Boston Electric Light company uses wooden posts except for street lighting for the city; these are of iron and the city owns them. There are 2,350 in all. Commissioner Murphy and Superintendent of Lamps Buckner have held a conference and it was decided to erect three or four posts, which are supposed to be capable of doing the work and to thoroughly test them. It is the intention to utilize the present electric light postsas far as possible in order to avoid the extra expense of replacing them with new posts. C. S. G.

## PERSONAL.

J. Hill of London, manager of the gas engine department of Dick, Kerr & Co., the well-known English engine builders, is in Chicago in the interests of his firm.

City Electrician Barrett of Chicago has the sympathy of the entire electrical fraternity in the great loss he sustained recently in the death of his daughter.

George G. Carter, who has for some months been in Mexico looking after his interests in that country, has returned to Chicago. Mr. Carter was accompanied by his wife and both speak most enthusiastically of their Mexican sojourn.

L. A. Scovil, who made many friends in Chicago during the World's Fair period, while acting as general superintendent of the department of electrical operation and maintenance, has been made superintendent of the lines of the City Railway company of Dayton, O.

Capt. Brophy of Boston, Mass., was badly injured while crossing Tremont street, in that city, one evening last week. He was knocked down by a bicycle, his head badly cut and nose broken, and he was taken insensible to a hospital. It is reported that he is slowly improving.

## ELECTRIC LIGHTING.

Articles of incorporation of the Mammoth Springs, Ark., Electric Light & Power company have been filed. The company proposes to maintain and operate a system of electric lights, generate power by electricity and to build and maintain telephones lines. The capital stock is $100,000, of which $10,000 has been subscribed by H. G. King, W. D. Cook, M. J. King and M. H. Cook.

Application has been made by stockholders of the Kaukauna, Wis., Electric Light company to have a receiver appointed. It is alleged by the Green Bay & Mississippi Canal company and other creditors that the company has been managed poorly; also that John Earles, manager, holds a chattel mortgage on the plant and threatens to foreclose. The company is incorporated for $50,000, four-fifths of which has been paid. Dr. W. H. Earles of Milwaukee is one of the principal stockholders.

Articles of incorporation have been issued to the Chicago Heights Electric company. This company will acquire title to an electric light and power plant which has been built at Chicago Heights by W. G. Caldwell. The capital stock of the company is fixed at $50,000. The station is a two-story pressed brick building equipped in part with dynamos from the old Edison plant on Adams street. About three miles of wire has been strung for street lighting and service to stores and residences. The franchise granted to the company gives it the right to furnish power to the various factories at Chicago Heights and to operate a telephone service.

## ELECTRIC RAILWAYS.

All the contracts for the construction of the Buffalo & Niagara Falls electric railway have been let, and the work will be rushed. The contractors have been notified that the road must positively be completed by July 1st. The contract for the entire equipment of the road has also been awarded. Wheeler & Holden of Buffalo are to furnish the ties. The cars of the new road will leave both terminal points every 15 minutes.

If you see a man riding all day long in a trolley car, apparently for the mere pastime of the thing, says the *Hartford Post*, you may make up your mind that he is a victim of rheumatism. Somehow or other, rheumatics have become possessed of the idea that the electric heat in the trolley cars is a panacea to their pain-racked bones, and I know half a dozen men who spend three or four hours each day in the electric cars. And they declare, in evident sincerity, that they are being rapidly cured of their ailment.

It is said that negotiations are in progress for the purchase by an English syndicate, represented by J. M. Lively of Port Townsend, of the three electric street railway systems in Portland, Ore., with the expectation of consolidating them under one management and making such improvements as will serve to give the city a cheaper and more complete service than it has ever had. The proposed deal involves a cash expenditure by the purchasers of between $2,000,000 and $3,000,000. The total trackage of the street railways to be included in the contemplated consolidation is about 128 miles, and the total cost of construction was $2,975,000. The companies now owning the lines are the Portland Consolidated, the City & Suburban and the East Side.

## MISCELLANEOUS.

Some robins have built their nest in a rather curious place at Lord Rothschild's mansion, Tring Park, according to an English contemporary. At the rear of the switchboard in the switch-room on the ground floor two of these birds have taken up their abode in the network of the electric wires and cables which conveys current to the various parts of the premises. The hen bird is at present sitting upon four eggs.

M. Oovaroff, the Rusian electrician, of Moscow, and Professor Hischrt, government forest inspector of the same city, have made some investigation concerning the liability to lightning stroke of certain species of trees. In the summers of 1893 and 1894 the two scientists mentioned spent 109 days in the great forests between Moscow and Remereff, and during that time found 597 trees that had recently been struck by lightning. Of the total number of marked trees 302 were found to be white poplar (populus alba), this notwithstanding the fact that that species is not near as common as a half-dozen or dozen other varieties. On Oovaroff's suggestion the government recommends that the peasants use it as a lighting protector.

A London restaurant keeper supplies electrically heated plates to customers. It is found that a circular hot-plate eight inches in diameter may be maintained at a temperature of 212 degrees at an expenditure of one ampere at 100 volts. This would cost about one cent per hour. There appears to be considerable scope in this direction, and the durability of the plates should be very great, as they are not strained in reaching the above mentioned comparatively low temperature. Another system is sometimes adopted—that of using a quick-heating plate which is connected when the order is given. The plate becomes hot in a couple of minutes, and is then used in the same manner as a hot-water plate. In the latter case no connecting wires are required on the table, the plate being previously heated from some convenient spot. It is found that the plates retain their heat for a considerable time.

## TRADE NEWS.

It is announced that "Francis R. Upton has no connection whatever with the Upton lamp."

F. H. Angell, who is well remembered by the older element of the electrical fraternity, has recently accepted a position with the C. & C. Electric company. When recently met in Syracuse, Mr. Angell reported that he was having a large trade and the prospects were very bright for the future.

The W. J. Davis Electric company of Pittsfield, Mass., reports a great influx of orders for its new alternating fan, which is wound for either 50 or 100 volts, and is said to be positively self-lubricating, enabling it to run the whole season without attention. It is also constructed in a manner that will keep it in perfect alignment.

Francis Iehl, who for several years was one of the electrical experts connected with the Edison laboratory at Menlo Park, and who has been in Vienna for the past thirteen years, has returned to America and will be located at No. 60 Liberty street, New York city, representing F. Hardtmuth & Co., manufacturers of carbons. Mr. Iehl has an extended experience in this line of business.

J. Grant High & Co., Philadelphia, have issued a businesslike catalogue and price list of switches, switchboards and electric specialties whichthey are manufacturing. Projectors of electric plants will find much to interest them in this publication, and old station managers will do well to consult its pages before making any further extensions or changes in their present equipment.

The Syracuse Storage Battery company has recently installed a plant of 60 cells for Dey Bros. & Co. of that city. It is to be used for lighting the show windows and various portions of a large retail store, using about 250 lights, and is intended to be a model installation. The new seamless cells are used. This concern has also sold Chas. Fletcher of Providence, R. I., 50 storage battery cells to be used on his new yacht Seneca. This concern reports business as having improved very rapidly of late.

It is difficult to conceive of anything more dainty or pleasing in the way of advertising literature than the brochure "Of Luminaries" issued by the Chicago Edison company. T. C. Martin, the author, and Bartlett & Co., the publishers, have combined in the production of a booklet that presents, in most graceful form, the advantages of the electric light in the home. Entirely artistic and satisfying the most exacting requirements of good taste, this brochure will be highly prized by all recipients. The pen of the writer, the brush of the artist and the skill of engraver, paper maker, printer and binder are here very happily employed to show to the house-holders of Chicago what the Chicago Edison company can do for them.

The Metropolitan Electric company, 186 and 188 Fifth avenue, Chicago, furnished the lamps for the large tower of A. M. Rothschild & Co.'s new store. This tower has created a sensation, and the Metropolitan company feels that it has "scored a hit" by having its lamp selected after other lamps had failed. The Metropolitan company is advising customers and the trade generally, that while it is willing to meet competitive prices on high grade rubber wire, the National India Rubber company, manufacturer of N. I. R. wire, will not enter competition upon the low grade of cheaper wires that have been foisted on the market. The company prefers to keep up the excellent standard of this wire, feeling that in the long run it will be to the advantage of the business at large and the wire in particular.

A description of the standard water-tube safety boiler, manufactured by the Link Belt Machinery company, Chicago, has been issued by that company in the form of a circular. The method of purifying the feed water in the standard boiler before it takes circulation is described. The purifying chamber is extended back of the circulating tubes and separated from the rest of the drum by a partition. The water enters the boiler through the feed pipe, and falls into the series of pans, where it is sprayed from one pan to the other and finally falls into the settling chamber. The temperature of the water is raised to that of steam when decomposition of the carbonates and sulphates takes place, and they are deposited in an insoluble form in the settling chamber, from which they are blown off. The only part of the purifier in which hard scale can form is in the pans, and these can be readily removed through the man-hole, cleaned and replaced. If the purifying chamber is properly blown off, the other parts of the boiler will be kept free from scale.

## BUSINESS.

W. W. McChesney, representing Huebel & Manger, of Brooklyn, was in Chicago last week. He has been on a business trip covering the principal western cities, and reports a satisfactory trade.

A fine catalogue is that just issued by the Commercial Electric company of Indianapolis, Ind. Motors, lighting dynamos, power generators, direct-connected units and switchboards are illustrated and described in very attractive style.

H. B. Wyman & Co. of Albany, N. Y., report they are having an unusual amount of new business from the increase of building operations in and about Albany. This is a well known firm of electrical contractors, Mr. Wyman having been for a number of years connected with the old Thomson-Houston Electric company as an engineering expert.

The Leclanche Battery company of New York reports that the sale of the Gonda cell has increased very largely of late, and that it is supplying prominent telephone companies who are using batteries in connection with their instruments. This battery is well known as a standard open-circuit cell. General Manager Brewer is pushing its sale.

The McLean Armature company is building a very neat fan motor called the Parmele fan. It has carbon brushes, 12 inch fan and fan guard, oil cups and all the details of a good piece of work. By adjusting the relation between the fields and the armature, by means of a screw, any desired speed from 100 to 1,500 can be obtained, no artificial resistance being used.

The Electric Appliance company is receiving a large number of inquiries regarding its new Meston alternating current ceiling fan, which promises to find fully as useful, if not as large, a field, as the regular Meston alternating current fan. As this is practically the only alternating current ceiling fan on the market, it should certainly prove a good seller during the coming season.

The Electric Engineering & Supply company of Syracuse has recently moved its New York office and store room from 136 Liberty street to room 205 Thames building, corner of Greenwich and Thames streets, where under the management of F. M. Hawkins the company will keep constantly in stock a full line of its well-known specialties, knife switches, sockets and rosettes.

Recent word comes from Secretary J. S. Speers of the Partridge Carbon company, Sandusky, O., to the effect that he has just landed a large order for 150,000 self-lubricating Partridge motor brushes to be shipped to the Philadelphia roads and Jersey City. Mr. Speers states most emphatically that trade is good and that the Partridge products are decidedly "on top." Undoubtedly the secret of the Partridge Carbon company's success has been its firm purpose to produce only the best line of carbons. Quality is what tells, and without question Mr. Speers appreciates the importance of keeping a uniformity in this respect.

The Central Electric company, Chicago, is now western agent for the Billings & Spencer drop forged products. The drop forged overhead materials are meeting with splendid success, and the marked advantages and great strength of this material are gaining recognition from rail-

way men. Some good railway contracts have been closed by the Central Electric company, and the results obtained by placing high grade material upon the market have proven very gratifying.

Secretary James P. McQuaid of the National Conduit Manufacturing company of New York has been making an extended survey of the country in order to become thoroughly posted in regard to the numerous points where this concern is about to begin the laying of its wrought-iron conduit. Mr. McQuaid reports that the season of '95 will without doubt show double the amount of work done in 1894. Large additions have been made to the working force of this company in order to meet this increase of business.

Henry F. Kellogg of Boston, Mass., who for several years has been general sales agent for the Whitney Electrical Instrument company, has connected himself with W. B. Southgate & Co. of Boston. Mr. Kellogg is known from the Atlantic to the Pacific in all branches of the electrical trade, and in his new connection will undoubtedly meet with success. Mr. Kellogg says that this new concern will continue to handle the Whitney electrical instruments, with privileges to sell in any portion of the United States and Canada. It will also have in addition a large line of specialties and electrical apparatus.

The Stanley Electric Manufacturing company of Pittsfield, Mass., is at present, and has been for some time, working twenty-three hours per day, and is now so crowded with orders that it has about decided to erect another large factory, a duplicate of the one which it now occupies, in order to take care of its growing business. This concern is now completing the third 500 kilowatt generator for Quebec, and has orders for two more for the same customer. The weight of this machine complete is 58 tons; it is wound for 5,500 volts, giving a maximum of 5,000 at the end of the line. General Manager Henry Hine reports that the Stanley company has recently added $100,000 to its capital, all of which was taken by the present stockholders. Not a little of the success of this company can be credited to Mr. Hine. It has been under his guidance that it has grown to the present large proportions, and the Stanley apparatus is recognized as standard by the electrical trade.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued May 14, 1895.*

539,022. Method of and Means for Assembling Commutator Segments. Asa F. Batchelder, Schenectady, N. Y. Application filed February 28, 1895.

As a means of assembling the segments of the commutator of a dynamo-electric machine, an assembling ring or cylinder of slightly greater size than the finished commutator is provided as shown, this cylinder having longitudinal cuts upon its inner surface arranged to retain in position sheets of insulating material.

539,024. Electrical Connector. Frank N. Bell, Milford, Mass. Application filed July 28, 1894.

An outer thimble has one end closed to a centrally located bolt hole, the exterior surface of the thimble tapering from the partly closed end and the interior surface tapering toward the end, the wall of the thimble being split lengthwise upon one or more lines. An inner sleeve or thimble is provided with a tapering exterior surface corresponding to the interior taper of the outer thimble but of slightly longer mean diameter. The inner sleeve is split upon one or more lines through part of its length and adapted to enter and expand the outer thimble upon receiving end pressure from the bolt.

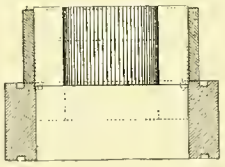
539,032. Carbon-brush Holder for Dynamos. Winfield S. Bosley, Chicago, Ill. Application filed September 8, 1894.

The device is shown in the cut. The combination claimed consists of the bar upturned at its end, a clamping plate secured by one end to the bar, a carbon block adapted to rest between the upturned end and the elevated end of the clamping plate, and a screw for moving the end of the clamping plate toward or from the bar to clamp or release the carbon block.

539,040. Insulator. Leonard H. Desisles, Boston, Mass. Application filed September 10, 1894.

A main body of insulating material, having end brackets, a metallic clip and a holding screw, the screw and clip to have screw-thread connection with each other, and co-operating with a bracket to hold a wire.

539,068. Telephone. Morris Martin, Malden, Mass. Application filed November 10, 1886.



NO. 530,022.

The principal feature of the invention is shown in the cut, and the principal claim is for the combination of an inducing magnet and coil and diaphragm constituting the telephonic instrument with a movable armature or keeper for the magnet and actuating mechanism operated by the removal of the telephone from its support and its replacement thereon whereby the keeper is retained on the magnet when the instrument is not in use, and is removed therefrom when the instrument is in use for telephonic communication.

539,079. Electric Push Button. August J. Oehring, Chicago, Ill. Application filed November 2, 1893.

A base formed of flexible material and having the pins formed integral with it and a plate secured in place by bending the pins over upon it.

539,086. Telephone Transmitter. Robert F. Rice, Hartford, Conn. Application filed May 18, 1893.

In this instrument there is the combination with the diaphragm of an undulator consisting of a multiplicity of surface-contacting members under successively increased loads, and comprising single-part and multi-part members in alternating succession.

539,099. Annunciator Connection for Multiple Switchboards. Giles Taintor, Keene, N. H. Application filed April 11, 1892.

One claim follows: The combination with a telephone circuit of an annunciator included in series in the circuit, a normally open short-circuit about the annunciator, and means for closing the short-circuit by the act of making connection with the line.

539,105. Variable Rheostat. Ernest P. Warner, Chicago, Ill. Application filed September 18, 1894.

The claim follows: In a drum wound rheostat, the combination of the bare resistance wires constituting the winding, with a contact device adapted to travel over the wires, the contact device being provided with contact rollers, which are adapted to bear upon a number of the convolutions of the winding at the same time.

539,123. Cross-arm for Carrying Electrical Wires. Thomas T. Eckert, New York, N. Y. Application filed March 20, 1895.

The features of this device are: A wooden bar of small cross-section and an iron plate or bar of considerable horizontal and vertical width combined into a structure of great strength, small cross-section and surfaces.

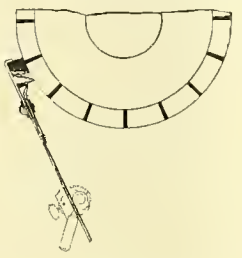
539,142. Telephone Circuit and Apparatus. Charles W. McDaniel, Kansas City, Mo. Application filed March 16, 1895.

This is a main telephone circuit entering and extending through a plurality of stations in series, in each of which the circuit passes through two double spring jacks, branch conductors from the circuit conductors including a high resistance call bell; a test jack in a bridge between the circuit conductors, and a testing circuit including telephones and a double connecting plug, whereby upon the insertion of the plug into the test jack the testing circuit is bridged into the main circuit.

539,150. Electric Lamp. William H. Sheppard, New York, N. Y. Application filed November 20, 1894.

An incandescent light socket having bracket arms, which may or may not swing and have secured at their lower end a shade and support for an electric lamp.

539,154. Railway Signal System. George L. Thomas, Brooklyn, N. Y. Application filed January 26, 1895.



NO. 539,032.

A block signal system has a series of signals arranged along a track in interconnected sets, insulated track sections corresponding to the number of sets of signals, a main track circuit, including the rails of one of the insulated track sections, a battery having one of its poles connected with one of the rails and its opposite pole with the other rail and a relay at one of the members of a set of signals, and electric circuits connecting the individual members of a set of signals and the adjacent sets of signals and under the control of the main track circuit to display the proper signals when a train is moving in either direction along any of the insulated track sections.

539,163. Telephone Transmitter. Alfred C. Brown, London, England. Application filed September 27, 1894.

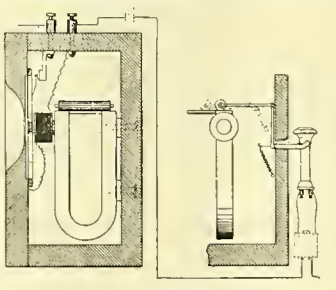
A diaphragm, a back electrode, conducting granules compressed between the diaphragm and back electrode, a frame or case, an elastic ring seating at the front of the diaphragm between the same and the case, and means for fastening the diaphragm and back electrode in the frame and at the same time holding the diaphragm pressed from its rear against the ring

539,170. Magneto Call Apparatus. Frank B. Cook, Chicago, Ill. Application filed December 26, 1894.

The combination is claimed with a telephone circuit of a magneto call generator normally connected in, but shunted from the main circuit, generator actuating mechanism, an automatic telephone circuit switch, and means controlled by the concurrent operations of the actuating mechanism and telephone switch for withdrawing the generator from its shunts.

539,184. Closed Conduit Electric Railway. Paul Lucas, Berlin, Germany. Application filed June 23, 1894.

The continuous closed casing has stationary contacts arranged at intervals; the conductor is located in the casing; the series of rocking arms are carrying each a contact electrically connected with the conductor and there is a series of vertically movable plates in the roadbed, electrically connected with the stationary contacts in the casing.



NO. 539,068.

539,192. Electric Light Headgear for Personal Wear. Alfred M. Rodriguez, Brooklyn, N. Y., and Edward D. Rockwell, Bristol, Conn. Application filed February 25, 1895.

The cap has two wires permanently applied thereto, and terminating at their rear and forward ends in contact points, whereby an electric lamp and wires supplying a current thereto may be connected with the cap.

539,222. Electric Conductor. John R. Hare, Baltimore, Md. Application filed November 23, 1894.

A series of separated bars is utilized, coated at the sides and one edge and at their ends with some vitreous substance, and electrically connected by rods which extend laterally from them and are electrically united.

539,234. Electric Fire and Water Alarm. Gustave S. Neu, New York, N. Y. Application filed January 25, 1895.

A device to be released by heat and water is composed of a spring actuated plunger, a soluble button, a fuse and electrical contacts kept normally apart by the soluble button and the fuse in combination with an automatic sprinkler, an alarm bell and an electrical battery.

539,274. Mounting for Telephones. Thomas Kelly, Philadelphia, Pa. Application filed September 8, 1894.

A telephone transmitter and receiver, with a slab or plate of slate carrying them and rigidly supported upon, but some distance away, from the wall of the room or apartment.

539,277. Electric Motor. John C. Lincoln, Rochester, N. Y. Application filed January 16, 1892.

The combination is described with the shunt field magnet connected in series across the main line, of the armature, the series coil partially surrounding the armature and directly magnetizing it, the coil and armature being connected in series with each other across the main line.

539,293. Controller for Electric Motors. Horace F. Parshall and John W. Darley, Jr., Lynn, Mass., Application filed February 11, 1893.

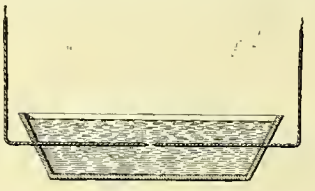
The combination, with a controller cylinder for an electric motor, of an electric motor for actuating such cylinder. means for throwing the line current through the motor or interrupting. its flow, and means for returning the cylinder to its normal position when the line current is broken.

539,298. Communicating, Signaling, etc., to or from Movable Objects. Joseph Y. Porter, Cleveland, Ohio. Application filed February 14, 1894.

The features of this invention are: A trolley wire, a current collector projecting against the same from a car, a supplemental conductor insulated from the trolley wire, pivoted hangers therefor, and an insulated sleeve or contact upon the current collector against which the supplemental conductor slides, and electro-magnetic or circuit controlling devices in circuit with the supplemental conductor and the sleeve.

539,299. Electric Track Switch. Joseph Y. Porter, Cleveland, Ohio. Application filed February 14, 1894.

A track switch, electro-magnetic means for operating it, an insulated section of trolley wire adjacent and extending some distance on each side of the switch, and circuit connections to a source of current supply, from the section of trolley wire and the magnet, whereby both may be supplied with current simultaneously.



NO. 539,302.

539,302. Electric Glass Cutting. Israel L. G. Rice, Weston, Mass. Application filed January 2, 1895.

The art of cutting glass by means of disruptive discharges of electricity is described, consisting in puncturing a series of holes through the glass in close proximity to each other and in lines. by means of disruptive discharges of electricity through the glass, the hole or holes nearest the electrodes being closed with a material having greater electrical resistance than the glass and the electrodes so insulated that the discharges will be made to pass through the glass, as shown in the cut.

539,365. Electric Arc Lamp Clutch. William B. Luce, Brookline, Mass. Application filed March 15, 1894.

A clutch ring or plate composed of an inner ring or plate, a ring or plate of insulating material and an outer plate or ring.

539,381. Apparatus for Indicating and Signaling Speed of Vehicles. John W. Darley, Jr., Baltimore, Md. Application filed March 29, 1894.

An indicator is described, consisting essentially of an electro-magnet, an armature adapted to be drawn thereto, a bent wire with guides therefor pivotally attached to the armature, a light signal card carried by the wire, and a fixed slotted screen in front of the signal card.

539,392. Arc Lamp. Charles A. Pfluger, Chicago, Ill. Application filed April 5, 1894.

The combination in an arc lamp is claimed of two electrodes having each two carbons adapted to be fed toward each other at an acute angle, means for moving the upper carbons simultaneously to establish the arc, and a device for feeding the lower carbons comprising a weight, a rod upon which the weight is adapted to slide, cords connecting this weight and the carbons passing in opposite directions over two pulleys, the whole being arranged between the lower carbons.

539,393. Electric Arc Lamp. Charles A. Pfluger, Chicago, Ill. Application filed July 2, 1894.

An arc lamp comprising a solenoid, the core of which is adapted to move about a center, a ratchet wheel adapted to move about a different center and a pawl or the like connected to the solenoid core and adapted to engage the teeth of the rachet wheel.

539,396. Railway Signal. John Stringham, Jersey City, N. J. Application filed February 6, 1895.

A signal is set at danger by the passage of a train into a guarded section. There is also a releasing circuit for setting the signal at safety, a circuit controller for the releasing circuit, and electrical connections with the track preventing actuation of the circuit controller until the rails are bridged at a plurality of points before the signal is reached by the train.

# Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, JUNE 1, 1895. No. 22.


## Chicago's Street Railway Mail Car.

Postoffice officials say that the effort now making to utilize existing lines of street car transportation in cities marks a very important advance step in the perfection of the mail service, and that this improvement will facilitate the collection and delivery of mail matter to a greater degree than any other method except the use of pneumatic tubes, which is expensive and only practicable in the very largest centers of population. The plan of running mail cars on street railways is now in daily operation in Boston, Brooklyn and other cities, and on May 25th the street railway mail car herewith illustrated, built especially for this service, made its initial trip in Chicago over the Madison street cable line.

The car is 30 feet long, four feet six inches wide and was built by the Pullman company. A photograph of it is reproduced in Fig. 1, and the plan, Fig. 2, shows the manner in which the space is divided. This car is built for a trailer for cable or electric roads, but it is very strongly constructed, with a steel frame, and could easily be transformed into a self-propelling motor car for use on electric lines. As shown in Fig. 2, the car is divided into two sections, one for passengers, and the other, entirely secluded, for the mail clerks. The latter compartment is provided with storage room, sorting tables and pouches, letter boxes, stamping pad —in fact, every requirement of a standard railway mail car, including a water cooler and wash stand. It is lighted and ventilated by windows protected by wire screens, so that pieces of mail cannot blow out, and by a skylight. The exterior of the car is painted white and handsomely lettered and decorated in gold. The interior is finished in oak, with metal fittings of polished and bronze roller curtains.

The car will be manned by three mail clerks, who will sort and distribute the mail for the carriers' pouches, thus saving much time. For instance, the force on the Madison street car here illustrated, with the first trip of the car leaving the barns, will take on mail from Station E, at Fortieth and West Madison streets, exchanging a pouch at Station D, Western avenue, and receiving one for delivery at Station C, at Center avenue, and the central office down-town. At Station C a pouch will be exchanged, one from Station E and one from Station D, and there will be received one from Station C for the central office. At Madison and Clark streets a wagon is to be in waiting to take the mail from Stations E, D, and C and give in return the mail just received at the central office for Stations C, D, and E. This car is to be attached to a regular train and will make the round trip in two hours. There is ample time between the central office and all the stations, as well as between the stations themselves, to distribute the mail in transit. An hour on each trip is saved in the distribution of mail, which means a saving of one and in some cases eight hours in the delivery of mail. Upon the expiration of the trial period of 90 days, it is expected that the system will be extended to all the trunk cable and electric lines of the city.

On the initial trip on Saturday a number of invited guests were present. No mail was carried by the car, but "dummy" pouches were thrown on and off at the different stations, according to schedule, and the trip finished on time without a hitch. In a brief address Postmaster Hesing said: "The carrier force at the three stations served by this car is 114, a number larger than at Minneapolis or Omaha or New Orleans, and a number almost as large as the entire carrier force in all the other cities in this state. As we handle at our office 2,000,000 pieces of mail matter a day, it can be readily seen that everything which tends to facilitate this business, everything that would bring about a division of labor, and everything that will hurry on the mail must be greeted, not only by the Postoffice Department, but by the citizens themselves, with satisfaction."

At the instance of Alderman Coughlin of the First ward, quite generally known as Bath House John, the council passed an ordinance prohibiting street car companies from carrying mail matter in Chicago. This was done probably with the idea of befriending the employes of the companies, who, on strike, would be deterred from interfering with the service by the presence of the government's mail cars. But the mayor did not approve of this ordinance, and the postmaster paid no attention to it.

FIG. 1. CHICAGO'S STREET RAILWAY MAIL CAR.

The Toledo, O., Traction company will entirely overhaul its system and increase the capacity of the plant from 1,800 horse power to 5,000 horse power, supplying current also for lighting and for stationary motors.

## Electric Motors in Sugar Refineries.

In the sugar houses of Groningen, according to O. Kohler, in the *Deutsche Zuckerindustrie*, the electric installation comprises two dynamos (continuous current) of Siemens & Halske pattern. One of these gives 41,600 watts and the other 23,000 watts. They are run by turbines situated about 700 meters distant. At the works there is installed a battery of 120 elements and 594 ampere hours capacity, and as a reserve there are two spare dynamos of the same capacity as the above machines to be run by steam power. The dynamos furnish current for 750 incandescent lamps, ten arc lamps, five small motors aggregating about 25 horse power, and the large motors.

The small motors have been substituted for a number of small steam engines, and for the last two years have given perfect satisfaction. Thanks to the use of carbon brushes the commutators show only a minimum wear.

The economy realized was shown by the application of an electric motor to an elevator which had formerly been actuated by a steam engine of three horse power. This engine was continuously moving whether the elevator was moved or not, while the motor is only in action when at actual work. The two systems compare thus:

1. With steam power: With no load save shafting, two belts and two pulleys there were absorbed 2.1 horse power. Elevating 600 kilogrammes of coal required 4.8 horse power.

2. With electric power: Motor, one belt and one pulley required 1.4 horse power and elevating 600 kilogrammes of coal absorbed 4.1 horse power.

As the double elevator raised in 100 hours 300 times 600 kilogrammes of coal and the duration of each trip is 55 seconds, we have for the time of work 4 hours and 18 minutes, and a period of rest of 5 hours 42 minutes.

Under the former conditions there were used:
With no load.....5.7×2.1=11.9 horse power
With load.....4.3×4.8=20.6 horse power

Daily.....32.5 horse power
Under the new regime:
4.2×4.1=17.6 horse power hours.

Another appreciable advantage of electric power is the ease with which the location of the installation of the motors can be changed. It is sometimes necessary to change

the locality of the motors, to suit the exigencies of the case, and it is an easy matter to run a couple of wires for temporary use, and the motor can be fastened to the earth, against a wall, or even suspended, if necessary, to suit the emergency. This is no inconsiderable advantage, as by the old system with many small engines steam had to be conveyed a long distance with a large loss, or otherwise several steam plants would be needed. The movement of the centrifugal machines in groups or gangs, and which is wasteful of power, is now arranged so that each of these may be operated independently, which, it is easy to see, will be an immense advantage—each may have its special motor. The following data on this point are interesting:

The idle machinery absorbs 4.25 horse power; with the pulleys of six machines this absorption mounts up to 6.5 horse power and with 12 pulleys to 7.5 horse power. Now one machine, when once in motion, requires one horse power, but to set it going, to overcome the inertia, is a very different affair. If to get it up to proper speed requires 20 to 25 seconds, it will need about 10 horse power for the first 10 or 15 seconds, when the demand will rapidly decline until the minimum is reached. If 50 to 70 seconds are required to obtain full headway, then for the first 15 seconds four horse power and for 15 to 45 seconds five horse power will be called for.

The largest of the centrifugal turbines are run by electric motors of 35 horse power. These turbines have a diameter of 800 millimeters, receiving a charge of 250 kilogrammes and make 950 revolutions per minute. The idle machinery for 18 turbines absorbs at 160 revolutions 8.7 horse power; with full load 15 horse power.

Lastly, there is a large advantage gained in the individual application of power over the group or general system, as the slipping of belts and the heavy shafting, with their great waste of power, are dispensed with entirely.

## Non-magnetic Arc Lamp.

By W. E. Irish.

This lamp, for either constant current, series, alternating or constant potential circuits from any generator, is governed by the thermal wire, lever and counteracting spring as usual, but instead of a clutch or rack it employs a screw feed with more sensitive mechanism.

The screw feed is a new, simple and valuable feature. It retards the fall of the carbon so as to prevent over feeding, and it is not affected by a dirty carbon rod. The carbon rod carries at its upper end a traveler, which engages in a deep, square-cut thread of a long screw, having a pitch of about half an inch.

The traveler simply carries the carbon rod, which is free to turn for convenience of trimming. The object of the screw is to maintain a slow, regular and continuous feed so as to obtain an absolutely steady light in place of the intermittent feed and constantly varying candle power and electromotive force incident to most of the clutch and gear lamps.

For constant current series circuits the lamps are equipped with a simple variable shunt resistance and an automatic switch, which also acts as the cut-out. This device tends to maintain the electromotive force and current of the line constant in opposition to the contrary tendency of the lamps, for as the resistance of the arc increases the resistance of the shunt will correspondingly decrease and vice versa. By employing this automatic cut-out and variable shunt there is practically no burning out of the shunt coils or opening of the circuit.

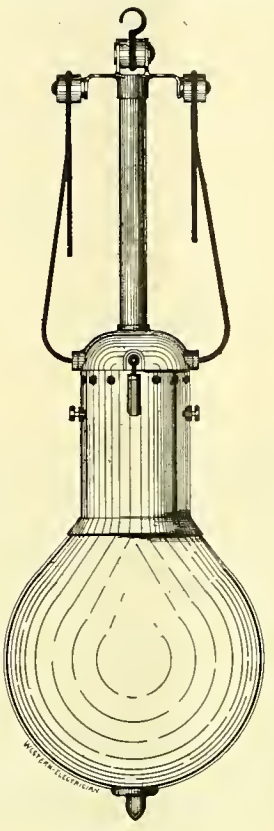
The longer the arc the greater will be the current that passes through the shunt, as the resistance of the shunt will decrease in proportion to the increased resistance of the arc.

In the event of the carbons breaking the lever of the cut-out will act, and by rapid steps vary the shunt resistance until the lever reaches the line terminal and makes a short circuit, when the lamp and shunt will be completely cut out of circuit and the line wires bridged across.

As there is no breaking of the circuit within this lamp, there is no arcing or interference to prevent the perfect working of lamp and circuit.

On starting a newly trimmed lamp employing this automatic switch the current will, when the hand switch is open, have two paths, one through the lever of cut-out and a small resistance, the other through the carbons.

The resistance of the line through the cut-out is made a trifle higher than the resistance of the lamp circuit, so that the automatic device may respond more promptly and by opening the line force the whole of the current through the lamp. Here again the current finds two paths, one through the carbons and the other through the variable resistance shunt. The chimney top is furnished with a cross-arm and insulated hanger. The cross-arm carries the wires leading to the lamp, the whole making a good substitute for a hanging board. The lamp top, chimney and cross-arm may be considered as a separate part from the lamp proper. The top carries the hand switch and the automatic variable resistance, contact plugs, terminals and wires. The wires pass through insulating and water-tight bushings to the terminals. To this upper part the lamps proper may be attached in a simple, handy and rigid manner, while the upper part is hanging, so that a defective lamp can be removed and replaced without interfering with wires, switches or circuits.



NON-MAGNETIC ARC LAMP.

To lower the globe for trimming it is only necessary to release the clamping screw in the globe holder, when the globe may be let down until its top is in line with the lower carbon holder, at which position it will be held by a flexible wire cord. When the globe is replaced the wire is coiled back into the base of the lamp by the tension of a spring.

To remove the globe entirely, all that is required is to unscrew the thumb-nut at the bottom so as to release the wire from the holder. The cover is readily lowered or removed by partly unscrewing the two thumb-screws at the sides.

A glass tube encircles the carbons to increase the length of their life and keep down the resistance of the arc by excluding cold air.

This lamp for all circuits is bug and water-proof, and being practically sealed needs no spark arrester.

## Arc Lamps in Streets.

Discussing the best position for arc lamps for street service, *The Municipality and County* says: The lamp which swings from a wire stretched across the street is too much at the mercy of the wind. A pole placed in the middle of the street is a dangerous interference with traffic on a busy thoroughfare. Discarding these two methods, we are almost restricted to that of placing the pole on the sidewalk. Assuming this to be the favored position—which is undoubtedly the case in large cities—the next question is, how shall the lamps be hung upon the poles? The short arm has been discarded because of the shadows made by the poles. Placing the lamps directly on the tops of the poles (just as gas lamps are fixed on the top of the lamp posts) is probably the most general custom to-day. About the only objection to this plan, which we shall style No. 1, is that it brings the lamp too close to the buildings, and does not permit the utilization of all the light which the lamp is capable of giving. The rays of light which strike the building are cut off from lighting a large area which would be lighted if the building were not there. To overcome this objection some cities are adopting the plan of hanging the lamps at the end of 12 foot arms which extend from the top of 35-foot poles on the sidewalk. This plan, which we call No. 2, gives rigidity to the lamp; the distance of the light from the pole greatly lessens the shadow of the latter, and the extending of the lamp 12 feet into the street carries it so much farther away from the building and permits all its rays to strike the pavement. These points are so thoroughly illustrated by the cut on page 263 that no further elaboration is necessary.

## An Automatic Bicycle.

Millet's bicycle shown on the opposite page has several unique features. Fig. 1 shows the entire machine, while Figs. 2 and 3 illustrate details. Referring to Fig. 1, *A* is an induction coil, *B B* are cans for coal oil and for lubricating oil, *C* is the lever controlling the "parachute," *g g'* a species of safety balance or support, *D* is a gasoline reservoir, *E* the battery box, *O* the arms of a saddle which, thrown under the rear wheel, form a rest, allowing the machine to "stand alone."

The machine complete weighs 70 kilogrammes, and is in reality a petroleum engine, ignition being obtained through the electric spark. The wheels are .85 of a meter in diameter. Five cylinders, with as many connected pistons, actuate the machine, as shown in Fig. 2.

The energy is produced in this system by the explosion of a mixture of gasoline and atmospheric air, as in many other systems, but differs from them in this, that, while ordinarily the cylinder is stationary and the piston moves the crank, in this arrangement the axis is fixed and the reaction on the piston moves the cylinder, which consequently becomes the driver. Fig. 2 shows the back wheel with its five cylinders. The axle cover being removed shows the extremities of the piston rods in various positions.

Fig. 3 gives the details of one of the explosion chambers *M*, with its piston *P* and rod *B*. A tube *M'* forms a communication through *m* and *R*, which, at the proper moment, opens the valve *s* and admits the gas, filling the chamber, when a spark across the two terminals of the coil, inclosed in *O*, completes the work by exploding the gas.

The electric current is produced by a Bunsen battery, shown in Fig. 1 at *E*, resting upon two centers, which permits of a swinging movement of the battery box, so as to immerse or withdraw the elements from the acid. The spark coil *A* is composed of a bobbin inclosed in hard rub-

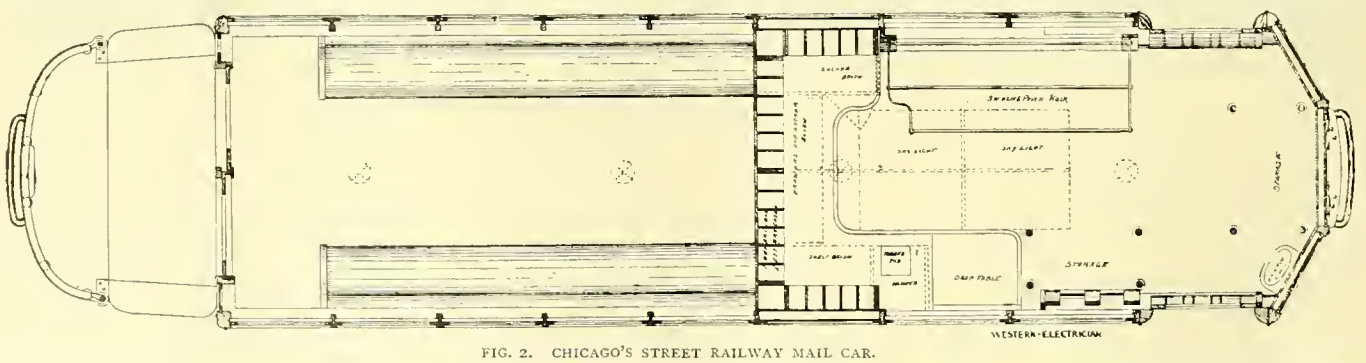



FIG. 2. CHICAGO'S STREET RAILWAY MAIL CAR.

ber, with a condenser above and an ioterrnpter below the coil.

The gasoline reservoir, *D*, is also a very thick wheel guard or protector, and has three fasteniogs upon which to fix packages. The two reservoirs, *E* and *E'*, discharge, the one into the cylinders, while the other leaks drop by drop into the tube leading the explosive mixture into the center of the motor wheel. The oil is thus driven into all the moving parts of the machine. The air required for the explosive melange is taken in below, heated, filtered to free it from dust, and mixed with the gas entering the explosive chamber.

The bicycle, standing in the rests, is readily mounted by the rider. Installed in his position, he presses upon the pedals, restores the "parachnte" to its normal position and starts on his journey; presses a sector with his right foot, which throws in the motor combination by furnishing a spark from the battery. In front of him a pointer is turned either right or left to accelerate or retard his motion, by using more or less gas for each charge.

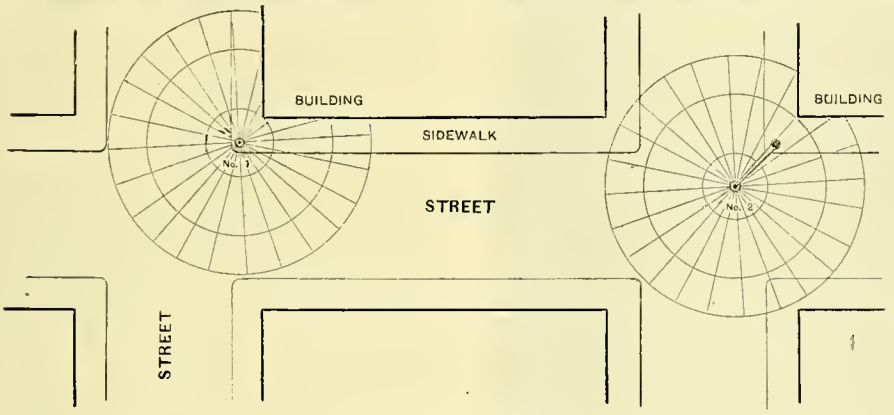
With 180 turns per minute a power of 50 kilogrammeters is developed per second, or two-thirds of a horse power. A speed of one kilometer in 65 seconds has been accomplisbed (or more than 55 kilometers per hour) with 325 revolutions per mioute, the motor giving 86 kilogrammeters per second. The consumptioo of fuel is about one liter of gasoline for 40 kilometers, one filling being sufficient for a 12 hours' trip.

All in all, Millet's bicycle, the illustrations for which are from *La Nature*, is the most ingenious and interesting of all the two-wheeled vehicles so far shown.

## Some Practical Hints in Dynamo Design.[1]

By Gilbert Wilkes.

When the matter of this lecture first came up for consideration, I thought I would discuss generally the results in relation to designing drawn from my shop experience. I had not, however, gone far when I realized that this subject would cover a number of lectures, so it was limited to refer to continuous current machines for general purposes. Not only are alternating current machines designed on very different lines from continuous current dynamos, but that large and varied class of machines used for traction purposes and represented principally by the street car motor is, I believe, an equally distinct class. The design of street car motors brings in so many points that place in the background the rules for ordinary designing, that the one is little guide to the other.




ARC LAMPS IN STREETS.

Street car motor design is, or should be, more the result of reasoning, based on actual personal experience on a car and under it in the pit, than that of hours and days at a desk. The rules for shafts and bearings for stationary machines are of little use here, and some of the most successful street car motors are machines of poor electrical design. One I recall has a magnetic leakage of 35 per cent. The real power for continuous work is never equal to the rating of a street car motor, and the method of control has much to do with the average possible work obtainable without overheating. I have therefore limited my subject to stationary machines—generators and motors for standard work, with special reference to medium sized machines—neither very large nor very small.

The first thing to be considered is, and this really comes before the actual work of designing. What is absolutely necessary in any good dynamo? In order to compete with other machines on the market, a few points are absolutely essential. These points are to influence the design, but no trimming can be allowed upon them, and to them all considerations of economy, weight, size and appearance must bend.

The first of these preliminary requisites is mechanical stability, and whether the type is to be the horse shoe or inverted horse shoe, bi-polar, or multipolar, iron-clad or Manchester, whether the armature is to be smooth or slotted, the same remarks will apply. Let not economy or a bearing of trimmer appearance dictate the use of a small shaft. This is a point in which electrical engineers are systematically criticized by their mechanical brethren. Dynamo shafts are too often on the wrong side of safety. This error is probably an heirloom to us from the time when the generation of electricity itself was so puzzling a conundrum that all other questions were relegated to the background.

I remember one of the first dynamos that I saw—about eleven or twelve years ago. The dynamo room (which was on board ship, where every square foot is valuable) was large and contained a remarkable tangle of belting and jack shafts, which would be considered ridiculous to-day. The dynamo ran, however, and the lamps gave light, thus answering the most rigorous requirements of the time, until one evening the pulley was wrenched completely off with the end of the shaft. I once heard a complaint from the business side of a company against the large sized shaft of a large new dynamo. The answer was, "Did you ever hear anyone complain in buying an engine that the shaft was too heavy?" The machine was a success and the only comments afterward made about the shaft (which was 5½ inches for 150 kilowatts) were to the effect that it was according to common sense.

Let the shaft run in good solid bearings, supported on a solid base. Whether the machine is mounted on skids or the more expensive sub-base, give it a broad foothold. Do not let the weights overhang the extreme points of support like the balls on a balancing pole. The side pull of the belt with a high center line of shaft will tend to tip the machine, and the changes in the pull due even to the undulations of the belt will cause a tremor in the machine. You may feel it with the hand and think it a matter of no importance. But each tremor jars the brushes and in weeks the effects may be visible on the commutator, while in months the foundation may be shaken to pieces. Let your work be such that when it is completed and accepted you have heard the last of it. The dynamo is here to stay. It is to-day as reliable as a high grade engine, and not one-tenth of one per cent. as dangerous.

One does not have to look back many years to the time when each new plant was rather expected to turn in reports of burned-out armatures or fields; when a new street railway plant might burn out armatures actually by the dozen. But now if an armature is lost in a generator, it is the cause of close inquiry. Not quite so good a record, however, can be shown by most companies in the matter of the armatures of street car motors. A record of ten per cent. of the armatures burned out on a new street railway line in the first three months is not bad.

After the mechanical features comes absence of spark at the brushes. A dynamo tender has no patience with a machine that sparks, and his disgust is soon transmitted to his employers, so that the machine is in disfavor. It is worse than giving a dog a bad name. A large part of the electrical personnel is still migratory, and a machine's reputation travels fast.

It is not too much now to expect absolutely no sparking at the brushes under practically constant load and none under a change either way of 50 per cent. of full load. In fact the best machines will stand sudden changes from no load to full load, and vice versa, without sparking. If you have ever watched a 20 inch belt when opening and closing the snap switch which controls the full load of a 150 kilowatt generator, you will realize the enormous mechanical and electrical strains a good machine must be made to stand, for exigencies really as severe as this not infrequently occur in the operation of railway plants. However, my remarks are not intended so much in relation to these larger machines as to the smaller sizes. There are few firms manufacturing dynamos of 150 kilowatts or greater capacity, and therefore the competition is not so severe, and greater freedom is allowed the designer of the large units.

In a visit to the first Edison central station in Pearl street, New York, one could not look at the hot scored commutators, and see the evidence of excessive wearing, without being almost forced to the conclusion that the generation of electricity and the destruction of copper went hand in hand. But this was in the days of Edison's Jumbos—strange to say these first large generators were direct driven—while everyone now knows, in contrast, the beautiful Edison dynamos of later times. In fact, until the last few years, the history of the constant pressure dynamo in this country is largely a record of Edison's great work. Now even his name does not appear on any dynamos that are on the market.

The commutator of a modern stationary machine will last for years, and often will run, with a proper arrangement for collecting the current, for more than a year without even being turned down.

The brushes and brush-holders must be simple and should be preferably automatic in taking up wear. Opinion is divided as to the proper material for brushes, and the largest makers seem to prefer copper in some form for large current machines. Carbon is, however, much easier on the commutator. Brushes of carbon and their brush-holders can be designed which will take off the current just as well as those of copper, and cost no more. The commutator, however, brings in an additional cost where carbon brushes are used.

Considerable prominence was given last year to a device for preventing the shifting of the neutral point by a special arrangement of the series field. The particular form of machine which I have seen illustrated was of what is commonly known as the continental type. I did not see the particular machine, but, from considerable experience with this type, I believe that the dynamo would, if properly designed, work equally sparkless when built as an ordinary machine. I have designed a full line of these machines from five to 45 kilowatts. The brushes of any member of the series may be rocked fully 30 degrees on each side of the horizontal plane without any sign of sparking, and the lead never changes with the load.

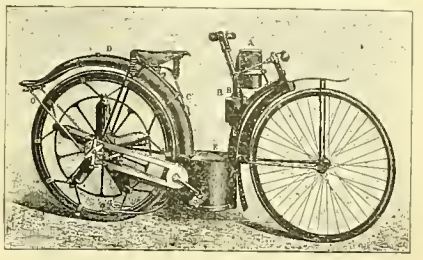
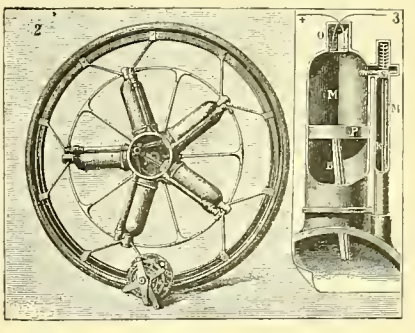


FIG. 1. AN AUTOMATIC BICYCLE.

All makers agree in setting about the same limits for heating. The armature is usually not allowed to go above the temperature of boiling water. Occasionally, in order to get more money for a given amount of iron and copper combined in a determined form, a company will increase the ratings of its machines; but loss of reputation and a few burned-out armatures usually have the effect of cooling their ardor and later—the machines. Owing to the effect of the large mass of the field, the temperature of the ontside of the coils is never that of the hottest part of the wire, as can readily be seen by bridge measurements. It is, therefore, good practice to run the fields about 15 degrees centigrade, as shown by the thermometer, cooler than the armatures. Many formulas are given for determining the armatures and the fields for a given heating and output, and these often do not agree. But I fancy that much of the disagreement lies in the different forms of fields, different ends to the armatures and different methods of heading up. Most of the formulas for field heating take no accounl of the fact that there may be more cooling by conduction through the iron of the magnet cores than from true radiation. The only safe rule is to learn the constants for a particular type of machine by experiment and make your own empirical standards. Even the heating in different sizes of the same type will vary somewhat from the usual coefficients.

The last point to be considered before commencing upon the specific design of a machine is the bearings. The leading manufacturers use a ratio of length to diameter of bearing, varying from 3 to 4½, the usual ratio being about the mean of these figures. The English seem to use shorter bearings than we, and, judging from recent articles in English publications, the self-oiling and self-aligning box is rather new with them. In this country a dynamo can not go on the market as a high grade machine without this very desirable feature.

Having thus outlined the considerations which hold good with any high grade dynamo, we can consider the questions which must receive attention in the designing proper. The most important of these is economy of manufacture. Thirteen years ago it did not matter if the field cores of an Edison "Z" machine were not only twice as long as necessary, but, in fact, were the cause of a waste of material and efficiency, making the machine both cost too much and require too much power for a given output. At that time few people knew any better, and dynamo building in this country was carried on by only two or three small concerns. The importance of economy had not as yet been felt; machine work was lavished without question. Anything was done to make the dynamo work; then it was sold for a large enough price to cover all shortcomings in economy of manufacture. I had to do with an evidence of this lavishness in expense, when an officer in the navy. An Edison "L" machine, a 250 lighter, was installed on board ship in 1882. It towered above me and naturally had not its sea legs on. In order to keep it upright a heavy bronze brace weighing from two to three hundred pounds, was bolted to the keeper and to the ship's deck. There was evidently a determination to prevent any loose magnetism getting away by this route. Yet this needless waste in using bronze never excited remark. Matters are now in a very

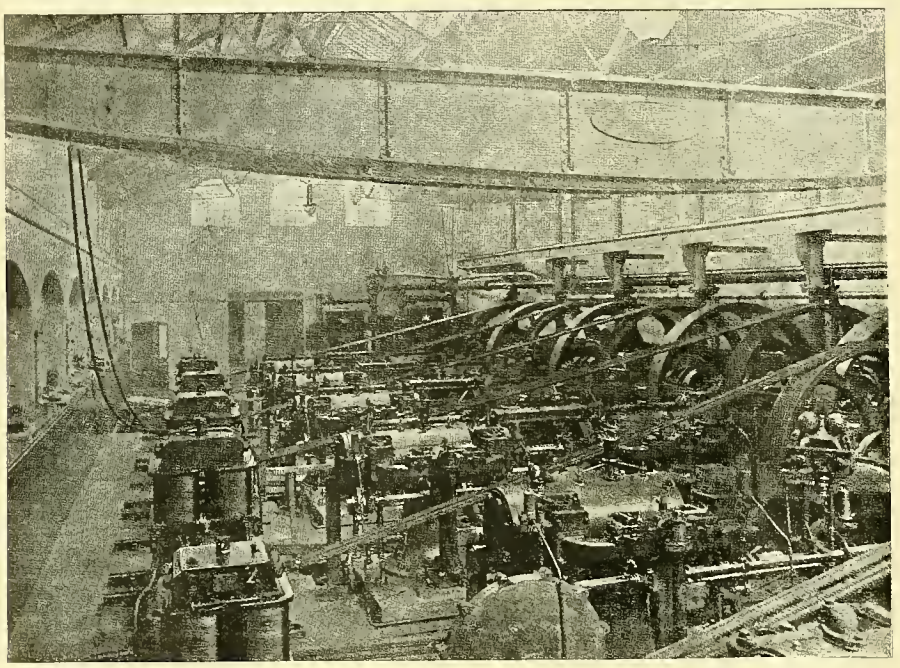


FIGS. 2 AND 3. AN AUTOMATIC BICYCLE.

1. From the Bulletin of the University of Wisconsin, for May, 1894.

different condition. Every state—almost every town of over 100,000 inhabitants—has one or more smaller or larger manufacturers of electric machinery, up to the size of 75 horse power. The business in these smaller machines is enormous, but the margins of profits are very close. There are probably a dozen different makers whose machines fill the preliminary requirements of a good dynamo. Several of these, with enough others to make about ten, are apt to meet in competition on every contract of considerable size. Large sums of money are invested in the different companies and, with very perfect systems of commercial inquiry, the principal companies are alive to the opportunities of every contract. Every dollar on the selling price counts. Remember that magnet wire costing originally about eighteen cents per pound costs double this before it leaves the shop on a completed machine. I will explain this large increase. Different shops have different methods of costing. In some, the cost of the actual amount of raw material required for the finished article is added to the sum obtained by placing a fixed charge per hour for each class of work and keeping account of the number of hours each operation requires. In other shops, to the cost of the raw material is added the actual cost of the labor of the men. To this is also added a proper proportion of the shop salaries and general shop expenses. In either case the result is usually known as the shop cost and amounts to about the increase already mentioned.

The design of the dynamo must be so perfect in economy that when all these additions—running expenses of the shop, shop salaries, percentage for interest and depreciation of plant, percentage for offices, agents, and commissions, and finally the percentage for profit—have been made to the actual bare cost of the labor and material, the price must not exceed that of other reliable makers. Think of this and you



GAS ENGINE ELECTRIC LIGHTING STATION AT BELFAST.—ENGINES AND DYNAMOS.

will appreciate how dimes in the original material mount up into dollars in the selling price, and how an hour's labor at even fifteen cents makes a large difference in the product.

There are several details of design and manufacture on which an hour might be spent exclusively, but I shall touch only briefly on the following: Building up the armature core; armature winding; commutator construction; prevention of sparking; the relation of size of armature to output; and the relation of field loss to radiating surface. Each of these subjects is worthy of a separate lecture, and in these days, when a new armature insulator is advertised every month, one ought to be posted on the requisites of a good insulator for this purpose, to keep from being led astray by plausible agents.

*Armature Core.*—There are a great many different mechanical methods of building up the cores of armatures, varying not only for the drum, Gramme, and Pacinotti types, but also varying in each type. All are, however, built up of thin disks of sheet iron or mild steel, forced together between two substantial heads by means of hydraulic pressure or powerful screw presses, and held tight by through-bolts, nuts and thread on the shaft, or shrunk collars on the shaft. I have used the last method with success in the case of drum armatures, but great care is necessary to obtain the best Norway iron for the collars to prevent their bursting when contracting on the shaft. There are three methods of preparing the plates for the laminations—first, by pasting paper on one side of each sheet and then punching out the armature plates; second, by punching the plates from the sheets and separating them with loose sheets of tissue paper in building up the armature; third, by using no separator at all and relying on the oxide formed in rolling to separate the plates sufficiently from metallic contact. This separation does not need to be of high resistance.

I regret that I cannot now state the difference in heating due to the different methods of construction, but I am now having armatures built up to determine this point. It is usual to turn armature cores and balance them before preparing them for the wire. The turning of course tends to bridge over the insulation between the disks, but it is necessary to make a good mechanical job.

The iron usually used is not less than 14 mils thick; the paper should be not more than one mil. Concerning the thickness of iron, many of the smaller concerns use taggers iron, which is not made in this country but comes from England. It is only seven mils thick and costs, pound for pound, twice as much as good domestic-iron 14 mils thick. The latter therefore commends itself if it is adapted to the purpose. To determine this point I made very thorough tests on 15 kilowatt armature cores built of each, with the result that the heating was with the thin discs 29° C., and with the thick 38.5° C., when run for three hours at their proper speed and field, the induction of which was 5,300 lines of force per square centimeter.[1] This decided me in favor of the thick iron. There is one unknown factor in armature heating—eddy currents in the core—and this must be determined for each type of machine and kind of iron. A loss equal to that for the hysteresis is a usual figure.

In designing dynamos you will find that you cannot always control all of the quantities as you wish. Thus in the continental type, unless you wish to use very high speeds and have very little torque in the machines as motors, you must use large armatures, and this means low induction, as the fields are of cast iron.

*Armature Winding.*—Armature winding is like the "fifteen" puzzle. When accustomed to the general plans, you can carry them in your head and will become fascinated with the new ideas that form themselves in intricate curves and cross connections. But fortunately or unfortunately for the inventor, there seems to be little new under the sun in this line, and one is very apt to find his pet scheme only a variation of one of the many diagrams in that little book entitled "Ankerwicklungen der Gleichstrom Dynamomaschinen," by E. Arnold. It is useless to touch on this very broad subject. I will simply say that the old Siemens-Hefner-Alteneck winding has had its day and is succeeded by a number of symmetrical windings. The Gramme ring is disappearing for four-pole machines and being succeeded by the Pacinotti drum, wound preferably with symmetrical, replaceable coils. This substitution, weight for weight and dollar for dollar, increases the output of a machine 15 to 20 per cent. or more, depending upon the size and design.

*Commutator Construction.*—The commutator is the most vital part of the machine and too much attention cannot be paid to it. There are dozens of different shaped bars and modifications of the general way of holding them in place. Great variety of opinion exists as to the amount of insulation to be used between the bars. I have found the thickness of insulation between the bars the sole cause of destructive sparking in a line of machines which otherwise worked well and were cured of this by thinning the mica. What sense is there in putting as much mica between the bars, where there is small difference of potential, as there is between the bars and hub, where there may be at least half the voltage of the machine? I have found in my experience that thinner mica between the bars than is usually used gives better results. The proper amount varies with the number of segments and kind of brushes. The best practice is now unanimous in requiring mica between the bars and at the ends of the bars. This does not refer to the special direct-connected generators, whose conductors also serve as commutator segments. The size of bars and diameter of commutator vary greatly with the kind of brush. On account of economy of operation, automatic adjustment, and small amount of attention required, I prefer the carbon brush for all purposes, except, of course, for special machines either of very high voltage or very great current (as for electrical deposition). I have spent much work and study on the subject of brushes, for carbon brushes have some serious faults, though they are ideal in the matter of wear of commutator, small cost, and the small attention they require. The high specific resistance of the material causes heating in the brushes, and, by conduction, in the commutator. To overcome this, I have tried several plans, such as plugging the carbon with bunches of fine wires; depositing a heavy coat of copper around parts of a brush and then soldering these segments together; building up a brush of two thin plates of carbon with a sheet of copper gauze between and soldering a connection to this gauze. The last promised well, but in the course of a few months the commutators showed cutting, and the plan was abandoned for a simple carbon brush with a flexible lead soldered to the back. Carbon brushes were also tried incased in brass sheaths, but these arced to the brush-holders and stuck. Other plans which I have tried are incasing copper gauze in babbitt, and also making the whole brush of a block of babbitt fed radially. One small machine fitted in this way has been running two years without showing wear either on the brushes or the commutator, but I have not seen the plan succeed with larger machines. The following data give an idea of the comparative size of commutators using copper and carbon brushes. The Edison 45 kilowatt bi-polar machine has 52 segments, a brush bearing surface $5\frac{13}{32}$" long and $6\frac{3}{16}$" diameter; the same sized machine of the continental type designed by me, using carbon brushes, has 54 segments, with a bearing surface $8\frac{1}{2}$" long and $9\frac{1}{2}$" in diameter, or there is nearly twice as much copper in the one using carbon brushes. This is, however, an extreme case, as this is the largest sized machine that I should recommend building of this type. The brushes are thick and are apt not to bear over their entire surface, and yet it is difficult to subdivide them. Of course, going into the multipolar type, the brushes for low voltages and heavy current can be made thinner and more numerous. I shall compare these two 45 kilowatt machines again later.

*Prevention of Sparking.*—The prevention of sparking is such a large subject that it is a pity to touch upon it at all, as it can only be imperfectly discussed. There have recently appeared on the subject a number of papers in the English electrical journals which are worth reading.

Sparking may come from careless attendance, overload, error in design (such as thickness of commutator insulation which is not based on calculation), insufficient number of commutator segments, insufficient carrying capacity of segments, brushes covering too many or too few bars, and instability of the neutral point. I leave out of the above machines of positively bad electrical design that have no neutral point. It used to be considered as necessary for steady, sparkless running under wide variations of load, that the field magnets should be saturated and operated well above the knee of the curve of the iron of which they are built. In this I do not agree, and where light weight is no object, I prefer to run lower on the curve—at about the knee—as the magnetism at this point is more unstable, and I think the iron can reply more quickly to changes of magnetization, and therefore keep the voltage of the machine more constant under rapid variations.

Granting that the machine is not badly designed, the three principal conditions for obtaining a steady neutral point and therefore the sparkless condition, are: the proper number of commutator segments, a proper ratio between the ampere turns on the fields and of the distorting coils on the armature, and a proper ratio between the total magnetizing force required and that used in overcoming the reluctance of the gap. The first two conditions are inter-dependent. The first is more the result of reasoning from experience with dynamos—not only in the shop and testing room but in practice with machines of different designs—than from calculation. The other two are dependent upon the type, and one must make his own empirical formulas from the data of the first tests.

It is the third condition—the proper ratio between the magnetizing force required to overcome the gap and the total magnetizing force—that shows us why it is so much easier to build a sparkless small dynamo than a large one; for 80 or 90 per cent. of the total magnetizing force is necessary to overcome the high gap resistance. The area of cross-section of the gap is not only small, but, owing to there being several layers of wire on the armature, the length is relatively greater. This also points out one reason why small machines are relatively much more expensive, because relatively so much more copper is necessary on the fields. Thus a one horse power machine costs about one-twentieth of a 50 horse power, and a three horse power about one-seventh of a 50 horse power machine.

Going back to the 45 kilowatt continental machine of which I have already spoken. It is at the head of a list of machines of that type. We would, therefore, expect its field coils to weigh proportionately less than any others of the series, and, if so, that it should be nearer the sparking limit; also that the complete machine should weigh proportionately less than the other members of the series and cost proportionately less. All of these points are true. The weight of wire on the field is only equal to that on the similar 20 kilowatt machine. Its speed is 800 revolutions at 110 volts as a motor, and when run at about 35 per cent. above this by weakening the field, the machine is unbalanced, and there appears that peculiarly disagreeable snapping at the brushes. Yet the machine runs at its proper speed with absolutely no lead and no sparking at the brushes. The machine does weigh and cost proportionately less than the other members of the series. Its frame is made entirely of one iron casting, and yet the weight of wire on the armature is practically the same as that on the armature of the 45 kilowatt Edison machine above referred to; the weight of the wire on the fields is less, and the total weights are: Edison 6,800 pounds; continental, 7,625 pounds. This is a very remarkable result, when it is remembered that the Edison machine is of wrought iron, and that a considerable expense is necessary in building it to machine and fit the parts of the field circuit. The two machines run at the same speed. Wrought iron does not necessarily make the lightest machine, nor cast-iron the cheapest. The design must be adapted to the material to be used.

*The relation of size of armature to output, and the relation of field loss to radiating surface.*—Concerning the relation of size of armatures to output, different rules are given by different people, and, in fact, not only will the watts per square inch allowable differ for Gramme rings, Pacinotti and drum armatures, but different armatures of the same type but different size will give varying results. A larger ratio of watts per square inch can be allowed for armatures

1. *Elektrotechnische Zeitschrift*, vol. 14, page 737.

having a single layer, than for those having several layers of wire. This also holds true for field coils. The wide variation that exists may be illustrated by the fact that Kapp states that in field coils the watts per square inch of radiating surface may be taken between one and four. This would be rather an unsatisfactory basis on which to begin designing. I have found Esson's figures good for a first approximation.

As regards the present field for continuous current designing, the popular gaze is for the present in the direction of polyphase power transmission apparatus; so that the time is peculiarly suited for quiet study and advance in continuous current work. It is not necessary that the idea should be entirely novel. Many of the best plans have failed, owing to not being worked out properly. See the toothed armature. Four years ago it was regarded as a thing of the past and was simply remembered as Pacinotti's pioneer attempt. To-day it has returned in an improved form and displaced everything else for large machines and small slow-speed machines.

Something must be done to cheapen the manufacture of small machines—say from five horse power down—and my remarks may contain a hint as to one way of accomplishing this. Remember that the gap reluctance in small machines is much greater than is necessary from reasons of good running. Is it not possible to use iron wire for these small machines both on the armatures and fields? I feel sure it is. The fine wire used on these machines is very expensive, costing more than twice as much per pound as for the larger sizes. I have already built fan motors, even for 500 volts, using iron wire exclusively, and the machines were not larger than the usual run of fan motors of equal capacity. I hope soon to try iron wire on small machines of somewhat greater capacity.

One last remark in relation to experimental machines. Let them be roughly made, for they will be very expensive anyhow. An experimental machine should never be begun until the improvement sought for is well fixed in the mind and all the calculations are made showing just what the machine ought to do, and every detail drawn out to scale. Drawings are slow, tedious, and expensive; but you can change them and cannot materially alter the final product when it appears in copper, brass and iron.

## Gas Engine Electric Lighting Station at Belfast.

The *Electrical Review* of London, from which the accompanying illustrations are taken, says that the central station for electric lighting in Belfast, Ireland, possesses probably the largest installation of gas engines in the world. The plant has a capacity of 10,000 eight candle power lamps and is laid out for the direct current three-wire system at a potential of 200 volts, with accumulator storage. The *Review* gives this description:

Viewed from the exterior, the building presents an unusual appearance when compared with the works using steam plant. The tall chimney does not exist, and the building is different in shape, being long and rather narrow, due no doubt to the absence of boilers. The interior is distinctly impressive, the gas engines being a good deal larger than one would be led to expect from the illustrations.

Before making any comments on the system, it would be as well to give a short account of the plant. Taking first the gas engines, which, by the way, are made by Dick, Kerr & Co., Kilmarnock, there are four tandem cylinder double acting gas engines, and two single cylinder double acting gas engines. The former are required to drive four 60 kilowatt dynamos, and the latter two 26.5 kilowatt dynamos.

The following details have been supplied by the makers: The engines were made under Hartley & Kerr's patents, and are in some respects similar to the ordinary double acting engines which have been on the market for the last eight or nine years. The chief interest lies in the tandem engines, which have been specially designed and built for this station; the two cylinders are in line, and the pistons are secured to the same piston rod, which works through a crosshead and connecting rod on to a single crank in the manner common to steam engines. The makers claim that this arrangement is simpler and more economical than the coupling side by side of two ordinary gas engines; the working parts are fewer and more easily got at, while the floor space required is only the width of an ordinary engine. The length of the tandem engine is no detriment, as the dynamo is placed near to the back cylinder, and driven by ropes running along the back of the engine.

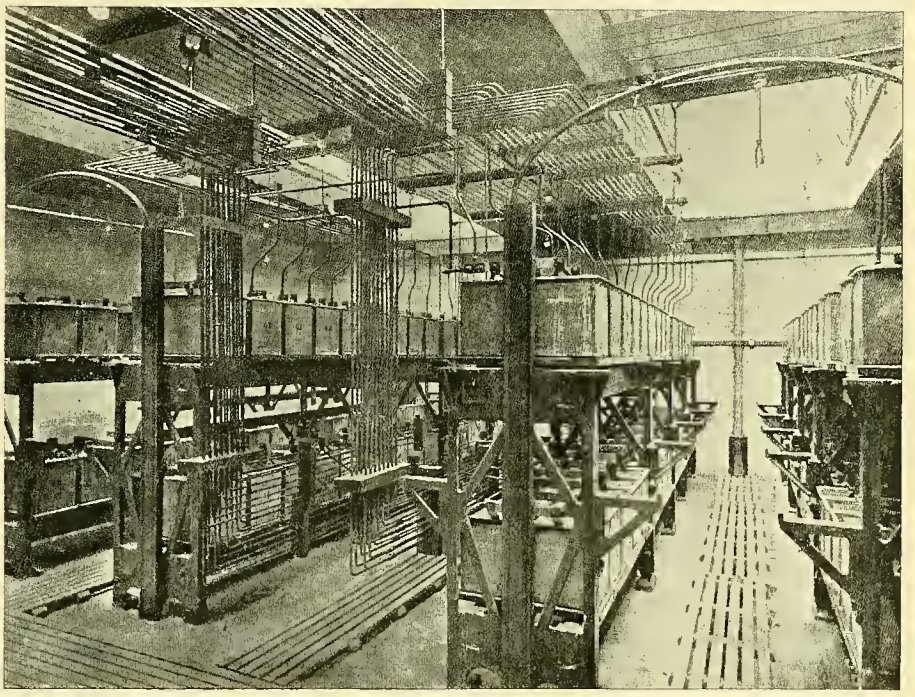
The turning of these engines is very regular, owing to the fact of there being one impulse for every half revolution of the crank when running at full power, or four times as many as could be obtained from a single cylinder single acting Otto gas engine, so that these engines running at 160 revolutions per minute receive 320 impulses per minute, the same as in a double acting steam engine. It is just as desirable that the engines should run steadily at light loads as well as at full load, therefore the makers have designed a special governor, by means of which the power of the impulses is diminished to a fixed point (similar in effect to the automatic expansion gear on a steam engine), after which, cutting out of the charges takes place, first at one end of one cylinder, then the other, and so on until all four working ends are running idle.

The consumption of gas is stated to be very low. Messrs. Dick, Kerr & Co. inform us that at an official trial of a tandem engine at the makers' works, extending over six hours, at full load, it was found that the gas used per electrical horse power did not quite reach 24 cubic feet, and the mechanical efficiency of engine and dyamno combined, 76 per cent. The output was 84 electrical horse power, being about 10 per cent. above the contract load of 77 electrical horse power (240 amperes at 240 volts). During the trial a main fuse "blew;" but so well was the engine governed, that, with the whole load suddenly thrown off, there was only a slight increase of speed and no sign whatever of racing. The engines run inward, so that the slack of the driving ropes is on the top side. The method of starting these engines is interesting, and we shall refer to it shortly. The gas is practically delivered from the street mains straight into the cylinders of the engines, though on its way it passes through the meters. The main gas pipe is arranged on similar lines to steam pipes, it being connected to the engines by means of T-pipes. The water for the piston chambers of the gas engines is obtained from a tank, the circulation of the water being maintained by a small centrifugal pump under each engine. The gas for the ignition tubes is taken through a special pipe, and is measured by a special meter. Before speaking of the starting method, however, it will be more convenient just to refer to the electrical generating machines, which have been supplied by Messrs. Siemens Bros., Limited.

The construction of the smaller dynamos embraces two or three novel and interesting points. In the four large dynamos, however, there is nothing special or peculiar; they are of Siemens two-pole drum armature type, the armature is wound with bars, the field-magnets being in shunt. The output of each machine is 57½ kilowatts at 600 revolutions per minute. These dynamos have three bearings, and are driven by eight ropes ⅞ inch in diameter. The normal current is 240 amperes at any electromotive force from 225 volts to 240 volts; but, exceptionally, an output of 210 amperes at 250 volts can be obtained.

The smaller machines, two in number, are specially adapted to fulfill three purposes, viz., to charge the accumulators, to act as balancing machines on either side of the three-wire system, or as motors to start the gas engines.

They are also shunt-wound two-pole machines, with bar armatures, but the armature of each dynamo is provided with a double winding and with two commutators. The brushes of each commutator are connected to four terminal blocks



GAS ENGINE ELECTRIC LIGHTING STATION AT BELFAST.—ACCUMULATOR ROOM.

for each dynamo, so that the two windings can be put either in series or in parallel, while, as in the case of the four large dynamos, the strength of the field can be varied by putting extra resistance in or out of circuit. The speed is always 750 revolutions per minute, and the load is 26½ kilowatts. This output admits of the following variations:

A. Two windings in series—
   Normal output ..... 110 amperes at 240 volts.
   Exceptional " ..... 80 " 270 "
B. Two windings in parallel—
   Normal output ..... 200 amperes at 110 to 120 volts.

It is to be remembered that, in accordance with the specification, all the regulation of electromotive force is effected by variation of the strength of field, the gas engines running always at the same speed.

The gas engines, as we have already stated, are started electrically; that is, a current from the batteries is sent into the field magnets of the dynamos and they become, in effect, motors running the reverse way. The automatic switch, which has been devised by Prof. Kennedy, cuts the machines out at the necessary moment. We had the pleasure of witnessing the starting up of one of the small engines, and though three or four of the drivers helped to give the initial start, the help was comparatively small, and the method of starting must be considered successful. It is, however, not an easy matter to start the engines, and the power they require is considerable, it being, in the case of the small engines, as much as 35 horse power.

The secondary batteries are divided into two sets, each containing sixty-three cells of the 34 K. E. P. S. type.

The switchboard is divided into panels, one side of the switchboard being negative and the other side positive.

The most novel features of the switchboard is the battery regulating device, which places the middle batteries in parallel, as opposed to the old arrangement of putting in more or less cells, the battery being regulated from the center panel of the switchboard. The second feature is the automatic cut-out, which cuts out the dynamos from the battery circuit when they have been run as motors to start the gas engine. Without drawings, however, it is difficult to make this quite clear, and though Prof. Kennedy has been good enough to lend us diagrammatic drawings of the switchboard, the great pressure on our space compels us to leave them over. The switchboard has been made by J. H. Holmes & Co.

In the distributing system, a good deal of care and skill has been necessary to overcome the obstacles imposed by the peculiar conditions of the soil. For the most part a bare copper system has been adopted, though under the roadways Callender's cable is used as well as in some of the narrow streets. A concrete trench is employed, in which the bare copper mains are laid. Owing to the extremely wet nature of the soil, a most careful system of inspection has been organized; the box covers are provided with inspection plugs, which, when taken out, allow the men, who are sent round every morning, to pass in a pole, and thereby ascertain the height of the water.

As objections to the use of gas engines in central stations, the *Electrical Review* instances the cost of manufactured gas and the noisiness of the plant.

## Changes in the Brush Company.

A press dispatch of May 22d, from Cleveland, says: At the annual meeting of the Brush Electric company to-day Robert Treat Paine of Boston was elected president to succeed W. H. Lawrence. Mr. Paine is the representative of the General Electric company, which purchased nearly all the stock of the Brush company several years ago. J. P. Ord of Schenectady, N. Y., was elected vice-president in place of C. A. Coffin of Boston. C. G. Smedberg was chosen treasurer in place of B. F. Miles. Mr. Smedberg was for years the assistant treasurer of the General Electric company. Secretary A. H. Hough, General Manager S. M. Hamill and Superintendent Charles N. Black were re-elected. It is believed the new deal is a step toward a closer consolidation of the various interests of the General Electric.

## Infringement Case at Concord, N. H.

Papers have been served by United States Marshall Campbell on the officials of the Concord Land & Water Power company in a suit brought by the Westingbouse Electric & Manufacturing company. The action is in the nature of a bill in equity, in which the plaintiff seeks to recover damages for the alleged infringement of the patents on the inventions of Nikola Tesla, owned by the Westinghouse company, and an injunction is asked to restrain the defendant corporation from their further use. The claim is that the General Electric company, from which the Concord Land & Water Power company purchased the plant, has no right to use the triphase system. The real controversy will therefore be between the Westinghouse and the General Electric companies, and the defendant in this suit will not be directly affected by the result.

A short time ago suit was instituted against Bartlett & Cushman for a like infringement in manufacturing triphase motors, the invention of the latter.

Under the rules of procedure in the federal courts the bill is returnable on the first Monday in June, and thereafter the defendant has 30 days in which to make answer. It is not expected that the case will come to trial for several months.

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IN a table of telegraphic statistics not entirely complete the English *Electrical Review* kindly makes clear, in parentheses, that "The statistics marked —— are not given." This is enlightening British obtuseness with a vengeance. We believe, however, that our contemporary, in its grandmotherly anxiety, rather underrates the intelligence of its readers, even if they are English.

AN interesting comment on the present telephone controversy is found in the local paper of a small town in which a new telephone system is being introduced. Attention is directed to the fact that the work of construction is being done by "home labor" and that "the labor on construction is being paid every Saturday night in cash and the money so distributed, amounting to several hundred dollars weekly, finds its way to the channels of local trade." No wonder competition is welcomed.

AMERICAN inventors may be interested in the proposition of the German government, noted elsewhere, to pay 3,000 marks as a prize for a system by which "the indications of the compass-card of a ship's compass shall be automatically transmitted to another location in the ship, in such a manner that the ship may be steered." It is further provided that "the invention must be applicable to actual service." This is not a particularly liberal offer, especially in view of the fact that "the Imperial Marine Office reserves the right to use the prize invention for the imperial navy without special remuneration." A practical solution of this problem has long been sought, but thus far without success. Such an invention, it is believed, would be worth considerable money to the inventor.

TO ALL disinterested foreigners who have investigated the subject the desirability and utility of cable connection between Hawaii and the United States are very apparent. Thus Prince Francis Joseph of Battenberg, who is just completing a tour around the world, recently spoke of the Hawaiian Islands in most enthusiastic terms to a New York reporter. "They are the most charming of the South Sea Islands," he declared, "and I cannot help believing that there is a great future before them. But it must be under American protection with a local government, and I should think there must be a cable between the islands and San Francisco—the sooner the better. Ten days' time between the two countries is too long, and all your commercial interests demand the speedy establishment of telegraphic communication." The opinion of the prince is shared by most Americans, but it doesn't find much favor with the present administration at Washington.

IN its amended form the bill regulating the granting of franchises by city councils which is now before the Illinois Legislature is generally commended and it is expected to pass. It will be remembered that Governor Altgeld vetoed the original bill making it impossible to grant a gas or electric light franchise without a previous petition of a majority of the property owners on each block of any street that it was proposed to occupy. Under the provisions of the bill now pending the consent of a majority of the frontage for every mile of a street is required. It is believed that there can be no objection on the part or the governor, or anyone except boodle aldermen, to such a provision as this. It applies to gas and electric light ordinances the same rule that has long been in force regarding street railway and elevated railroad ordinances. It has worked satisfactorily there, and will when made obligatory in the case of electric light and gas ordinances. It will prevent a good deal of unnecessary ripping up of pavements, but if a genuine lighting company comes along which can convince property owners it means to sell cheap light it can get the necessary signatures without trouble.

IS AN electrical engineer a gentleman? This seems a rather startling question, but in England, where the term "gentleman" is applied, not in consideration of one's actions and conduct, but as a matter of heredity and social status, the question was recently discussed with entire seriousness, if we may believe a London contemporary. The issue was raised by these circumstances: An individual, who was described as a gentleman, and who lives at Connaught Place, Hyde Park, was brought up in a police court on the 2d instant charged with being disorderly and with assault. A solicitor, who attended on his behalf, expressed sorrow for what had occurred, and stated that "the prisoner was not a gentleman; he was an electrical engineer." That seems to be making an apology that is worse than the original offense, and the incident affords a curious commentary on the artificial social distinctions so dear to a portion of the British public, and also illustrates the queer mental processes of at least one member of the English bar. In this country, fortunately, every man is himself the builder of the measure of his reputation as a gentleman. As a class, American electrical engineers are entirely secure in the rightful possession of this honorable appellation.

THERE is no doubt that the plan outlined elsewhere in this issue to form an association of telephone manufacturing concerns to fight the Bell interests has many advantages that will commend it, especially to the weaker companies. Whether anything comes of the project depends almost entirely upon the policy adopted and the men selected to execute it. There is no doubt that the American Bell Telephone company is anxious to again control the entire telephone field and that it will make a determined effort to accomplish this purpose, but it is equally true that the competing companies if properly organized can present a much more satisfactory opposition than could any individual corporation. At present it is understood to be the plan of the organization to make a bold fight against the Bell company, contesting every point with the old concern and carrying the war into the enemy's territory. The new companies say this policy is the only one left them, as the attitude of the Bell company since the last Berliner decision proves conclusively that the old corporation is prepared to wage a bitter war of extermination against its competitors. Of course such a plan will necessitate a great expenditure of money on both sides. This outlook is not particularly pleasing to those who hold the interests of the business above the success or discomfiture of any corporation or class, but there is consolation in the reflection that the competing companies are in better condition to-day to contest the claims of the Bell interests, which have precipitated this fight, than any former rival of the old concern

ONE would imagine from a casual perusal of the daily papers of Milwaukee that Henry C. Payne was the biggest man in that town. His name is mentioned in connection with every local enterprise of any magnitude, his counsel and support are sought in every public movement and his great executive ability and political influence are much in demand. All these qualifications make Col. Payne invaluable to the great corporations whose management has been entrusted to his care. An observing visitor to the metropolis of Wisconsin cannot fail to be impressed with the colonel's importance; in fact so essential is his presence that there is no wonder that public-spirited citizens feared for the welfare of the town during the colonel's recent trip to New York. It is true that the wheels of the great machine of commerce were kept in motion, but it was only upon the solemn assurance of the press that the visit would be of short duration. Every day his absence was noticeable, and one issue of the *Sentinel* spoke of three public enterprises that had to be delayed by reason of his absence. No doubt his return was welcomed by every man, woman and child of the town, bringing as it must a sense of relief to the entire community. Truly Col. Payne is a great man in Milwaukee.

ALTHOUGH the subject of dynamo design and construction has been pretty thoroughly discussed, the comments of practical men on this topic are always interesting and very often of great value. Many suggestions will be found in the lecture on "Some Practical Hints in Dynamo Design," by Gilbert Wilkes before the students of the College of Mechanics and Engineering, University of Wisconsin, which is printed elsewhere in this issue. Mention is made of the fact that the commutator of the modern generater, whether for power or lighting circuits, has been brought to a high state of perfection and that in many cases it lasts for years, often running for more than a year without even being turned down. This is really a remarkable advancement since the days of the old Edison jumbos, when, as Mr. Wilkes says, one could not look at the hot-scored commutators and see the evidence of excessive wearing without being forced to the conclusion that the generation of electricity and the destruction of copper went hand in hand. Other improvements of equal value have been made in the design and workmanship of other parts. It is true that these advances have only been made after costly experiments and practical experience, but the fact that they have been acquired at great cost will insure greater attention to these lessons by those who have had to pay the penalty.

THERE seems to be no change in the attitude of projectors of telephone enterprises in competition with the Bell interests, despite the decision of the United States Circuit Court of Appeals in the Berliner case. It is evident that the backers of the new companies were prepared for this adverse decision, for it has not created the consternation in their ranks that the old company looked for. On the contrary, they appear more determined than ever to prosecute their plans. There seems to be neither lack of funds nor influential friends behind these schemes, and there is certainly a preponderance of public opinion in favor of competition in the telephone field. It remains now for the advocates of these several schemes to secure the practical support of the public. It will be necessary for all these new enterprises to have more than working capital, enthusiastic promoters and the good will of the public generally. All these are of great value, but they must also have the confidence of the community in their enterprise—the public must be made to look at the Berliner patent in the same light that the backers of the new companies do, and not as the Bell people would have them regard it. The old company has taken pains to announce in every part of the country that the decision in the Berliner case gives the American Bell Telephone company a monopoly of the telephone business until 1908. The evident purpose of this announcement is to prevent capitalists from investing in rival enterprises and intimidate the public from patronizing the new companies. It is maintained on the other hand that the Berliner patent does not give a monopoly of the telephone business to the Bell company that it is not essential to the practical working of an exchange, and that the decision of the United States Circuit Court of Appeals is of no practical value, unless it be in affording a pretext for the Bell company to "bluff" weak concerns out of the field. Of course all this is largely a matter of opinion and can only be determined by another legal battle. It is probable that the opinion in the Berliner case, which is expected on June 10th, will throw some light on the situation.

# OPPOSED TO MONOPOLY.

## Telephone Manufacturers to form an Organization.

Manufacturers of telephone apparatus are convinced that the American Bell Telephone company will attempt to use the recent decision of the United States Circuit Court of Appeals in the Berliner case to force small concerns out of the field. In order to prevent such action it is proposed to form an organization for mutual protection of companies manufacturing telephone apparatus. An important step was taken last week when a call was issued for a meeting of representatives of the interests which are threatened by the Bell company. Copies of the appended telegram and letter were addressed to manufactnrers of telephones throughout the country. They were sent out by J. E. Keelyn, president of the Western Telephone Construction company of Chicago. The telegram read:

Can your managing official meet here with others to perfect national organization for mutual protection, on Saturday and Monday, June 1st and 3d? Important immediate action. Answer quick, confidential.

This was followed by the following letter, which gave additional details:

The probable effect that will obtain in the future respecting the form of order to be entered by the United States Court of Appeals in the Berliner case at Boston requires the earnest and urgent attention of all those expecting to be engaged in the manufacture or production of telephone apparatus.

The further necessity for preparing for the promised onslaught of the Bell people calls for immediate organization toward a peaceful conduct of legitimate telephone business, and the maintenance of the legal and business rights of those engaged in it.

This has suggested the prompt meeting of interested parties. If you desire to be identified with this organization, it will give the writer pleasure to have your prompt advices to that effect.

Responses have been received from many companies pledging co-operation and assistance. Answers to the telegrams also indicate a large attendance. It was not thought wise at this time to make the convention open to the public. It is hoped, however, that the result of the conference will be conducive to the enterprise and encouraging to ingenuity and personal advancement.

## Columbus, O., Telephone Service Severely Criticized.

The people of Columbus, O., have been dissatisfied with their telephone service for some time, and they have recently instituted an examination of the system. The local Board of Trade has fathered the investigation, and at a recent meeting of that organization the following report was presented:

We have met a number of times and have received numerous complaints and suggestions, both verbal and written, a number of which accompany this report. It has been a matter of surprise to the committee to note how universal were the complaints regarding the service, and there seems to be good ground for the belief that we are not getting what we are justly entitled to.

From the start we have labored under considerable difficulty in getting definite information regarding the inside workings of the home exchange. We submitted a list of questions as to the number of instruments, operators, hours employed, etc., to the manager, and received a promise from him, and also from the superintendent, to whom it was referred, that answers would be returned to the same promptly. Up to the present time they have not been forthcoming.

Parties with whom we have corresponded in other cities have reported to us that they have experienced similar difficulty in getting information from their central office, so that it seems to be the policy generally to give out as little as possible information for the enlightenment of the public, evidently forgetting that while they may be private corporations doing business for profit, they are also public servants.

Your committee has not been satisfied, however, with merely the crumbs that chanced to fall from the table, but have earned their bread by the sweat of their brow in obtaining (no matter how) the following facts:

There are between 1,600 and 1,700 instruments in operation in this city.

There are 21 operators, counting the relief operator, employed each day of the week with the exception of Sunday, on which day there are three operators on duty.

There are 17 boards, 100 lines to a board and one operator to every 100 lines, with the exception of number one to 700, which embraces the majority of the business and freight houses, eight operators being employed on these lines. In other words, but one operator in addition to the regular force of one to each 100 instruments.

From 7 A. M. to 7:30 A. M., seven operators.
From 7:30 A. M. to 5:30 P. M., 21 operators.
From 5:30 P. M. to 6 P. M., 17 operators.
From 6 P. M. to 6:30 P. M., nine operators.
From 6:30 P. M. to 7 P. M., six operators.
From 7 P. M. to 8:30 P. M., five operators.
From 8:30 P. M. to 9 P. M., four operators.
From 9 P. M. to 10:30 P. M., three operators.
From 11 P. M. to 7 A. M., 2 operators.

The above figures may not be absolutely correct, but are as nearly so as it has been possible to obtain them from the information at hand.

The switchboards in use are not, we believe, of the improved pattern, and as they have been in use for some time, the numbers are badly worn and quite dim; this may account in part for some of the mistakes which occur in getting wrong numbers. As a result of our investigations, your committee conclude that there is a universal demand not only for a more efficient service, but also for a material reduction in rates.

In connection with the report, the committee stated that about two weeks ago it had addressed a letter to the local management of the company to which no reply had been made until a day or two ago. This letter asked the company certain questions, in order that they might make an explanation if they had any, on their own behalf. Among the questions asked was one as to the prospects for improvement in service, and another as to the prospects for lower rates. The reply was to the effect that the service was regarded by the company to be good as it is, and as to the rates, it called attention to the recent reduction on the mile limit. Later a conference was held with the local officers, in which the committee was unable to obtain any further information, the telephone officers declining to make any statement in writing. The committee felt it had been ignored by the telephone company, and so stated after the report had been read; nevertheless they had in one way and another obtained certain valuable information.

During the discussion which followed the reading of the report, C. O. Tracy, of the committee, presented a comparison with some other cities which use the service of the Central Union Telephone company. He stated that in Dayton, where there were 1,100 subscribers, the rate for business houses is $54 a year and for residences $36; in Indianapolis, with 1,729 subscribers, whose lines are operated by 40 operators, the rate is $60 per year for business houses and $42 for residences; in Toledo, where there are 1,600 subscribers, the rate is $60 for business houses and $42 for residences, though a new company introduced in that city with 1,000 subscribers has announced a rate of $40 a year for business houses and $30 for residences; in Toronto the same company which operates in Columbus has a contract to furnish metallic service to business houses for $45 a year and to residences for $25 a year. In Columbus for its 1,600 subscribers there are only 21 operators, just half as many as in Indianapolis, and a rate of $60 a year is charged for business houses and $45 for residences.

Mr. Hildreth, of the committee, stated that the attitude of the company seemed to him to be that of trying to compel its patrons to put in long-distance telephones, which are infinitely better than the ordinary instruments. He stated that the wires in use were of so long standing that they were in bad condition, and moreover with the increase in the use of electricity and the numerous other wires which are strung about the city, the difficulties of induction had been enlarged.

Mr. McAllister, the chairman of the committee, during the course of his remarks in the discussion of the report, made an interesting statement which he had not incorporated in his report. He said that of the operators two receive $22.50 a month; five receive $20 a month; five receive $17.50; seven get $15; one receives $10, and one receives $8. The chief operator is paid $40 a month and the assistant $25. One all-night operator receives $25 and another $20. He estimated that the four local officers received on an average of $100 each a month, three electricians $40 and five wiremen $30. In this way he figured that the total annual expense of the company for help was $13,620. Added to this $1,500 rent, $1,000 for material for repairs, and $9,000 interest on capital invested, he stated that the total running expenses of the company are $25,120 a year. In order to be absolutely conservative, however, Mr. McAllister allowed $6,810 more for help, and doubled all the other items of expense. On the other side of the balance sheet he stated that 1,700 subscribers at an average yearly rental of $60 would bring in to the company $102,000, from which he deducted $4,300 for the free telephones, which left an income of $97,700 a year. He figured that thus the company had an annual net income estimated on the outside figures of expense, of $55,430, which is about six per cent. on $1,000,000.

De Witt C. Jones asked whether these persons who were getting $15 a month are grown persons, and was informed that they were young ladies between 16 and 20 years of age. Said he, "Why, a kitchen girl makes that much and has her board thrown in."

Mr. McAllister also informed Mr. Jones and the board that rules governing these girls are of the most rigid nature, they being allowed only 10 minutes off duty in the morning and 10 minutes in the afternoon, and that this is all the time they get while on duty. If one of them is 10 minutes late coming to work she is docked for 20 minutes.

Mr Jones asked who was behind the telephone company and what it was. He was informed by Mr. Lentz that its headquarters are in Chicago, and that it is in reality the American Bell Telephone company of Boston, which is incorporated in the different states under different names.

## Telephone War in the South.

The Harrison Telephone company has extended its operation to the South. At Owensboro, Ky., a local company, capitalized at $20,000, has been formed by J. R. Lancaster, J. W. Slaughter, J. H. Parrish, R. Monarch, Z. T. Robinson, Lawson Reno, J. W. Carter, J. D. Powers, Dr. E. H. Luckett, Wilfred Carrico. The new company announces that it will be strictly a home institution, owned and operated by home capital and opposed to the Bell monopoly. The necessary number of subscribers are pledged and as soon as the necessary preliminaries can be arranged work will begin on the construction of the exchange. The new company announces a rate of $30 a year for business houses and $18 to residences, with special rates to professional men. The Cumberland Telephone company, which owns the Bell exchange at Owensboro, has been keeping quiet since making its cut in rates when the Harrison exchange was first broached. The work of refitting its service has gone ahead and heavier poles have been erected along the streets where its lines are heaviest. There is a gang of men now at work in the city. Just what it will do in view of the low rates offered by the new company, which are $1 lower per month than those now prevailing, remains to be seen, but it is likely the old company will declare war on the new company. The Harrison people have attacked a strong point in the old company's armor, for Owensboro is reported to have more telephones in use in proportion to population than any other city in the country, and its country and long-distance lines extend over a wide territory.

## Ohio Telephone Association.

An organization of local telephone companies operating in Ohio has been formed under the name of the Ohio Telephone association, with the following named officers:

President—James M. Thomas, Chillicothe.
Vice-presidents—Charles Parrott, Columbus; Jason Blackford, Findlay; Harry D. Critchfield, Mt. Vernon.
Secretary—James K. Hamill, Newark.
Assistant secretary—Caleb S. McKee, Columbus.
Treasurer—Newton Leggett, Marysville.
Executive committee—George W. Sinks, Columbus; F. L. Beam, Mt. Vernon; H. H. Weller, Cambridge; Jerome Quinn, Washington C. H., and L. P. Lewis, Delaware.

About 60 delegates, representing new telephone companies in various towns in Ohio, took part in the preliminary steps and formed a state federation. Letters were read from 20 different towns not represented in the meeting, offering co-operation. The plan of organization provides that the association is to be made up of local companies already organized or to be organized in county seats and other towns of considerable size. A scheme is proposed to connect all the counties thus organized by each company extending its lines to the counties adjoining.

It was decided to hold the next meeting of the association in Columbus, Tuesday, October 1st. The new association will oppose the Bell interests.

## Telephone Rates in Connecticut.

Telephone subscribers in New England do not appear to be perfectly satisfied with the present arrangement, in spite of the assurances of the telephone people that there is no opposition to them in that territory. In Connecticut recently the Legislature heard arguments on several bills and petitions for reducing telephone rates. John W. Alling, H. Lynde Harrison and President Morris F. Tyler appeared for the Southern New England Telephone company. Judge Harrison said that he understood that Attorney Comstock of Montville was in favor of the measures, but after a consultation with Mr. Tyler he had agreed that his clients would be satisfied with what the company proposed to do in reducing the rates. Mr. Tyler said that the present reduction in rates came because patents have expired. The character of the service will not be lowered. Mr. Tyler said that there were 1,000 subscribers in New Haven and that there were 1,400 telephone wires strung in that city. Eighteen people worked at the switchboard during the day and four at night. The usual statements regarding the cost of operation were presented in behalf of the company.

## New Telephone Company for Buffalo.

The company which is behind the new telephone proposed to be put into Buffalo, the Mutual Automatic, is beginning to get pretty close to the mark where it will apply to the Common Council for a franchise to string wires and open up business as a telephone exchange, ready to supply the people of Erie county with a telephone at the rate of $30 a year for residences and $36 for business places, as against $50 and $75 now charged by the Bell company. The latter company is beginning to feel that the trend of public opinion is toward cheaper telephones and that a company that guarantees good and instantaneous service, together with cheap rates, is the company that will in time do the business. The agents of the old company have been making a campaign of late, which more than anything else

tends to show that the new company is much stronger than any other concern that has ever attempted to occupy the high-priced fields held by the Bell companies.

The Automatic company has received over 1,000 subscribers and there is every indication that within a few months the people of Buffalo will have at their disposal a cheap telephone and one that is thoroughly serviceable.

## Influence of the Bell Company.

[From the Buffalo, N. Y., *Enquirer*.]

The determination of the Bell telephone monopoly to fight everything resembling competition is evidenced by the snag which the recently organized Mutual Automatic company of New York struck to-day.

The Bell company succeeded in defeating the efforts of the new concern to establish a satisfactory test of its new instruments at a long distance.

On Saturday afternoon General Manager Huntley of the General Electric company informed J. M. Drill that he thought there would be no objection to the new concern using four or five poles to string wires to police headquarters, but that he would have to consult the board of public works. Mr. Drill informed Manager Huntley that he had the permission of the city, the police commissioners and the superintendent of police.

This noon, however, Manager Huntley informed Mr. Drill that at a meeting of the directors of the General Electric company this morning it was decided to decline the request for a permit.

This arbitrary action shows where the Bell monopoly has gotten in its work.

Mr. Huntley stated that the General Electric company had an agreement with the Bell Telephone company for the use of each other's poles, and that it was impossible to grant this privilege to a newcomer.

All that was asked for was permission to use four or five poles running along Delaware avenue and the Terrace.

## Opinions of Counsel in the Berliner Case.

[From the Boston *Globe*.]

Frederick P. Fish, of counsel for the Bell company, said: "Yes, the decision is a big victory for the Bell; but really I cannot say anything about it yet. You understand the text of the decision is not yet known. It will not be until June 10th that we can see it. The bare decision is all we have so far. No one but the court knows as yet what the grounds of the decision are. Until they are known, there is nothing to say on the matter."

Lawyer Causten Browne, who is leading counsel for the United States in this case, declared in an interview:

"All I have to say is that the case will be carried to the Supreme Court of the United States."

Ex-United States District Attorney Frank D. Allen, who was in office when the suit was first entered, declined to discuss the latest phase of the case before the full text of the decision is made public.

It is surmised that the reason the decision of the court was rendered so unexpectedly was to prevent a premature knowledge of the decision from getting abroad.

## Reduction in Telephone Rates.

[From the Hazleton, Pa., *Plain-Speaker*.]

Nearer and nearer to Hazleton comes the reduction in telephone rates. Reading was the last city of the state to enjoy a lowering of the rates and Easton is anxiously awaiting a similar condition of affairs. It is becoming evident

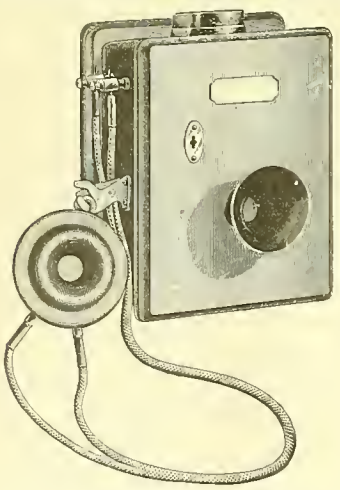


FIG. 2. UNIVERSAL TELEPHONES.

to the Bell telephone monopoly that it cannot keep up its extortionate prices in view of the fact that several important patents have expired or were declared invalid.

The company is well entrenched behind franchises already secured, but the consideration it has shown indicates that it does not feel altogether secure from competition of other companies. It is noticeable, however, that the reductions are principally made in the lower grades of instruments, while the rates on those telephones that give the best service and are most indispensable to the transaction of business, are kept up to their former prices. The sentiment against the exorbitant rentals charged by the company has been growing stronger, and since the users have a chance to vigorously protest by the formation of new companies and the erection of competitive lines, it will not pay the company to continue the practice of these arbitrary methods.

The people cannot be deluded into the belief that they are obtaining important concessions from the company by a reduction of rentals on low grade instruments when those who need a service giving the greatest satisfaction receive no benefit. It is a well known and much deplored fact that the rents of the instruments are out of all proportion to their actual value and the cost of their maintenance. A large, all around reduction could be made; the company would still reap a handsome profit on the investment.

## Competition Desired in California.

[From the San Diego, Cal., *Union*.]

From all over the country come reports of local opposition to the American Bell Telephone company. It is quite

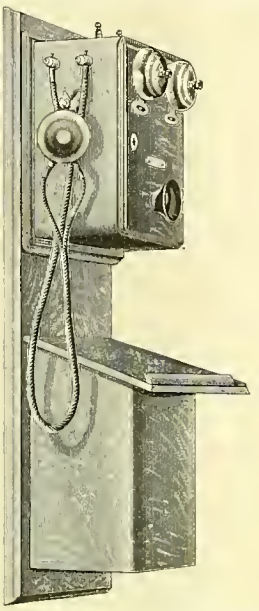


FIG. 1. UNIVERSAL TELEPHONES.

evident from the number of new organizations now being formed for the purpose of providing cheap telephone service that the various exchanges of the Bell company will have to make decided reductions in their rates or else lose their business. A syndicate has just been formed at Attleboro, Mass., to furnish a new telephone system for that place at one-half the rates now paid for the use of the American Bell telephone service. There is just as good an opening in San Diego for a new company, and careful estimates of the cost of construction and maintenance show that a handsome profit can be made at half the rates now being charged by the Sunset Telephone company.

## New Telephone Enterprises.

It is quite certain that within a few days the Wayne County Telephone company will be organized in Clyde, N. Y. The capital stock will be $5,000. Most of the stock has been subscribed.

The Winona Telephone company of Winona, Wis., has now placed in position more than 200 'phones, and by the middle of next week all of the remaining subscribers will be connected. The list of subscribers to the new company is said to comprise all of the patrons of the old company and many new ones.

There's no reason why we can't have a "hello factory" of our own as well as Belvidere, Woodstock, Harvard and the rest of the girls around here, says the Marengo, Ill., *Republican*.

The Dees Telephone company has been organized at Lake Charles, La., with an authorized capital of $25,000. The first board of directors will be George Lock, William E. Ramsay, Chester Brown, A. P. Pujo and Elly H. Dees, with George Lock as president, A. P. Pujo, general counsel, and Elly H. Dees, secretary, treasurer and general manager. Alex. Erwin, a contractor of Houston and Galveston, Texas, will have charge of the work of construction, and the management promises as fine and complete a telephone system as can be found in the south.

A strong company is being organized at Fresno, Cal., to put in a competing telephone system in opposition to the Pacific Telephone & Telegraph company. The directors are Alexander Goldstein, Arthur Dinkelspiel, Sam Woldenberg, W. W. Phillips and Frank P. Wickersham. It is proposed to reduce the charge to $2.50 a month. The company will use the system now being introduced in San Jose, Santa Cruz, Stockton and other places.

Under a deal that has been on for a couple of months, the Harrison Telephone company of Toledo goes into the hands of a syndicate, of which Senator Calvin S. Brice is the principal capitalist. The syndicate recently secured a majority of the capital stock of $250,000, and at the annual meeting of stockholders, Col. H. S. Bunker, Edwin C. Shaw, H. T. Cook, of Toledo; C. A. Layton, M. D. Shaw, Jacob Hauss, Wapakoneta, and George W. Hull, Lima, were elected directors. Mr. Hull will change his residence from Lima to Toledo this spring. The directors elected Mr. Cook president, Col. Bunker secretary, and Mr. Hull treasurer.

The Home Telephone company has begun operations in Baltimore by placing a telephone service between the office of District Attorney William L. Marbury, in the postoffice building, and Mr. Marbury's private law office, in the Glenn building, on St. Paul street. The telephones in the two offices of Mr. Marbury are the only ones of the company yet put up in the city. Mr. Marbury is the counsel for the Home company. The new company will operate the Drawbaugh patents and its service will be at a great reduction in rates. The company has already secured a large number of subscribers who have given three-year contracts. President Franklin Noble of New York is known as one of the best organizers in the telephone business, and it would seem that he has a company that would rapidly extend its lines to the neighboring vicinity of Baltimore.

The Shamokin Valley Telephone company of Shamokin, Pa., has determined to extend its line from Sunbury to Pottsville. The Schuylkill Valley Telephone company has been organized and is now applying for a charter. This will be a branch of the Shamokin company and the directors include Capt. E. C. Wagner, Girardville; E. C. Price and M. A. Marr, Ashland; Samuel Kaercher, Pottsville; E. B. Hunter, Shenandoah, and Edward Sillyman, Mananoy City. E. C. Price has been elected president and E. B. Hunter, treasurer. In less than four months it is expected that the entire line will be in operation with nearly a thousand subscribers.

The Union Telephone company began the erection of poles at Marietta, Ohio, on May 1st. Negotiations are now going on between this company and the new Standard Telephone company which will, it is thought, result in the Union company being made a factor in the proposed chain of exchanges throughout the country. Another new telephone company is anticipating establishing itself at Columbus, Ohio. Preliminary steps with this end in view have been taken. The concern is the Phœnix Telephone company of Chicago and Indianapolis. The company will operate in Columbus, providing 1,800 three-year subscribers can be secured. The rates will be $36 a year for business houses and $24 for residences. If 1,800 subscribers are guaranteed the new company announces that it will erect a plant estimated to cost $216,000. Behind the organization are Nelson Morris, J. W. Doane and other well-known Chicago capitalists.

## Universal Telephones

"Not how cheap, but how good," is the motto adopted by the new Universal Telephone company of Indianapolis, which is putting telephones on the market that are said to have qualities superior to any other. Fig. 1 shows the type known as "Model A." This telephone includes lightning arresters, magnetos capable of ringing through a resistance of 10,000 ohms, and a semi-automatic switch, all contacts of which are provided with platinum, the lack of which in other telephones is to be observed only by the most careful examination. The receiver is carefully made in the form of either a watch case or the regular Bell shape. A 250 ohm induction coil, a universal transmitter and a hard rubber mouthpiece are included. This fine telephone is assembled in handsome oak or walnut cases, and all outside fittings are nickel-plated.

Fig. 2 shows "Model C," designed for short lines in factories, hotels, residences and elsewhere. This is a very compact telephone, the dimensions being four by five by two inches. It is fitted with either bell or buzzer, with a

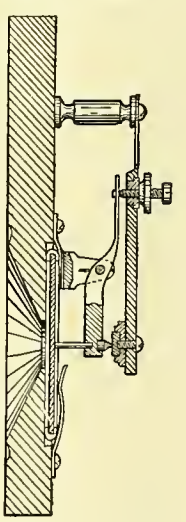


FIG. 3. UNIVERSAL TELEPHONES.

push-button for ringing up. It is found to be a very satisfactory instrument.

A cross-section of the Universal transmitter is shown in Fig. 3. This transmitter is entirely of metal, except the carbon contact. It can be easily adjusted, and, being arranged with compensating contact, no vibrations of the diaphragm are lost or fail of reproduction by the receiver. It is a frequent experience in operating telephones which have been constantly in use to find that, when speaking too loudly, in order to overcome some cross or fault in the line, or because the battery power is weak, or where, from other causes, the ordinary tones of the voice are entirely unintelligible to the listener, the electrodes are thrown entirely apart, thus preventing any sound from being transmitted. By

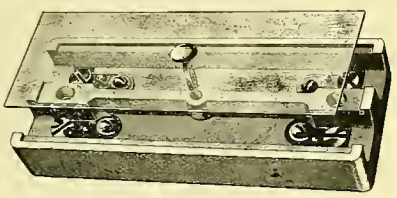
t
he device attached to the Universal telephone, instead of any tendency to throw the electrodes apart by loud speaking, the action of the reacting lever necessarily causes them to receive a closer pressure by the increased amplitu le of the vibrations of the diaphragm, and thus transmits the exact modulations of the sound waves thrown thereon. The construction of the instrument is, however, very simple, and it will not easily get out of order.

The Universal Telephone company owns patents granted April 28, 1885, upon a new form of transmitter. The validity of these patents has never been questioned, it is said, and the patents are therefore of great value in protecting the manufacture and sale of this transmitter.

## Boynton Primary Batteries.

What would appear to be a radical departure in the construction of primary batteries in the application of material necessary for the work has recently been brought out by the Boynton Multivolt Battery Company of Brooklyn, N. Y. In a recent test the standard, six by eight jar was used; when on open circuit the cell showed an electromotive force of 5¼ volts, and on short-circuit it gave a current of 5 amperes. The cell was then run on short-circuit for 20 minutes and the current reduced to two amperes. It then measured 3.6 volts at the terminals with two currents running.

The multivolt cell is of the one-solution type, its great power being the result of a peculiar method of grouping and combining the elements; also in the manufacture of the carbon element. The positive element consists of a cylindrical cup of carbon. The outer surface of the carbon is covered with a tightly fitting shell of vulcanized rubber, to within about an inch of the top, open end. Around this exposed rim of carbon, inside and out, is cast a ring of solder to give a large and firm contact surface. The casting forms one piece over the top edge of the carbon, and the union between the metal and carbon is further strengthened by the metal running through holes bored through the carbon before the casting is done. A few holes are provided in the carbon and its hard rubber covering, near the top and bottom of the cylinder, but on one side only. These holes allow



BRYANT MICA-COVERED CUT-OUT.

the circulation of the exciting fluid within the carbon cup. In the standard cell three such carbons are provided. They are attached to the hard rubber cover which supports them in the liquid. Perforations through the cover admit an ordinary Leclanche zinc into the interior of each carbon cup. The zincs are supported on a frame, which permits of raising and lowering them from and into the liquid. The cell is filled with the exciting fluid to within an inch or so of the top of the hard rubber covering of the carbons, the zincs are lowered to the desired depth, and the cell is ready for action. The elements are connected in series, zinc and carbon alternately, and the current is varied by increasing and decreasing the immersion of the zinc. Each pair of elements is provided with terminal posts, so that it is possible to get one-third, two-thirds or the full voltage of the cell, according to the number of pairs in circuit. This cell, therefore, provides means for varying both the electromotive force and current, according to the necessity of the case. The outside surface of the carbon being insulated from the liquid by its hard-rubber cover, only the inside surface is acted upon. The result of this method of construction of the carbons is to give from the three groups of elements an electromotive force of over five volts, although there is really but one cell of battery.

Electropoin fluid may be used in this cell, but for convenience the company furnishes a powder which makes the work of recharging very easy.

Fig. 1 shows a standard cell with the zincs fully immersed, Fig. 2 showing the zincs withdrawn from the fluid.

This cell will undoubtedly meet with great favor on account of its great power and the important advantages it offers in the matter of economy in cost, space, and maintenance.

This cell is the invention of E. S. Boynton, vice-president and general manager of the Boynton Multivolt Battery company.

The Suburban Electric Railway company has filed its articles of incorporation with Recorder Chase of Chicago. The charter, which is dated May 8th, and was filed with the secretary of state May 16th, terminates in fifty years. The object is the construction of a railroad from Chicago to cities, towns and villages in the counties of Cook, Lake, Du Page and Kane.

## American Cruisers' Electrical Display at Kiel.

At the great naval celebration at Kiel, Germany, on June 19th, marking the opening of the Baltic canal, the American cruisers will assist in the evening fetes by an electrical display. The Columbia has been fitted with an excep-

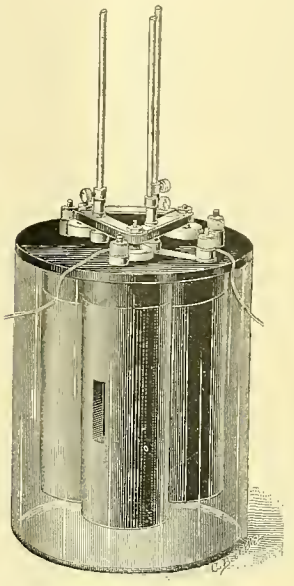


FIG. 1. BOYNTON PRIMARY BATTERIES.

tionally extensive system of electric lighting, which, when in full operation, will give a novel and brilliant effect. Wires are to be strung all around the railing and rigging of the Columbia, and the name of the ship in large letters of electric lights has also been prepared, which will be placed on the side. The cruiser also has a large shield made of colored lights, containing the arms of the United States and of Germany. She carries two similar shields for the San Francisco and the Marblehead, and one has been placed on the New York.

## What Governmental Control of the Telegraph Means in Japan.

Col. Cockerill, who is furnishing Americans an insight of Japanese life in his letters to the *New York Herald*, gives the following interesting bit of information about the telegraph department in a letter from Tokio, dated April 16th:

There is one feature of the Japanese government which I

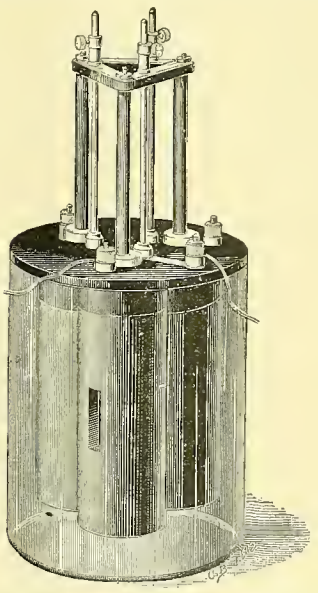


FIG. 2. BOYNTON PRIMARY BATTERIES.

can justly criticise, and that is the management of the telegraphs, which at present is purely Muscovite. The censorship is as rigid as anything ever known in Moscow, where, in addition to telling you what you shall or shall not send by wire, the telegraph official requires you to take off your hat while in his bureau, if there happens to be a picture of the czar or a sainted image on the wall—and there always is. Here your dispatch and money will be received by the gentlemanly official and many days afterward your copy and your money may be returned. Owning the wires, the government holds that it has a right to judge of what it will and will not transmit. This is an empire and we are at war. I have been politely requested not to send three different messages and in each case I consented with good grace. There are times when a polite imperial request moves me precisely as though it were an imperative command.

## A New Electrical Monthly.

From San Francisco comes the news that a new electrical periodical is about to make its appearance—the *Electrical Journal*, which is to be an illustrated monthly review of the industrial applications of electricity, gas and power. George P. Low, one of the best known electricians of the Pacific Slope, will be the editor and proprietor of the new journal, and associated with him in the editorial department will be Prof. F. A. C. Perrine of the Leland Stanford, Jr., University. Mr. Low has relinquished his practice as a consulting electrical engineer and severed his connection with the *Pacific Electrician* and will devote himself mainly to the new venture, which starts out with good prospects of success.

## Prize of $750 for Inventors.

Inventors will be interested in the following announcement made by the Imperial Marine Office, Nautical Department, in the *Elektrotechnische Zeitschrift*, Berlin, of May 9th:

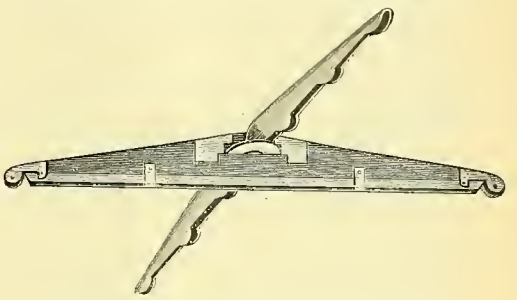
The indications of the compass-card (kompassrose) of a ship's compass shall be automatically transmitted to another location in the ship, in such a manner that the ship may be steered. The invention must be applicable to actual service. A prize of 3,000 marks is offered for the best solution of this problem. The awarding of the prize is left entirely to the secretary of state of the Imperial Marine office. Inventors must send the description of their invention to the department by March 1, 1896.

The Imperial Marine Office reserves the right to use the prize invention for the imperial navy without special remuneration.

## Car Fender Problem.

[From the New York *Sun*.]

One thing the managers of the street car companies may as well regard as settled: that they will be compelled to do that which gives the best promise of stopping the slaughter. Another thing they may as well make up their minds for: that if projecting, pick-up fenders give the best promise of that result, they will be forced to adopt such fenders. They will find no trouble in using them or in protecting them



MEDBURRY INSULATED CROSS OVER.

from damage while in use. They will be allowed then to run their cars at increased rate of speed over those allowed under the present restrictions, the capacities of the road will be greatly increased, the public will be better served, and the stockholders will rejoice.

## Trolley Lines and the Public.

[From the *Philadelphia Times*.]

There are two plain duties to be recognized for the common safety of people in streets occupied by trolley cars. The cars are indispensable and the increased speed attained by the trolley is a public necessity.

The first duty is that of the trolley managers to equip their cars in the best possible method that can be devised for the protection of life and limb. However costly it may be, it would be practical economy, and in addition it is a duty that the trolley companies owe to the public.

The other duty belongs to the citizens. They must learn that the public highways are not playgrounds for children; that they are for the use of vehicles, and that they are unsafe to be occupied by either men, women or children.

## Bryant Mica-covered Cut-out.

Main line cut-outs are important accessories to electric lighting, and improvements are always appreciated by the men who have to handle details in actual practice. The Bryant Electric company has placed upon the market a double pole mica-covered main line cut-out, in which the break for currents less than 25 amperes is amply sufficient for 500 volts. The illustration, while of reduced size, gives a good idea of the cutout. Grier Bros., the western managers, will carry a limited stock in Chicago.

## Medbery Insulated Crossover.

The Mason Electric Equipment company of Chicago, selling agent for the Medbery overhead material, has lately brought out the insulated crossover, shown in the cut, which is acknowledged to have peculiar merit. Made of the standard high grade material used in all the Medbery equipment, so constructed as to do away with the necessity of cutting the wires, unusually strong, yet neat and even handsome in appearance, it bids fair to become the "standard" where superior equipment is desired. The company reports

a number of trial orders during the month and also a large order for the complete system of one of the leading roads. The latter is particularly pleasing to the company, as in this case the most approved types of crossovers had been tried, but the decision was in favor of the Medbery. This is another instance where the manufacturers find it to their interests to furnish the best class of material.

### American Institute of Electrical Engineers.

At the annual meeting of the Institute, held last week, the council reported 944 members, showing a net gain of 144 for the year. The discussion of Prof. Anthony's paper on "Underwriter's Rules," read April 17th, was resumed and opened by Prof. W. L. Puffer of Boston. At the meeting of council in the afternoon the following named associate members were elected: William C. Andrews, Brooklyn, N. Y.; Clare F. Beames, Schenectady, N. Y.; Myron E. Canfield, New York, N. Y.; John Thomas Dewar, Antwerp, Belgium; William David Gharky, Philadelphia, Pa.; Henry Banks Henderson, Ithaca, N. Y.; Alexander B. Simpson, New York, N. Y.; Sydney Hogentoren, New York City, N. Y.; Theodore K. Jackson, Chicago, Ill.; Frank W. Roller, Brooklyn, N. Y.; Norman T. Wilcox, Seneca Falls, N. Y. The following associate members were transferred to full membership: Romaine Callender, New York, N. Y.; J. Day Flack, New York, N. Y.; F. R. Colvin, New York, N. Y.; Russell Robb, Boston; V. M. Berthold, Boston; Herbert Lloyd, Philadelphia, Pa.; Harry Hartwell Blades, Detroit, Mich. The council decided that the general meeting at Niagara Falls should be held on June 25th to 28th inclusive.

### An Electrical Mistake.

Somebody thought the battery which feeds the electric fire alarm system in the Oriental Hotel at Thirty-ninth street and Broadway was weak and needed recharging. This thought struck him at 3 A. M. on May 3d, says a New York correspondent, and he communicated it to the engineer. The engineer went to the office and opened the alarm box. "I don't think there is any current on this wire," said he, and touched the wire with a pair of pincers, one point of which came in contact with another small wire. There was a flash, a splutter and then the whole system of terrible gongs throughout the hotel sounded a wild alarm. In an instant the halls and corridors were alive with frantic men and women clad in all sorts of decollete garbs and tumbling over each other without regard for the proprieties. One desperate young woman in a night robe of delicate texture and bare feet went down the steps three at a time, with a spring bonnet in one hand and a tooth brush in the other. A man in pajamas, a silk hat and a pair of silk stockings assured her that there was yet time and perhaps it would be wise for her to retrace her steps, as he mildly suggested her attire was scanty. "Look at yourself, you horrid thing," cried the young woman, as she hurried on. A well-known prima donna escaped in her night dress with her parrot. The wise bird seemed to enjoy the situation hugely. "See the living pictures," he cried, with a hoarse, mocking laugh, as the exodus of scantily clad proceeded. Two young women went into hysterics and one fainted; one ried to go down the rear fire escape and another dragged her trunk down two flights of stairs and attempted to toss it over the banisters. Then it was discovered that there was no fire.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, May 25.—As is usual of late, the most interesting bit of electrical news for the week comes from the other side of the East river. It is announced that an important electric light deal has just been consummated in Brooklyn by which the control of the Citizens' Electric Light company passes into the hands of its rival, the Edison Electric Illuminating company. Until the political revolution of two years ago occurred, the Citizens' company virtually had a monopoly of the business, and even recently it blocked the way of the Edison company toward securing some valuable contracts. A few weeks ago the negotiations for the purchase of the controlling interest in the Citizens' company by the Edison company were begun, R. C. Peabody, Lowell M. Palmer, and Julian Fairchild acting as a committee for the latter. It was authoritatively announced on Thursday that the purchase had been effected, although the formal control of the old company would not be assumed by the Edison company until July 1st. Fully nine-tenths of the Citizens' stock was held by John Delmar, James Shevlin, Anthony Barrett, Thomas F. Nevins, Bernard Gallagher, and ex-Under Sheriff Hugh McLaughlin, and it is their holdings which the Edison company has purchased. It is understood that each company will retain its own corporate existence. The six principal owners of the Citizens' stock have been potent factors in the Democratic organization, and it is said that their influence in the Board of Aldermen had considerable weight in inducing the Edison company to buy them out. A member of the Edison company said: "Our company, by the use of the Citizens' plant, will be able to reduce the cost of furnishing public electric lights and will enable us to satisfy the municipal authorities."

An interesting meeting of the Chamber of Commerce was held yesterday afternoon. Three hundred and fifty members were present, and many of them were accompanied by their wives and daughters. The chamber met to receive the painting entitled, "The Projectors of the Atlantic Cable," presented to it by fifty-two of the leading citizens of New York. In receiving the painting the Chamber of Commerce honored the memory of Cyrus W. Field, Moses Taylor, Marshall O. Roberts, Wilson G. Hunt, Prof. Samuel F. B. Morse, Chandler White, David Dudley Field and the venerable artist who painted the picture, Daniel Huntington. All of these gentlemen are represented in the painting grouped about a table and globe. Morris K. Jesup made the presentation speech and Chauncey Depew delivered an oration. President Orr, on behalf of the chamber, accepted the picture. The canvas is seven by nine feet and cost $20,000. Cyrus Field is credited with the first conception of the idea of a group picture of the cable projectors, but the scheme met opposition and slumbered for many years. W. F. O.

### Niagara Falls Notes.

NIAGARA FALLS, May 25.—The proposition for lighting Prospect Park with electricity is revived. Some prominent business men have taken hold of the matter and a thorough canvass of the business portion of the city will at once be made to ascertain how much can be raised by popular subscription to carry out the project. A. Schoellkopf of the Niagara Falls Hydraulic Power & Manufacturing company has offered to furnish the current free. It is proposed, in addition to placing electric lights throughout the park, to purchase a large search light, similar to the one used at the World's Fair, which will be directed on the falls. It is also proposed to have band concerts three nights each week during the season. It is estimated that the expense of wiring the park, putting up the lights and furnishing music will be about $2,000. Proprietor C. N. Owen of the Hotel Imperial and S. M. Brooks are actively moving in the matter and they feel confident of success. It is believed that the illumination of the falls would draw a great many people and that business men would be largely benefited by it. The idea is generally looked upon very favorably, and the prospects are now good for its being carried out.

The Postal Telegraph company will set a good example by burying all of its wires on Falls street. The contract has been let to Hardwicke & Co. to put the wires in an iron conduit and the work will begin at once.

It looks as if electricity was sure now to supplant horses on the street railway from Niagara Falls, Ont., to Niagara Falls, South Ont., better known as the Clifton and Drummondville road. There has been talk regarding the change for a long time and Manager Black has asked for bids for furnishing poles and ties.

The power house and the grounds of the Niagara Falls Power company are to be fenced in. A gang of men is at work setting the posts from the inlet canal to the grounds of the Niagara Falls Paper company along Buffalo avenue. Most of the grading has been done there and the sodding commenced. The excavation for the big liberty pole in front of the power house has been made.

A greater portion of the route of the Buffalo & Niagara Falls electric road has been graded between Niagara Falls and Tonawanda. Between this city and La Salle the grading is finished, and the ties are being placed in position. The rails are expected within a day or two, and as they arrive the work of putting them down will be commenced. As soon as the rails are down stone cars will be run over the road distributing ballast.

At the regular meeting of the Buffalo Electrical society, which was held Saturday evening, May 8th, at the society's rooms in Buffalo, Prof. Albert L. Arey lectured on "Storage Batteries and Chemical Works." This finished the course and the society has adjourned until September, according to custom. The course of lectures provided by the Electrical society on "Practical Electrical Engineering" has been a decided success, the average attendance being about 250.

The Buffalo aldermen sent back the electric power franchise to the joint committee of the aldermen, councilmen and mayor's advisory board, which drew it up. Now the joint committee, if the action of the lower board is concurred in by the councilmen and the mayor, will confer with the representatives of the power company as to the several provisions. F. C. P.

### St. Louis, Mo.

ST. LOUIS, May 24.—The Edison Electric Illuminating company has ordered from the General Electric company another 800 kilowatt monocyclic alternator. This will be the second installation of these large units by the Edison company. The first machine, which was illustrated and described in the WESTERN ELECTRICIAN of December 22, 1894, was installed last winter and has given such satisfactory results as to warrant this second order. The entire station is being rearranged. A new Heine water-tube boiler plant is being put in.

The Terminal Railroad association is awaiting the results of the Baltimore & Ohio tuonel trolley working, with a view to adopting the same plan in the St. Louis tunnel.

The city has filed suit against the Missouri, Edison and Laclede lighting companies for amounts aggregating $104,000 for the non-payment of 2½ per cent. of their gross receipts for 1890 and 5 per cent. of gross receipts per annum thereafter. The lighting companies have always resisted these claims, claiming exemption under their contracts. The mayor has employed special counsel to prosecute these suits.

The Laclede Gas company is putting in a 600 horse power tandem compound condensing Hamilton-Corliss engine, a 200 kilowatt United Electric alternator and a 200 kilowatt, 500 volt power generator.

W. L. Arnold, of the St. Louis office of the General Electric company, has assumed charge of the Kansas City office. Geo. D. Rosenthall is in sole charge of the St. Louis office.

The Missouri Pan-Electric Telephone company has reorganized and will enter the field again at an early date.

R. J. H.

## PERSONAL.

W. E. Sinclair of Goltz & Sinclair, Milwaukee, was a visitor in Chicago last week.

Geo. W. Denny, who is associated with the Bryant Electric company in Chicago, gave a six o'clock dinner on Tuesday, May 14th, in honor of his wife's birthday.

Carl Kammeyer, well known as the western editor and manager of the *Electrical Engineer*, has recently resigned his position to become general manager of the Maywood & Proviso Electric Light & Power company, Maywood, Ill. Although Mr. Kammeyer has been in the newspaper business for some time, he is an old electric light man, and his new connection brings him back into a field and to a work with which he is perfectly familiar and for which he is eminently fitted. His experience in electric lighting work dates back to 1884, when he put up the first Excelsior arc light plant west of the Mississippi at Sedalia, Mo. Thence he went to St. Louis to superintend the erection of the Excelsior station in that city. He then connected himself with the Fort Wayne company, doing construction work, and in the fall of 1888 he became superintendent and electrician of the National Electric Manufacturing company of Eau Claire, Wis. Mr. Kammeyer's excellent work as electrician with this company for over four years is well known to almost every electric light man in the West. Mr. Kammeyer next went to Indianapolis and established a connection with the Jenney Motor company. In September, 1893, he came to Chicago to study the electrical features of the World's Fair, and after the fair he became western manager and editor of the *Electrical Engineer*. Mr. Kammeyer is a practical electrical engineer, and his work has been greatly to his credit. Many of his friends will remember his interesting paper at the Chicago Electric club, in which he presented stereopticon views of fuses photographed at the moment of rupture. In his capacity as a newspaper man he made many new friends, and all join in wishing him success in his new venture.

## ELECTRIC LIGHTING.

The power house of the Defiance, O., Light & Railroad company was partially burned on May 24th. The loss is estimated at $7,000, fully covered by insurance. The machinery was badly injured and the town is in darkness.

The Northern Electric company of Norwalk, O., has been organized to do electric lighting in that city. The old incandescent plant will be used as the nucleus for one of the finest lighting plants in Northern Ohio, if the city lighting contract is secured.

## ELECTRIC RAILWAYS.

Is is proposed to construct an electric railway over the new bridge connecting Louisville, Ky., and Jeffersonville, Ind.

Harry Munson, a conductor employed on the Meeker avenue line of the Brooklyn Trolley company, lost three fingers recently under peculiar circumstances. Munson was switching the trolley-pole at the Meeker avenue station, near Newtown Creek, when the accident occurred. While making the change the pole suddenly jerked upward, and the rope became twisted around the index, middle and third fingers of his right hand in such a manner as to tear the tips from the first joints of two fingers, and the third had to be amputated.

A recent dispatch from Anderson, Ind., says: The Gas Belt electric railway line is to take in Kokomo and Greentown. These towns are to be connected with the Gas Belt electric line at Marion and this will take in all of the principal cities of the state with the exception of Muncie, which is to be taken care of later. Charles L. Henry, the head of the Marion-Anderson line, has filed seventy-five deeds for right-of-way strips between this city and Summitville. The company of which he is the head is buying an independent right of way, and is not depending on highways. He will file a like number of deeds on the Elwood line. Into Kokomo and Muncie the line would be over a hundred miles long. It

will be the property of three distinct companies, but there will be a combination. There is to be a rate of about 1 cent per mile established. The Anderson-Marion line and the Anderson-Elwood line are to be in operation this year, and the Marion-Kokomo line, accordiog to the franchise granted, by the middle of the coming year.

It is announced that construction operations for the elevated structure of the Northwestern electric line in Chicago have been begun. A gang of men has started at the northern terminal to put in foundations, and the work is to be pushed as rapidly as possible. Officials of the Northwestern company are enthusiastic over the character of the structure which is contemplated. There are to be four tracks for a distance of about six miles, and the experience of the other elevated railroad companies, it is declared, will furnish valuable data, and many mistakes which those companies have made will be avoided.

## TELEPHONE.

The new building of the Rocky Mountain Bell Telephone company at Salt Lake City was recently opened in the presence of a brilliant company of invited guests.

A number of farmers living ten miles west of Yankton, S. D., have established a telephone system covering eight miles of fence wire. The farms in this vicinity are surrounded by barb wire fences. Each farmer is supplied with a transmitter at his house, connecting with the middle wire of the fence. The staples have been removed from this wire and insulated fasteners substituted. A cell battery has been constructed and the farmers are now able to converse with each other. The expense for the entire system did not, it is said, exceed $25.

## TELEGRAPH.

It was announced early in 1893 that the telegraphic system from Fort Salisbury, in Mashonaland, Africa, would be continued through the continent to connect with the Egyptian system at Cairo. A company was formed with a capital of $2,000,000, and on September 27, 1894, the line was open from Cape Town to Blantyre. Commencing at Salisbury, the line is to cross the Zambesi in the neighborhood of Tete, and continue to Zomba. From Zomba the line will skirt the shores of Lake Nyassa up to Karonga. From Karonga the line will be continued along the Stevenson road, which runs over the uplands on the Tanganyika plateau, and it will touch the lake at a point on Abercorn bay. From the North of Lake Tanganyika the line will proceed to Victoria Nyanza, and thence to Uganda. The wire will be strung on light iron poles. When connection is made with the Egyptian lines at Wady Halfa, it is expected that messages will be transmitted from London to Cape Town at one-third the present cable rates.

## POWER TRANSMISSION.

It is said that electric motors are used for power in over 600 establishments in the city of San Francisco. About half of these installations are in connection with elevator machinery.

Articles of incorporation of the Leadville, Colo., Electric Power & Irrigation company have been filed. The incorporators are R. E. Goodell of Leadville, J. H. Poole of Denver and E. W. Rollins of Boston. It is the intention of this company to use the water of the Arkansas river, and to build a dam in Lake park. The power house will be located in Malta, four miles below Leadville. The company will expend $250,000 for the erection of the plant.

The new Electric Light & Power company at Eau Claire, Wis., will expend nearly $300,000 in improvements. The upper dam will be improved so as to give a fall of sixteen feet; the lower dam near the linen mill will also be improved and the horse power greatly increased. At present only half its power is utilized by the mill. A large dam will also be constructed at the falls, near Altoona. These improvements will give the new company a capacity of 600 or 700 horse power.

The Utah Power company, whose purpose it is to tap the waters of Big Cottonwood, near Salt Lake City, for 3,000 horse power and transmit the same by electricity, has filed its articles of incorporation, the capital stock being fixed at $1,000,000, divided into 10,000 shares of the par value of $100 each. Francis Armstrong subscribes for 130 shares; A. W. McCune, 130; R. C. Chambers, 260; John E. Dooly, 260 shares; Richard Mackintosh, 130; W. P. Read, 45 shares, and Orson P. Arnold 45.

Robert Marshall of Pittsburg is agitating an electrical transmission scheme to obviate the smoke nuisance in that enterprising city. His idea is to erect a mammoth electric plant outside the city. It would be located at some big coal mine, probably up the Monongahela river. By this location the expense of transporting fuel will be saved. All the refuse slack from the mines, which is now thrown over the dump, can be used under the boilers for fuel. It can be bought for almost nothing. The boiler plant may be erected inside the mine and the smoke shaft arranged to serve as a ventilator. In referring to this project Mr. Marshall said: "This is the only practicable solution of the smoke question. It will do away with furnaces in the city entirely, for electricity can be furnished from this plant cheaper than power can be generated at isolated plants. All the big establishments in town which are now paying thousands of dollars a year for power and heat would save at least half that amount. Power could be secured from this central plant to run dynamos for the manufacture of light. Motors would displace steam engines and electricity would heat the buildings better and more economically than steam, hot air or hot water. There would be absolutely no dust, no dirt and no danger."

## TRADE NEWS.

A $25,000 school building will be erected at Reynoldsville, Pa., this year, and it is proposed that the principal's room be connected with all of the class rooms by telephone. M. M. Davis, secretary of the school board, can give details of the plans.

New England "Peer of All" is the trade name given to the new snap switch manufactured by O. S. Platt of Bridgeport, Conn. The class of electerical goods manufactured by Mr. Platt is well known to the electrical trade, and its appreciation is shown from the many duplicate orders.

Morris & MacCurdy, Indianapolis, Ind., makers of the "Phœnix" insulating paint, are being overcrowded with orders for this excellent article, which is receiving such favorable attention from users. The "Phœnix" paint is now known all over the country and is said to be giving perfect satisfaction wherever used.

The Bradbury-Stone Electric Storage company has recently installed at the residence of W. E. C. Eustis, Milton, Mass., a storage battery of 1,000 ampere hours capacity of the very latest type in lead-lined wooden tanks. The plant is operated by windmill and is the second largest installation of this character in America.

The Onondaga Dynamo company of Syracuse, N. Y., has recently added some new machine tools in order to meet the demand for large generators, a number of which have been recently sold for future delivery. This concern is anticipating an extension of its business, with the central and western states as the objective point.

The third edition of catalogue No. 27, issued by the M. C. Bullock Manufacturing company of Chicago, fully describes the Willans patent central valve engine, of which this company is the sole American manufacturer. This famous English engine is especially adapted for direct coupling to dynamos, and units of over 105,000 horse power have been installed.

The new table push manufactured by Huebel & Manger of Brooklyn is having an extensive sale. Huebel & Manger report that the sales have been so large for this appliance that they have added to their help in order to fill orders promptly. This concern has recently issued a new catalogue which is profusely illustrated and gives full description of a large line of electrical and brass goods.

Receivers Chauncey G. Parker and Thad. T. Grover, under authority of the Supreme Court of the state of New York, offer the balance of the stock of the Electric Construction & Supply company, consisting of a large number of Ward and Knight lamps which are claimed to be in perfect condition and also parts of these lamps. They have a large quantity of domestic and imported carbons, together with search lamps made up with iron parabolic reflectors.

The E. P. Gleason Manufacturing company of New York has recently perfected a celluloid shade, which will bear the trade name "the Gleason," the outside of which is a natural green color to protect the eyes, while the inside is lined with white, making a powerful reflector. It is especially economical, being very hard to break. It is also adapted for use on cord pendants, because it is as light as paper. The shade is 10 inches in diameter and fits a 2¼ inch holder.

The E. G. Bernard Company of Troy, N. Y., has recently extended its department for the manufacture of dynamos and motors. This apparatus is constructed in such a manner that the magnetic field is made of one piece of forged iron. The Bernard company claims to be the only manufacturer in America of this type of machine, which gives a superior efficiency, while it can be manufactured for a very low price. The company is doing a large amount of work and reports prospects for future orders as bright.

The portable fire hose bridge, for which the Metropolitan Electric company, 186 and 188 Fifth avenue, Chicago, is general agent, is meeting with the approval of the electric street railways. This company has already received orders from several roads and is constantly receiving inquiries. The Metropolitan company reports a very good demand for the well-known P. & B. products. Numerous street railway customers express themselves as being well satisfied with results obtained from the use of P. & B. tape and compounds. The company wishes to inform the trade that it is now in position to fill orders from stock for the Solar arc lamp for incandescent circuits.

The American Electrical Works of Providence, R. I., find their large manufacturing plant not too extensive in taking care of the orders which have been flooding this concern since the first of the year. Every department is being worked to its utmost capacity, and nothing is known of hard times about the establishment. President Eugene F. Phillips looks after the wants of all visitors by very courteously having a steam yacht at their disposal for a ride on the river from the termination of the cable road to the factory. At the present time the clams are being carefully selected which will be served to their friends at the annual gathering of this concern, which is the closing event of the summer season in the vicinity of Providence.

## BUSINESS.

The C. W. Hunt company of 45 Broadway, New York, manufactures industrial railways, coal-handling machinery, conveyors and manilla rope. Its light railway appliances, both steam and electric, are exhaustively described in a recent catalogue.

The Boston Braid Manufacturing company of Boston, Mass., is well-known for its high grade of incandescent lamp filaments. Skilled workmen take the greatest care in producing a uniform article, which is necessary for such an important adjunct to the manufacture of incandescent lamps.

The Electric Appliance company, Chicago, reports having just closed agency arrangements for the exclusive sale in the West of the Upton arc lamps for direct and alternating constant potential circuits and regular series arc work. The lamp is extremely simple in construction and is meeting with favor.

Many sales of Collins' compound, the well-known insulating paint, are reported by Lee & Collins, 1325 Monadnock block, Chicago. One of the most noteworthy of recent orders was that for the extensive new plant in the Rothschild building, Chicago, recently described in the WESTERN ELECTRICIAN. About 50 gallons of the compound were employed.

The Missouri Electrical Repair company, St. Louis, has installed a 290 ampere Colburn machine in the establishment of the John L. Boland Book & Stationery company, St. Louis. The company has also received its third order in two years for a Colburn dynamo, which supplants another make. The Missouri company is doing a good business in other lines.

J. F. Gerleman, selling agent for the American Electrical Manufacturing company, St. Louis, is at present in Chicago, where he has secured a number of excellent orders for the well-known "American" incandescent lamp. The American company has no complaint to make of business, which is better now than it has been at the same time of the year heretofore.

With the return of good business in the electrical trade, one of the first concerns to recognize this fact has been the Empire China Works of Brooklyn, who are among the pioneers in the electrical trade in supplying genuine hard porcelain cut-outs, switch bases, insulators, etc., which are recognized as standard. The growth of their business would indicate that the merit of their goods is recognized.

Queen & Co. of Philadelphia (J. G. Gray, assignee) have recently issued a circular which is numbered 655, giving a reduced price-list from their catalogue "T." These prices will hold for a short time only, and those interested should write for this circular immediately, as unusual inducements are offered on the entire list of electrical instruments, and especially upon standard resistance boxes and condensers. Other instruments listed are "M. V." volt and ammeters, electro-dynamometers, Kelvin electrostatic and multicellular voltmeters, high grade galvanometers, keys, etc. They also call special attention to their circular number 580, describing cable testing apparatus. Opportunities are here offered for a selection of instruments such as seldom occur.

The telephone business of the Julius Andrae & Sons company of 225 West Water street, Milwaukee, is flourishing. Recent sales of instruments, switchboards and other supplies are reported as follows: Hoffman & Billings Manufacturing company, Rundle & Spence Manufacturing company, Johnson Bros., Milwaukee Bag company, Kieckhefer Bros., *Daily Journal*, *Daily Herold*, Anchor Line, Western Transit company, Gugler Lithograph company, Kalamazoo Knitting company, Schultz Paper Box company, Milwaukee; Menominee Range Telephone company, Menominee, Wis.; Wolf River Telephone company; Wanshara Telephone company, Wanshara, Wis.; Geo. C. Mansfield company, Johnson's Creek, Wis.; Citrus Belt Telephone company, California. The Andrae company has also wired and finished complete the electric installation for the Streissguth Clothing company, Milwaukee, consisting of ten arc lights and 350 incandescent lights, and has just completed the entire electric light wiring in the new hotel at Marinette, Wis., and wired the new summer residence of A. A. L. Smith at Pine Lake for electric light, bells, etc.

Times change and we change with them. The growth of the bicycle in popular favor has been wonderful, and even now the horse has been almost superseded by it. The student of history fifty years hence may perhaps read of the glorious "Charge of the Bicycle Brigade;" of another King Richard reeling from the bloody field of Tewkesbury and offering to exchange England for a Monarch bicycle; of another Sheridan scorching down the Winchester pike grasping a pair of handle bars on his swift Monarch; of another Paul Revere, not pausing a moment to tighten his saddle girth as he nervously watches for the signal light in the old North Church tower which was to ring up the curtain of the revolution, but standing by his Monarch examining it carefully to see that all nuts were tight and tires hard for a run that was destined to become memorable. The bicycle has come to stay and the reign of the horse is over, while the supremacy of even the cable, electric and steam cars may yet be overthrown. The "Golden Age," the "Electric Age," or any other remarkably progressive period in the world's history, pales into insignificance before the wonderful growth and popularity of the bicycle. This is the "Bicycle Age," and the king thereof is the "Monarch." You can get them in four styles.

Among the recent orders taken by the Walker Manufacturing company for improved street railway motors and generators may be mentioned the following: Detroit Railway company, one 750 kilowatt direct-connected generator, this being the second machine of this size which the Detroit company has ordered from the Walker company; Aurora, Ill., Street Railway company, nine complete car equipments, eighteen 25 horse power steel motors. This order is the second awarded the Walker company by the Aurora people. Akron, O., Street Railroad company, two 200 kilowatt direct-coupled generators, three complete car equipments, six 30 horse power steel motors. This is the third order received from the Akron Street Railroad company. New York, Elmsford & White Plains Railroad company, one 75 kilowatt belted generator, three complete car equipments, six 25 horse power steel motors; Lakeside Railway company, Mahonoy City, Pa., two complete car equipments, four 50 horse power steel motors; W. C. Thayer, Cleveland, O., two 200 kilowatt direct-coupled generators, ten complete car equipments, twenty 50 horse power steel motors, one complete car equipment, two 100 horse power steel motors; Ashland & Catlettsburg Street Railway company, Ashland, Ky., two complete car equipments, two 30 horse power steel motors. The company's shops are still running both day and night, and the force is being increased almost every day.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued May 21, 1895.*

539,404. Regulating Alternating Current Induction Motors. Albert H. Armstrong, Schenectady, N. Y. Application filed December 5, 1894.

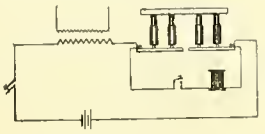
This method of regulating mechanism driven by two or more induction motors consists in coupling the motors in tandem, then open-circuiting one motor, and finally connecting the primary members of the motors in multiple with their secondaries closed.

539,418. Conduit System for Electric Railways. Wilson H. Cotton, St. Louis, Mo. Application filed August 25, 1894.

A feature of this invention is a contact shoe for electric railways, consisting of a flexible central insulating web or partition, and metallic sides attached thereto, the sides being provided with upright contact rollers, and divided into sections having interlocking ears or lugs.

539,431. Electric Bell. Francis G. Ingersoll, New York, N. Y. Application filed October 26, 1894.

There is the combination with an electric bell and its base, of a bail secured to the base, hooks, cushioned bearings, and electric contacts separated from each other and connected to the terminals of the bell circuit.



NO. 539,437.

539,437. Microphone. Ernest J. P. Mercadier and Joseph M. Anizan, Paris, France. Application filed June 3, 1893.

The cut shows the essential features of the arrangement. Claim one reads as follows: In combination in a microphone the vibrating plate and the carbon pencils comprising the carbons, the metallic sockets about the lower ends thereof and the lower bearings for the carbons consisting of the metallic points engaging the conical cavities in the metallic bearing blocks.

539,446. System of Electrical Distribution. Edwin W. Rice, Jr., Swampscott, Mass. Application filed May 24, 1893.

A system of electrical distribution is described, comprising separate circuits connected in multiple, switches at intervals along these circuits whereby sections of any circuit may be open circuited, and cross-connections made around this open-circuited section, whereby the remaining sections of the circuit containing the open-circuited section may be connected in multiple with the other circuits.

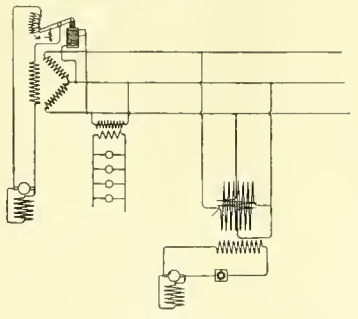
539,450. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y. Application filed December 20, 1894.

The method of electrical distribution illustrated consists in supplying from a polyphase generator or supply source alternating currents of a given phase relation for operating lights coupled in one of the branches into which the system is divided, and alternating currents of different phase relation for operating motors connected to one or more other branches of the system, and transferring energy between the lighting and motor branches through a balance wire to preserve the proper distribution of load.

539,452. Electric Meter. Charles P. Steinmetz, Schenectady, N. Y. Application filed February 19, 1895.

This instrument is devised for monocyclic circuits and comprises separate field coils whose exciting currents are respectively maintained equal or proportional to the currents in the main or teaser circuits, and separate armatures, one coupled directly or inductively across the main power leads, and the other between the teaser wire and a neutral point dividing the voltage in the main circuit.

539,453. Carbon Brush. Elihu Thomson, Swampscott, Mass. Application filed February 6, 1895.



NO. 539,450.

The method of forming commutator brushes consists in assembling and soldering together pieces of carbon coated with a thin film of metal, and incasing the bundle of metallic coated carbons in an outer metallic coating.

539,454. Carbon Brush. Elihu Thomson, Swampscott, Mass. Application filed February 6, 1895.

A commutator brush made of filamentary carbon coated with metal and mounted in a casing for strengthening it is described.

539,500. Automatic Time Switch for Storage Batteries. William Biddle, Brooklyn, N. Y. Application filed May 18, 1894.

A working circuit, two secondary batteries and the energizing dynamo are arranged in combination with a time controlled rotary circuit closer and its contact springs, a three-point circuit preserving switch, two helices and their cores or armatures standing in opposite directions and connected with the three-point switch, and circuit connections between the secondary batteries and the time controlled circuit closer, whereby the three-point switch is moved by first one secondary battery and then the other.

539,501. Electrical Instrument for Medical Purposes. Benjamin Y. Boyd, Wichita, Kas. Application filed August 27, 1894.

The instrument described consists of the combination of a galvanic battery, having positive and negative poles, the outer casing consisting of positive and negative parts, separated by an insulator and battery lining combined, and the screw plug in one end of the battery.

539,512. Telegraph Relay. Alois Gruner, San Francisco, Cal. Application filed July 28, 1894.

The claim: In a relay, the combination with a magnet having independently operated coils, of a battery, independent wires leading from the battery to the respective coils and from the coils to a main circuit, a supplemental dividing wire leading from the battery and forming an auxiliary intermediate circuit through the ground or otherwise, and a switch in the ground circuit.

539,516. Trolley for Electric Railways. John W. Hoag, Newark, N. J. Application filed January 19, 1895.

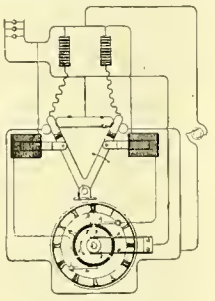
The device comprises a tubular post and an arm, oppositely projecting arms on the post, a trolley carrier pivotally arranged on the post, oppositely extending arms on the carrier and springs.

539,529. Electric Railway Signal. Henry V. Miller, Bloomington, and Alexander C. Miller, Aurora, Ill. Application filed January 5, 1895.

Among the features claimed are: A source of electric energy an electro-magnet connected therewith, a make-and-break armature lever for such magnet connected with the source of electric energy and vibrating between two contact posts, a clear light electrically connected with one of such posts and the source of electric energy, a colored or danger light connected with the other post and source of electric energy, a vibrating movable ground contact piece electrically connected with the magnet and arranged to move between two contact posts, both of which are connected with the source of electric energy.

539,537. Cleaner for Incandescent Lamp Bulbs. William O. Niles, Boston, Mass. Application filed April 13, 1894.

In the device illustrated there are a head, a plurality of resilient Ω-shaped wire arms rigidly attached at one of their ends to the head, and shaped to fit the bulb, and to enable the arms to be pushed thereupon and to be withdrawn therefrom, and a cleaning face applied to one or more of the arms.



NO. 539,500.

539,542. Magnetic Car Balancing Device. William B. Purvis, Philadelphia, Pa. Application filed May 26, 1894.

A series of connected magnets is supported on one side of a car, a switch at one end of the car having an arm in an electric circuit, a contact plate adapted to be engaged by the arm, wires leading from the contact plate to the end magnet farthest from the switch, and a connection with the magnet at the other end of the series and the adjacent axle of the running gear of the car.

539,559. Electrical Low Water Indicator for Boilers. Charles D. Tisdale, Boston, Mass. Application filed April 19, 1894.

A glass tube is connected with the boiler above and below the normal water level of the boiler and an auxiliary connector is inserted between the lower boiler connection and the lower end of the glass tube. Electrical conductors extend through the sides of the auxiliary connector, thence upwardly in the glass gauge tube. There is also a metal float having a convex surface and adapted to form an electrical connection between the electrical conductors, and an electrical generator and alarm device.

539,576. Electric Safety System for Railway Drawbridges. Edward Deming, Brooklyn, N. Y. Application filed April 4, 1894.

One claim follows: The combination with locomotives, of magnets on each in independent electric circuits which are normally closed, a drawbridge in the circuits, generators connected to the circuits at points beyond the locomotives measured from the bridge, and means controlling the motive power of the locomotives and controlled by either of the magnets.

539,583. Electric Cut-outs. John R. Hersh, Denver, Colo. Application filed January 11, 1895.

The combination is claimed with a case having a dial upon the outer face of a disk arranged within the case; also the conductor wires and plates, the fusible wires and contact plates, the brush, the operating lever and pawl and returning spring, the presser plate and indicator.

539,616. Electrical Bond Clamp. Alfred Green, Rochester, N. Y. Application filed August 27, 1894.

An electric rail bond is described, comprising the bond wire or rod, a pair of loose gibs provided each with a groove and a hole adjacent to the groove, and bolts inserted through the holes and provided each with a head having the grooves corresponding, and having means for tightening them upon the web of the rail.

539,622. Cut-out for Arc Lamps. Peter Kirkegaard, Brooklyn, N. Y. Application filed November 9, 1894.

The device consists of a carbon carrying rod and a cut out lever pivoted adjacent thereto, two projections on the lever acted upon alternately by the rod to open and close the cut-out.

539,636. Transmitter Diaphragm. George A. Nellis and Florence S. Weisser, Allegheny, Pa. Application filed March 11, 1895.

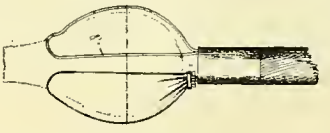
A transmitter diaphragm is claimed consisting of a plate composed of a mixture of aluminum and nickel, and another of aluminum with a small percentage of nickel and iron.

539,681. Base for Trolley Poles. Alfred Green, Rochester, N. Y. Application filed September 5, 1894.

Claim one follows: The base for trolley pole comprising the base plate formed with the socket step lined with the series of rolls, the swiveling head provided with arbor fitted within such rolls, the head being provided with spring tension arm with cross head having the tension screws provided with the double hooks, the pole provided with fork arms pivoted upon the head, and the pairs of springs connecting the tension screws and the fork arms.

539,701. Multiple Signal Transmitter. Bernice J. Noyes, Boston, Mass. Application filed November 4, 1890.

The features of this invention are: A units and tens group of rotable signal wheels, a normally open signaling key for and adapted to be closed by each signal wheel, and a motor to rotate the wheels in unison, combined with a selecting device



NO. 539,537.

including a series of normally open contacts in electrical connection with a battery, a branch wire leading from one member of each key to a group of contacts, a single wire leading from the other member of all the keys to the battery circuit, and means for closing any one of the contacts of the selecting device, whereby a circuit is completed through one of the signaling keys at each revolution of the wheels.

539,712. Telephone Call. Frederick J. Troll, Washington, D. C. Application filed September 22, 1894.

There is the combination with the box, the permanent magnets and the rotating armature arranged between the poles of the magnets of a coil spring fixed at one end of the armature shaft and directly connected to the same, a pulley fixed to the opposite end of the armature shaft, a metal tape wound about the pulley and contained wholly within the box, a lever connected at its inner end to the tape and fulcrumed to the opposite side of the box and extending through a slot in the same, and a pull handle attached to the end of the lever outside the box.

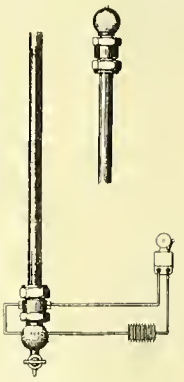
539,725. Cut-out Block. Frederic A. Chapman, Philadelphia, Pa. Application filed February 5, 1895.

A cut-out provided on opposite sides with chambers insulated from each other, contact plates secured to the sides of the plug and projecting below the bottom thereof, the upper ends of the plates being provided each with an offset projecting into one of the chambers on each side of the plug, a terminal located in one of the chambers on each side of the plug, fuse-wires connecting the offset of the contact plate on one side of the plug with the terminal on the opposite side and tap-wires connecting with the terminals.

539,726. System of Controllers for Electric Motor Cars. Charles L. Coombs, Washington, D. C. Application filed November 12, 1894.

A frame is suspended with brake-magnets secured to it, having their poles arranged to set over a rail of the track, an electro-magnet secured to the frame opposite the periphery of a car wheel, circuit connections with a rheostat or other current controlling device, and a lever for operating the device whereby a current of electricity may be sent through the magnets.

539,778. Rheostat Switch for Electric Motors. Frank B. Rae, Detroit, Mich. Application filed July 6, 1894.



NO. 539,559.

In an electric motor, the combination is claimed with the stopping and starting switch of a rheostatic switch whose resistance coils are upon the field magnet and connected in series with the armature coils, the rheostatic switch having a self-closing contact device to cut the resistance in, actuating connection to cut the resistance out by the movement of the motor shaft, and an electric clutch to make and break the connection.

539,737. Electric Treasure Guard. Robert A. Habersham, Portland, Ore. Application filed January 3, 1895.

A counter upon which money or other valuables are handled is composed in part of one or more metallic plates. There are also a metallic floor plate adjacent to the counter, an electric circuit including therein the counter and floor plates, and capable of supplying a current of dangerous strength, a treasure box or boxes arranged to have metallic contact with the counter plates, and a switch for closing the circuit.

Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, JUNE 8, 1895 No. 23

## Slavianoff Electric Welding System.

Up to the present the Thomson system in the United States and that of Benardos in Europe are chiefly employed for electric welding. A new process, entitled the "hydro-electro-thermic," is being introduced in France by Hoho & Lagrange, and appears to offer interesting possibilities, though not yet fully developed. Its principle depends on the employment of a bath and on the development of hydrogen gas at the negative pole. The gas surrounds the part of the object to be treated, forming a high resistance to the current, which is transformed at this point into calorific energy and communicated to the metal or other object forming the negative pole.

The methods of both Thomson and of Benardos are too well known to require description. That of Slavianoff, which is claimed as an improvement on both, is now receiving a growing attention on the Continent, having been in successful operation in Russia for several years at the well-known Perm Gun Works and elsewhere.

The essential principle of the Slavianoff system is contained in the supply of molten metal to the fractured part of the same nature as that of which the object to be repaired may be composed. The inventor, indeed, has adopted for European practice, as applied to his invention, the not very happy title of the "Slavianoff smelting system," accentuating the point defined by the term smelting in contradistinction to other processes.

As will be readily surmised, both electrodes in the Slavianoff system are of metal, one electrode being provided by the object to be operated on, the other by metal of the same kind in the form of a circular bar, which, during the operation, is gradually melted down. The range of work which can be successfully undertaken by this method is sufficiently indicated by the accompanying illustrations, which show some of the repairs effected in usual practice at the Perm Gun Works. It will be observed that several of these—that especially in the case of the bell, which is the subject illustrated on this page—offer almost an insuperable difficulty to even the latest practice of other systems in this direction.

The process is described to be, in all its details, one of the greatest certainty, ease and convenience. The metal electrode affording the supply of molten metal is self-regulated by means of a spring and solenoid, by means of which its uniform position while melting may be automatically maintained. This regulating apparatus occupies but little space, and is so arranged that in case of an accident to the dynamo the workman can at once throw the whole apparatus out of operation. In addition to the regulating mechanism referred to, there is a solenoid, and also a commutator arranged in the electrical circuit. As the heat given off at the negative pole is about double that of the positive, an arrangement is made so that the current may be reversed at will in order to bring any or either, or any part, to a higher temperature. It may be mentioned that this variation in the current direction is accompanied with an effect on the chemical construction of the metal; it being possible, for instance, to produce a hard white, or soft gray iron.

The chief operations connected with the Slavianoff process are briefly as follows: The mechanical preparation of the object to be treated; the formation (where necessary) of the mold; the heating up prior to casting; and finally, the casting operation itself. A good joint is of course dependent on an uninterrupted metallic surface; and as the formation of a layer of oxide would prevent a homogeneous joining of the surfaces, pulverized glass is sprinkled over the metal bath; which forms a thin skin that excludes the air.

It is claimed that this process is applicable to al commercial metals,—cast-iron, wrought-iron, copper, bronze, etc., all being perfectly utilzible for the Slavianoff system. It is also claimed that an economy is effected over the Benardos system by the whole of the electric energy, part of which, in the process referred to, is expended in the heating of the carbon electrode, being applied to the direct operation, while, further, the metal at the point of repair is not rendered undesirably hard.

SLAVIANOFF ELECTRIC WELDING SYSTEM.—SPECIMEN OF WORK.

## The Regulator Patent.

Beginning on Saturday, June 1st, Judges Woods, Jenkins and Showalter, sitting in the United States Circuit Court of Appeals, in Chicago, listened to arguments on the appeal from Judge Grosscup's decision declaring the regulator patent void. This case is of great importance to all dynamo manufacturers, and the opinion of Judge Grosscup was given in full in the WESTERN ELECTRICIAN of January 19th last. The Thomson-Houston company took the appeal and is represented by Judge Robert S. Taylor and F. P. Fish, while Barton & Brown appear for the Western Electric company, the defendant in the original infringement suit. If Judge Grosscup is overruled, and the patent held to be valid, suits will doubtless be begun against other manufacturers, as the Circuit Courts of Appeal are courts of final resort in patent cases, unless the case is of sufficient importance to be certified to the Supreme Court by an especial arrangement.

## Niagara Falls Power Plant.

The Cataract Construction company will locate its transmission station on land it has bought from the North Tonawanda Land company in Gratwick. It is now positively announced that Tonawanda will be using current from the Falls about August 1st.

John Jacob Astor of New York, Dr. H. Walter Webb, vice-president of the New York Central & Hudson River Railroad company, and Edward A. Wicks, vice-president of the Cataract Construction company, made a trip to Niagara Falls recently on the private car Viceroy. They were driven to the power house of the Construction company and inspected the plant. It is supposed that the visit was in reference to substituting electricity in place of steam on the Central's branch between Niagara Falls and Buffalo.

It is said that the preparations were not quite completed Saturday night, May 25th, to start the dynamos in the power house, but it is reported that on Monday morning, May 27th, one of the machines was started and operated in a satisfactory manner.

The contract for the electrical generator and motors for the Plumb, Burdict & Barnard Bolt and Nut Works at North Tonawanda has been awarded to the General Electric company through the resident agent, Thomas H. Feary. The plant will consist of a 200 horse power three-phase generator, seven six horse power and nine 20 horse power three-phase induction motors. These motors will probably be run by current from Niagara, but the firm could not wait any longer for the Cataract company, so it purchased a generator of its own and motors adapted to use the Niagara current as soon as it is obtainable.

This will be the first polyphase motor plant outside of Niagara Falls constructed to be run by Niagara current, which will be brought over twelve miles. The electric machinery and apparatus for the Pittsburg Reduction company and Carborundum company at Niagara Falls are also furnished by the General Electric company.

## How We Made Acetylene.

By One of Them.

We were five in number. There was the little professor of chemical atoms an authority on gases and salts, who knows more about agents and reagents, single and multiple, than any real estate concern in the city, and can fill the role of ringmaster to a chemical circus with pyrotechnical accompaniment, and never fail to make a hit. Then there was the doctor, who is famed as a hunter of a different form of atoms—a far-seeing microscopist, who could find an atom of vitality so small that a labor-day procession of them could march on the edge of a razor and leave room for spectators on either pavement. The third member of the party was the patron professor, who knows all about ohms and volts and re-volts and units, looking very wise and saying very little. The professor of gauges and of quantities, and the working professor, whose shoulders bore the brunt of the battle, completed the party.

It was one evening in May, when the Annanias who rules the weather destinies of our city had just whispered, "90° in the shade," to the journalists, when we gathered for the grand experiment. The stairs were many and long and steep that led to the working professor's den, and the chemical professor explained fully the constitutents of the saline fluid which oozed from every pore as we climbed, and the lines of the poet came pat as we reached the last stair—

> Ah! Who can tell how hard it is to climb
> The steep where fame's proud temple shines afar.

The working professor's den is a marvel of agglomerations. Scales for weighing, scales for measuring, tables for computing, tables on which we sat, lathes and motors and dynamos, and oh! how fortunate—fans, for the "sensible moisture excreted" from our manly brows, which, the little professor told us, was largely an aqueous solution of sodium chloride, demanded an enlivening of the air, to render the den inhabitable; and the working professor set the little windmills in motion.

Few and short were the words we spoke, but we got down to business at once after the three strange professors had been made acquainted with the keeper of the den—the working professor.

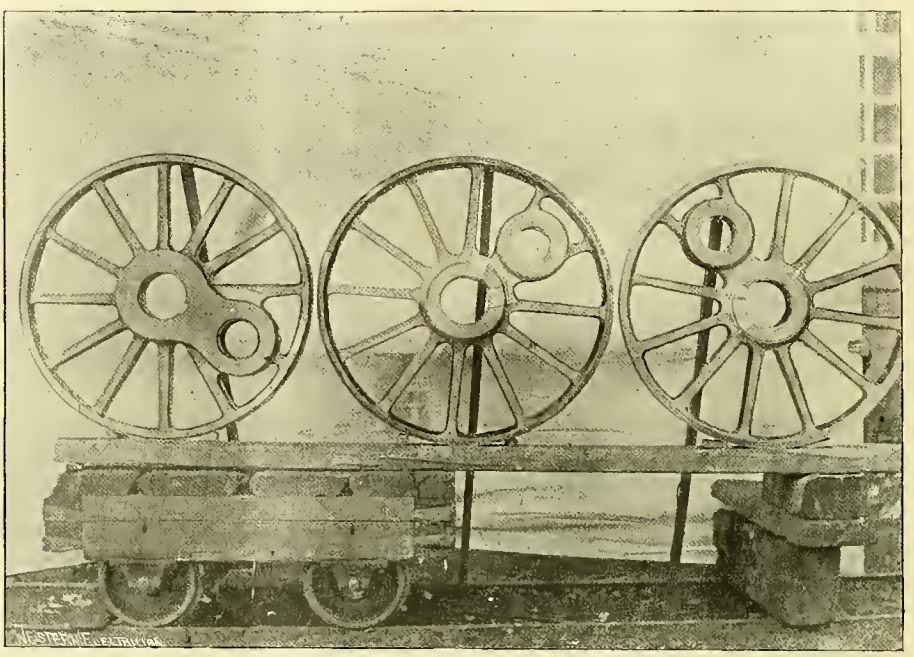
The little chemist brought out his package: two fire clay crucibles, a package of the finest bone charcoal and a bottle of chemically pure lime. Intimately mixed, the black and white ingredients became a clean pepper-and-salt gray. Two carbons for electrodes, well wired for contact, were then produced and placed in the larger crucible and the vessel filled with the gray powder. The contact was made through a water resistance, arranged for the occasion by the patron professor; an ammeter and voltmeter, borrowed for the occasion, were brought into line and the experiment was on.

7:15 P. M.—30 volts by the pressure gauge; 25 amperes. The arc is established. The heat is appreciable on the outside of the crucible. 7:35.—A flash, a boom and all is dark! The plate in the water resistance has a hole through it as large as your thumb and a fuse has blown in the cellar, four floors away and out under the sidewalk. None of us but the working professor knew where to find or how to replace the fuse. People on the first, second and third floors groped in the dark and started down wondering how they had wrought the mischief. There was quite a convention in the cellar and it was hot in the den.

7:45.—The lamps are again lighted, the fan has started anew and the working professor has returned. Again the contact is made and the current takes up the thread of its labor.

The doctor of atoms now wearied of the delay—there were no bugs to interest him—and the patron professor went out for a lunch which he had forgotten to eat.

For the next hour there was little to break the monotony.

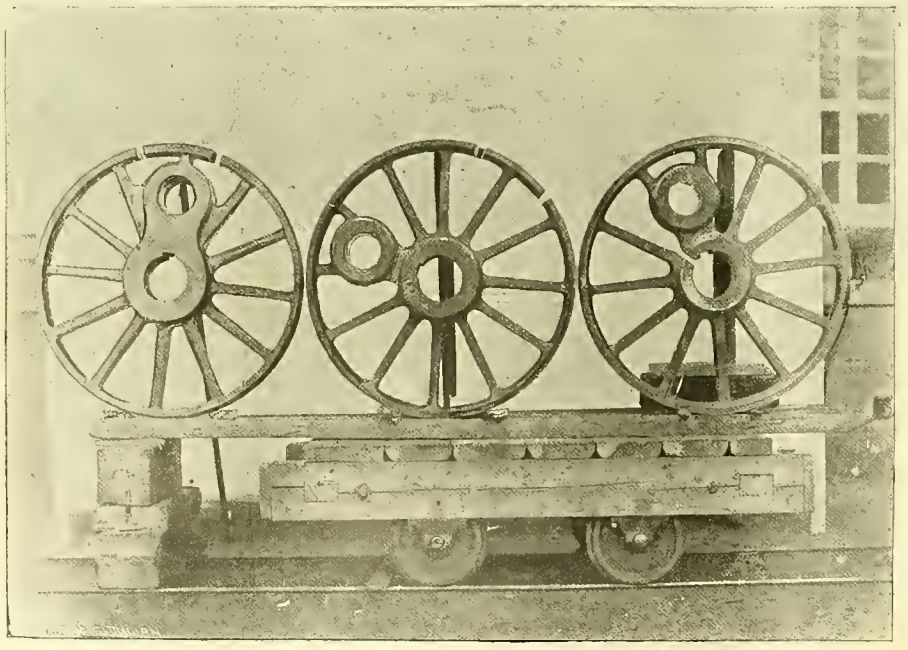


SLAVIANOFF ELECTRIC WELDING SYSTEM.—SPECIMEN OF WORK.

Flames of a bluish tinge came up through the mass and lime was spread over the top to keep these from consuming the coal. A decided smell of garlic pervaded the den, which was apparent to all save the chemist, who gave as excuse that he had eaten some raw onions just before coming up to the den. The patron professor returned and complained of the onions he fancied he smelled, which the professor of gauges and quantities explained was acetylene gas, a chemical odorific, and not a vegetable perfumer.

There was sufficient moisture in the carbon electrodes to disengage the acetylene from the calcic carbide, and four professors were in great glee over the result.

8:15.—The cooking had now progressed for one and one-half hours and the current was cut off. The fan was turned on to the red cheek of the crucible, and in 15 minutes more the mass was poured on a slab of tile. Four pairs of eyes gazed inquiringly through the garlic-tainted atmosphere, and saw in the bottom of the crucible about three ounces of carbide, which, broken from the crucible, was tested by putting it in water. A few bubbles of gas arose to the surface, but matches failed to light it. Disgust settled on the brows of four disappointed scientists, and while a sort of consolation meeting was in progress, there was a snap and a flash in the vessel of water. More and more frequent these became and a very pretty show of will-o-the-wisp explosions and rings followed. The professors had discovered a new method of producing phosphoretted hydrogen, a gas which explodes with a flame when brought into contact with the air. The experiment was interesting if it was a failure in the direct line, and the wise quartette concluded that at present at least, neither the electrical people nor the Welsbach advocates need have any fear of competition from acetylene gas as an illuminant, but we desire to place the fact on record that we did make calcic carbide and calcic phosphide, and acetylene and phosphoretted hydrogen gases.



SLAVIANOFF ELECTRIC WELDING SYSTEM.—SPECIMEN OF WORK.

## General Electric Company Non-suited.

Justice Childs has granted an order of non-suit with costs against the plaintiff in an action brought by the General Electric company to collect $2,000 from George B. Wightman on an agreement to subscribe for stock in the Buffalo, North Main Street & Tonawanda Electric Railroad company.

This case will settle finally all actions that were instituted by the Buffalo, North Main Street & Tonawanda Railroad company, in which the General Electric company was substituted as plaintiff against many citizens of Buffalo. This case is one of much importance and is of interest to many persons who agreed to subscribe for stock in the road known as the Arend road, running from Buffalo to North Tonawanda. The same facts were involved in this case as in the others.

## Electric Lighting in Paris.

Some very interesting statistics on the employment of electricity for lighting in Paris are presented in *L'Industrie Electrique*, compiled from the official returns of last year:

| Company. | Number of Patrons | Number of arcs. | Number of incand ts. | Output kw.hours. | Yearly receipts francs. |
|---|---|---|---|---|---|
| Edison | 1,208 | 781 | 43,978 | 1,586,371 | 1 897,293 |
| Parisian | 930 | 1,566 | 34,758 | 1,144,082 | 1,338,027 |
| Light & Power Co. | 1,061 | 2,391 | 46,996 | 1,253 482 | 1 298,632 |
| Secto-Clichy | 1,025 | 721 | 48,020 | 740,826 | 939,572 |
| Sector-Champs-Elysees | 260 | 91 | 27,925 | 133 503 | 169,867 |
| | 4,484 | 5,553 | 201,677 | 4,858,264 | 5 643,391 |

## Another Trade Affected by Electrical Progress.

[From the New York *Sun*.]

The horseshoers hereabout complain that their trade has been nearly ruined by the substitution of electricity for horse power on the surface cars, and also by the elevated railroads. Yet no intelligent horseshoer can desire that the benefits of the electric motor shall be denied to mankind for the advantage of his trade. The new motor promotes the welfare of millions of people, while the displaced horseshoers are but a small body of men. All the new labor-saving appliances are helping mankind to better times, and are also furnishing new opportunities to labor.

## Visual Sound.

By W. E. Irish.

It is well known that the vibrations caused by the utterance of words, by musical notes and other sounds made near a telephone or transmitter diaphragm or stretched drumhead, or any other flexible disk, held firmly at its periphery, leaving its center free, will be in unison with the sounds conveyed to it. There can be no doubt as to this fact in the mind of anyone who has ever examined and studied the Bell telephone. The vibrations of the diaphragm at the transmitting end of a pair of Bell 'phones vary with every sound, but for the same sound the vibrations remain a fixed quantity; therefore it is necessary for the diaphragm at the receiving end to make exactly the same number of vibrations and in exactly the same time to reproduce the sound which set in vibration the transmitting diaphragm. This being the case, it only remains for someone to devise a simple means whereby; instead of reproducing the sound as in a telephone, these vibrations are caused to be recorded in ink on paper, so as to give a distinct character or figure for every different sound affecting the diaphragm.

When he has done this he will also have discovered the key to a universal language and will have given to the world one of the greatest physical and mental labor-saving devices ever enjoyed.

It does not appear to be, and really is not, such a very great problem to solve.

Such a device would, in addition to being the key to a universal language and great labor saver, also be the key to a universal system of recording our own thoughts and the thoughts of others by means of the same simple sound characters, as in writing, printing, telegraphing, etc., but most important of all it would be the means of solidifying the thoughts of ablest men as fast as they could utter them.

Through its agency children would acquire more useful knowledge in two years with far less labor than they by the present system can now in five years.

The letters of the alphabet and orthography as now known would be entirely abolished, and correct pronunciation and visual sound characters substituted.

The student would be helped by hearing the teacher pronounce the words that would at the same time be visually represented.

Such a machine would write the whole of Webster's dictionary with about fifty different characters, all of which could be more readily learned than the spelling of fifty of the simplest words by means of the letters of the alphabet. These characters would convey much more readily to the mind and senses their import than is possible by any other means.

The future generations would not be mentally taxed to reason out why if P-L-O-U-G-H spells plough, D-O-U-G-H must spell dough.

The arbitrary characters which we employ to express our thoughts visually are by no means limited to twenty-six or to several hundred, for the reason that there are in many instances over thirty accepted different types of character representing the same letter. On this account the first lesson book for children should start out thus:

"A stands for ass, symbolical of the man who introduced the first variation in the formation of letters, for variation alone—thereby making the teacher's task perplexing, the pupil's more difficult and irksome, and the general reader's vexatious."

As true sound characters cannot be altered without changing their meaning, we may hope, should they come into general use, that they will be permitted to retain their simple natural form. Such an apparatus would save the author, editor, reporter, student and commercial man the drudgery of the pen and would enable them to preserve their brightest ideas.

The literary man would simply have to convey his best thoughts to the machine to have them recorded at unlimited speed in characters which would not require transcribing to be understood by others.

A person having a knowledge of these characters would be able to read German, French, Spanish, or any other language recorded by the machine, perfectly and with correct pronunciation, although the meaning might be quite unintelligible to him.

It would be a great help to the traveler in a foreign land, as well as to the student learning a foreign language.

In the study of music these characters would be of immense advantage. Records of pieces played by our most able masters, with feeling such as notes alone cannot convey, will represent the sheet music of the future.

In these visual sound characters newspapers, books and other printed matter will be published on one-fifth the amount of paper and with larger type and more distinct spacings, or when necessary, these same characters will be written with the pen or typewriter. A knowledge of these visual sounds will be acquired without any special effort or mental training, as while the learner listens to a telephone he will see the characters representing the words he hears written, and while speaking he will see his own talk also recorded.

Such an instrument would be found an able automatic secretary, a trusty automatic stenographer and a reliable automatic typewriter in sound characters, always ready and never tired or in the way.

These natural characters would be very much more complete and fewer in number than any arbitrary system of shorthand.

By the aid of such an apparatus, telephones would be brought to their fullest measure of usefulness, as all messages would be recorded without additional trouble.

Such a sound recorder would soon become a requisite in every office, school and home. It would be the tutor, help-mate, slave and friend of everyone, from baby to great-grandpapa, and from the idiot to the scholar. Even to the deaf or the blind or the dumb or the armless, it would be a comfort and a blessing, as all could use it to advantage.

We have but to call to mind the phonograph to remember that attempts have been made in this direction, but the stylus of the phonograph makes indentations in a soft medium, such as wax, from which the sounds may, in a measure, be reproduced.

These indentations, however, have never been visually deciphered and it is doubtful whether they ever will be.

If a magnified section at the center could be obtained, showing the variations and depth, etc., of the indentations, it might then be possible, but such a plan would have no useful application. In the successful instrument the stylus or pen must be free to vibrate in any direction and discharge a continuous jet of ink after the manner of the pen in Thompson's syphon recording telegraph.

SLAVIANOFF ELECTRIC WELDING SYSTEM.—SPECIMEN OF WORK.

## Power, Light, and Heat in City Blocks.[1]

By J. E. Talbot.

In considering the question of the cost to the consumer of obtaining a supply of electricity for lighting or power, it is very commonly assumed that, unless the quantity required is likely to be very large, the most economical plan is to arrange for receiving a supply through the street-mains from the most available central station. This, as a general proposition, may be admitted without question, but it is an old maxim that "*cessante ratione, cessat lex ipsa.*"

SLAVIANOFF ELECTRIC WELDING SYSTEM.—SPECIMEN OF WORK.

If the very causes that have been instrumental in the spread of central-station lighting to the partial exclusion of isolated plants are, in some cases at least, no longer operative, then the whole question is reopened.

The controlling considerations which led to establishment of the system of central lighting and power stations were the greater economy of large units, the longer "hours of earning," and the lower cost of operation due to the centralization of business and *personnel*—the same centralizing tendency which leads to the formation of our much-berated "combines," monopolies and trusts. It is true that it would

1. From the *Engineering Magazine* for June, 1895.

scarcely pay a consumer requiring not more than one or two hundred incandescent lights to install an isolated plant, provided it were practicable to obtain current from the street service at a fair price; and it is further true that a large number of the existing isolated plants were put in operation at a time when, or in a situation where, a reliable central-station service was not available. Let, however, the capacity of the plant be increased to 100 or 200 horse-power or upward; then we begin to approach conditions comparable with those of the central station. Take, for example, the case of a large "block" or "square" in one of our principal cities, and we find a population or occupancy equaling or exceeding that of a fair-sized town. Such a block may contain a hotel, a theater, an express office, a newspaper office, and stores of various kinds, as well as a number of light manufacturing industries, so that the power required in the form of electric current for lighting, for motors, and, in an increasing degree, for heating and cooking purposes, may easily run up into hundreds of horse power. Such a block, with the buildings upon it, may easily have a value of several million dollars; it may belong to one or several owners, and may possess a portion or all of the above-named characteristics of occupancy, and even more. These and other considerations materially modify the conditions of the problem in different cases, but in all there will certainly be the requirement of light, and, in nearly all, that of heat (almost universally in the form of steam distributed to radiators), as well as power for elevators, fans, sewing-machines, lathes, pumps and tools of different kinds. This being so, it becomes necessary for the proprietor, or proprietors, to provide some kind of steam plant, or, it may be, more than one, at a cost of several thousand dollars, and also to provide skilled labor for the operation and maintenance of that plant. The tenants may obtain their light and power from the owner, or they may provide them independently of him.

SLAVIANOFF ELECTRIC WELDING SYSTEM.—SPECIMEN OF WORK.

Now, following out the very principle of centralization and economical operation which has led to the establishment of existing stations for the distribution of current, let us assume that the proprietor, or combined proprietors, establish a central station of their own for all purposes within this block adapted to service by the electric current; then the question arises: Is there not in such a condition the potentiality, not only of economy in actual requirements, but also of some profit? And in both cases would these not be greater than they would if the necessary current were purchased at the usual rate from a company operating a central station, assuming such to be available? The answer to such an inquiry must depend upon various considerations. In the first place, such a proprietor already has the real estate and buildings, as well as the steam plant, subject to the necessary increase required; he has already provided the necessary fuel, labor, and supplies, subject also to some increase; the wiring and fixtures would be furnished by him in any case. Against this, he will receive a considerable revenue from his tenants, which would otherwise go to the gas or electric light company. It is true that in the operation of his plant he cannot expect to obtain as high a degree of economy as is possible in a large central station, but, as a set-off to this, there are many expenses that he would not have to bear. Eventually it is the consumer that is depended upon to make the central station remunerative. He it is, in the end, who has to pay the dividends, the interest on the capital invested in the real estate and buildings, the steam and electric plant, and the complicated and expensive system of canalization. He has to pay the salaries, wages, taxes, insurance and bad debts; if the revenue will not meet these charges, more revenue must be extracted from the consumer, or the central station must stop business.

No very exact figures can be given as to the actual additional cost of providing electrical facilities of the kind suggested, but some data may be presented, throwing a little light on the question. The quantity of additional fuel needed can be approximated by estimating a consumption of five pounds of coal per horse power hour, which, at $3 per ton, gives a fuel cost of ¾ of a cent per horse power (say ten 16 candle power lamps) per hour. Considering the staff of engineers, firemen, janitors, watchmen, etc., which would necessarily have to be carried on a plant or establishment of this nature (even if an electrical outfit were not provided), some one of whom would necessarily be on duty at all times during the 24 hours, the additional labor required would be comparatively little, while the extra oil, waste, water and sundry supplies would be but a trifle. Steam at a pressure of perhaps 120 pounds would be used, if the most economical engines were employed, but the entire heating of the block could be taken care of by the exhaust steam from the various engines if the heating apparatus were properly installed to prevent back pressure. If electric elevators are used the cost of a hydraulic system is, of course, saved, to say nothing of electric as compared with hydraulic means.

It is not to be assumed, of course, that every city block is adapted to such a light and power service as that which has been suggested; the writer has, however, now in his mind an actual instance of a block containing one large hotel of perhaps five hundred rooms, one large newspaper establishment, four restaurants, several small industries (such as tailoring, metal working, electro-plating), Turkish baths, a drug store, a book store, telegraph offices, many private business offices, and a police station to look after the morals of the whole. Five thousand incandescent lights connected with some multiple circuit arc lights (and perhaps a searchlight for the police station) would not more than fulfill the requirements for illumination, and with say eight or ten elevators, together with printing presses, sewing-machines, laundry apparatus, tailors' heating irons, soldering irons, coffee urns and motors for ventilating and light manufacturing, some 250 to 300 kilowatts in the form of light, power and heat are plainly "in sight."

That great desideratum, a constant, or at least a continuous, load throughout the whole 24 hours, can be more nearly realized in this case than with the usual isolated plant. Take, for example, the case of ten elevators; some of these will run say ten hours a day only, others 15 to 18 hours, and one or two day and night. For an elevator having a load capacity of 1,000 pounds and running 240 feet a minute, a maximum horse power of 15 may be allowed, while the average load will not exceed one-third of this; allow, therefore, 50 horse power. Then, again, as to incandescent lights (or arc lights on parallel circuits) in such a block as we are now considering, although naturally the bulk of the lighting would be from 4 P. M. to 11 or 12, yet a number of lights would be needed all day or at intervals through the day. Kitchens, the back part of restaurants, cellars, laundries, billiard-rooms, hallways, inside offices, vaults, porters' rooms, lavatories, etc., would provide an all-day load which, on a total number of 5,000 to 6,000 lamps connected, would not be over-estimated at 30 to 40 horse power. Motors for light manufacturing work, fans for ventilating and motors for washing machines and a variety of other purposes, will also add to the earning capacity of the plant during the daytime, and then, in the slack hours from midnight until early morning, there would be the newspaper presswork, in addition to the lighting of the newspaper offices, exterior arc lights and incandescents in the hotel and elsewhere. Thus, it will be seen, no inconsiderable portion of the electric installation would be continually in operation, and, by a judicious selection and arrangement of units, could be kept working at maximum efficiency at all times.

It may be objected, it is true, that we are proceeding on an unwarranted assumption that the light, heat, motive power, ventilation and the like provided for occupiers will be appreciated by the tenants on a money basis, so that a reasonable return on the investment may be anticipated. In New York, Chicago, Denver, San Francisco, Cleveland and the other modern and progressive cities we think there can be no question that offices, stores, workshops and other places supplied with such conveniences would find tenants much more readily, and at higher rentals, than the old dingy, stuffy, gas-befouled premises of a rapidly-disappearing era, some of which are still to be seen in our more "conservative" cities. In modern building, indeed, it is frequently the case that electricity is the only illuminant for which provision is made.

In the absence of definite figures only an approximate comparison can be made of the cost of production of electric energy in such a plant as that under consideration, with similar cost in a central station, but the analysis of data from a number of central stations shows that the actual cost (omitting interest on capital and dividends) of delivering one kilowatt hour to the consumer does not exceed seven cents, and is in some instances considerably less, while the price charged averages about 20 cents. The cost of fuel, under central-station conditions, averages from one-fifth to three-fourths of the total operating expenses, and although a "block" plant could not anticipate quite as high a fuel efficiency a sa well managed central station, yet in such a case other items (making up the greater part of the cost) are the either absent or largely reduced. No provision has to be made for paying dividends on watered stock; no large salaries to superintendents and experts; no wages of inspectors and outside men; no repairs or maintenance of outside conductors; no additional real estate and buildings; trifling loss in conductors from station to consumer; less taxes and insurance, and less expenditure for repairs. The whole installation would be directly under the eye of the proprietor, or man in charge of the plant, and changes in wiring or repairs could be made at cost by an employe of the establishment. As to the method of charging the

SLAVIANOFF ELECTRIC WELDING SYSTEM.—SPECIMEN OF WORK.

tenants, the price of their supply might, as to light, be included in the rent, or be fixed by contract (so much per lamp per month) or by meter, according to circumstances. Motors are customarily owned by the consumer, and power is charged for at their rated capacity per month, the tenant using all or any portion when and as he pleases. The details of the service will regulate the price to be charged, in the absence of a fixed rate per kilowatt by meter. Thus the running of ventilating fans may be considered almost a continuous full load service; the elevator service is intermittent and variable; sewing-machines, lathes, drills, etc., intermittent and of small average—so that the actual power consumed in any given period may be three or four times as much in one class of service as in another of nominally the same capacity. We do not, however, purpose here to deal with the details of this work; these must, from the nature of the case, be left for consideration in connection with the individual instance.

The use of storage batteries to relieve the dynamos for the supposed comparatively short period of maximum load might suggest itself. It is believed, however, that in the present state of that art in this country, taking all circumstances into consideration, this would be an advisable addition.

In the foregoing remarks it has been taken for granted that occupants of offices, stores, or premises of the class involved in the consideration of this subject will avail themselves largely of the conveniences afforded; but occasionally an individual might be encountered who has derived his ideas of life from the Plymouth immigrants or from the period of William Penn, and to him these "new-fangled" notions might seem distasteful; yet, after a short actual experience of the resources of modern civilization, he who came to "scoff" would "remain to pray."

By no means have we dealt with every aspect of this question; rather would we suggest matter for elaboration and inquiry, the local conditions in every case materially affecting the problem. At the same time it does seem certain that in very many instances such a "block" plant as has been suggested would enable complete electric service to be obtained under conditions where otherwise it could not be had, or at least not so readily, conveniently or economically.

## Fisk Telephone Switchboard.

Knowing ones in the telephone business say that the time has come when telephone exchanges should be equipped entirely with metallic circuits, and that there soon will be no grounded lines; and many say that those equipping new exchanges are making a mistake when no provision is made for complete metallic circuits. Another very important feature that contributes largely to the convenience of a telephone exchange, and without which, it is said, no switchboard is complete, is an effective and simple night-bell circuit. And experts say further that one point to be guarded closely is the avoidance of obstructions in a talking circuit.

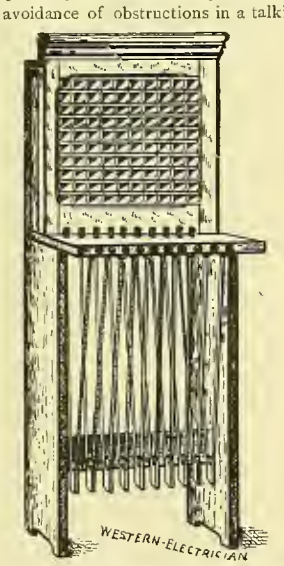



FIG. 1. FISK TELEPHONE SWITCHBOARD.

Coils when placed across lines for signaling or other purposes of course act as a shunt to that line. To overcome this difficulty these coils must be wound to a high resistance to practically cut them out; in other words, experience seems to have taught telephone men that coils of about 500 ohms at least should be used. Such points as these suggest lines of work to the modern switchboard constructor, and although perhaps not thoroughly appreciated by the larger number of layman buyers of telephone exchange equipments, there will nevertheless come a time when they must be considered, else inefficiency in exchange operation result.

Buyers of switchboards, to be of the best, will be interested in the accompanying illustrations of a new switchboard for telephone exchanges, invented by H. M. Fisk of Chicago, which has several novel features relating to the above points to commend it to the public. One of the most important is its simplicity, which is claimed to be almost phenomenal. The cut, Fig. 1, shows the appearance of the board, carefully and substantially constructed and ready for attaching lines. It is four feet high, 16 inches wide and seven inches deep, with a table ten by 18 inches. The striking feature of the board is the absence of spring jacks. These are placed on the plugs, and instead of there being one for each subscriber there are two for each pair of plugs used, and these are always convenient for cleaning and repairs. But as a matter of fact the jacks will never require cleaning, as the constant use of so few will always keep them bright. As a means of connecting to the line there are lugs of German silver extending from the back of the board, and provided each with a groove for receiving a small nib on the springs, Fig. 2. In this cut *a* represents the shutter or drop in its normal position; *b* represents the armature supporting the shutter; *c* represents

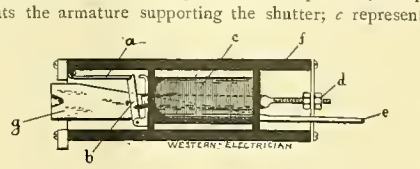



FIG. 2. FISK TELEPHONE SWITCHBOARD.

the coil and *d* represents the means of adjustment; *e* shows a means of attaching to framework *f*; *g* represents means for attaching the jack to the line.

The framework for holding the drops is made of the best quality hard rubber, allowing a space of one inch by one inch by four inches in the clear for each drop. The drop or signal is substantially constructed and may be readily adjusted at any time, or any drop can be detached from the board without disturbing the others. At the front of the board is hinged a shutter, swinging on a small steel pivot, supported at either end by metal bearings and so arranged that when thrown up and back it will catch upon the top end of the armature in a grove provided for that purpose. The coil of the electromagnet is two and one-half inches long and is wound to at least 500 ohms. At the front lower end, pivoted on two pointed screws, is the armature. A very simple wrinkle is provided to prevent it from sticking to the end of the core when the latter becomes demagnetized. At the back end of the coil are provided means of readily adjusting it with the shutter. At the back end of the core a small threaded portion extends far enough to receive a nut and lock nut, also a plate is screwed to the back of the frame, making a substantial fastening and a ready adjustment, two important factors in a good switchboard.

The advantage gained by winding the coils to a high resistance needs no explanation to telephone men, and Mr. Fisk claims it needs but a trial to convince anyone that it is the only true way of making a coil which has anything in common with a talking circuit, and it can readily be adapted to any system of wiring known to telephoning; it can be bridged across the line, it can be used on a grounded system, it can be used with a common return, or can be used on a straight metallic circuit and connected to ring to ground, and that is more than can be said, Mr. Fisk believes, of any other drop that is in the market for public use. The old telephone companies have long since found that high winding is the only successful method, and recent purchasers of exchanges have this to learn. One hundred ohms seems to be the standard adopted by most manufacturers of switchboards. The Fisk telephone switchboard is manufactured by Forsyth & Fisk, Manufacturers' building, corner Randolph and Canal streets, Chicago.

## Swiss Water Power Plant.

The accompanying illustration shows a well-arranged water power and electric plant in Ragatz, Switzerland, which is used to furnish light to the hotels and houses of the town. The building is of stone, which is very abundant in the neighborhood. Ragatz is in the valley of the Rhine, and the power is furnished by the Tamin, a tributary of that river, which has a flow of an average of three cubic meters per second, the fall available being 16 meters. It is estimated that the stream can furnish 480 horse power, of which only about 300 horse power is at present used. This runs 2,000 incandescent lamps and 42 arc lamps. There are also two electric motors, one rated at five horse power and the other seven horse power, receiving their power from this plant; both are used to run elevators.

The motive power is supplied by three Girard turbines with vertical shafts. Water is brought to the turbines by the large pipe shown at the right of the cut. The motion of the turbines is transmitted to a single driving shaft by bevel gearing, and the dynamos are driven from this main shaft by belts. A regulator is provided, as shown in the engraving, which is a section through the center of the building. The figures in the cut are in meters. At present there are in use four dynamos of the four-pole type, running 420 revolutions a minute, and rated at 72 kilowatts, 120 volts and 600 amperes. The building is so arranged that two more dynamos can be added if necessary. The four dynamos run together and are not connected with distinct circuits. An indicator is provided which gives notice of any considerable variations in voltage, and each dynamo is moreover provided with its own amperemeter and voltmeter. The picture is from *Le Genie Civil.*

## Physics and Electrical Engineering at the University of Illinois.

The following abstract of a paper on "The College of Engineering," by W. R. Morrison and P. Junkersfeld, is taken from the *Technograph*, the organ of the engineering societies of the University of Illinois:

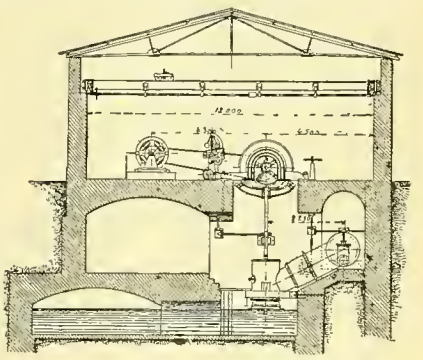
The department of physics and electrical engineering was created six years ago. Prof. S. W. Stratton, now of the University of Chicago, was placed in charge. Previous to 1888 physics had been taught by professors in other departments, and some instruction in electrical engineering had been given incidentally in the mechanical engineering course. For the last two years Dr. D. W. Shea has been at the head of this department. The growth of the department has been very rapid, and it is now one of the largest in the university. The work in physics presented for all students in the College of Engineering is intended to give such a knowledge of the more important laws and phenomena of physical science as to enable the student to profitably pursue his subsequent technical studies. More extended courses for scientific research are also offered. The work in electrical engineering is given with special reference to the needs of those who are preparing for work in the practical applications of electricity.

In Engineering Hall the department occupies the first floor of the west wing, and the first, second and third floors of the north wing. The rooms include an office, private studies, a lecture room, a large laboratory, cabinet rooms, preparation room, testing rooms, a constant temperature room, class room, drafting room, seminary rooms and a work room.

The lecture room is in form of an amphitheater and has a seating capacity of 200. The lecture desk is composed partly of thin masonry pieces, thus permitting the use of apparatus in demonstration which could otherwise be used only in the testing rooms. The facilities for experimental demonstration and illustration are very complete, gas, water, steam and electricity being available. Many phenomena may also be shown by the use of an electric lantern. The curtains of the room are controlled by means of an electric motor so that the room can be easily and quickly darkened.

The general laboratory occupies the third floor of the north wing. The equipment consists of apparatus carefully selected with special reference to quantitative laboratory work. Most of the apparatus used by students is kept in the adjoining store room. By means of a small freight elevator, this room is in direct communication with the cabinet room on the second floor and the testing rooms on the first floor. In advance work, the apparatus for special investigations is set up permanently or kept in specially provided cases. The testing rooms are all provided with masonry piers and dark curtains.

The dynamo laboratory is located in the basement of



SWISS WATER POWER PLANT.

University Hall. The rooms are: a direct current dynamo room, an alternating current dynamo room, two general testing rooms, a battery room, a photometry room, a store room and a work room. The laboratory is supplied with power from a 50 horse power steam engine. The equipment in direct current machinery includes a Brush 10 arc light plant, a Thomson-Houston three arc light plant, two Edison dynamos and a Thomson-Houston incandescent dynamo, and a Jenny 500 volt power plant. The alternating current machinery comprises a Thomson-Houston 300 light plant, two small single phase Westinghouse machines and a number of transformers. The measuring instruments are of late design and from the best makers. There are very complete sets of Weston and Whitney ammeters and of Weston voltmeters and voltmeters for direct and alternating currents, electrostatic, voltmeters, condensers, electro-dynamometers, Thomson balances, portable testing sets and galvanometers of all kinds. The laboratory is also supplied with much accessory apparatus, such as cradle dynamometers, prony brakes, contact makers, non-inductive resistances, arc and incandescent lamps and an electric light photometer. A number of lathes and a large variety of tools constitute the equipment of the work room.

The Lake Street Elevated company of Chicago is considering the advisability of adopting electricity as a motive power. It was recently reported that contracts had already been let for electrical apparatus, but this was denied by Attorney Knight. Mr. Knight admitted that the matter was under consideration, but said that it might be some time before the company would be in position to let contracts. The business of the Lake Street company is still disappointing, the average daily number of passengers carried being about 30,000.

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CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK
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THOSE who follow closely the contentions in the Patent Office cannot fail to notice the frequency with which reference is made to decisions in electrical cases to determine points raised before the commisioner, as well as in the federal courts. It is really remarkable that so much litigation should have accompanied the development of so young an industry. Apparently every conceivable point of litigation has been determined in contests over electrical patents, and an attorney familiar with the history and findings of electrical patent cases is well equipped for general practice in the Patent Department.

IS MCGRAW going to quit? Will Johnston drive the *Journal* out of the field? These are questions suggested by the present relations of the two eastern trade papers devoted to street railway enterprises. People out here are wondering how street railway men will receive Johnston's methods, how they will like to be relieved of the responsibility of placing their advertisements, and whether they will believe all the pretty stories the newcomer will tell them with an air of child-like simplicity. By the way, what has become of Johnston's *Electrical World*, which its publisher claimed was circulated in every part of the country and reached all the trade? Can it be possible that the "pioneer" is working what the boys would call a "double header" on the trade? Perish the thought!

IN determining to await the publication of the opinion of the United States Circuit Court of Appeals in the Berliner case before announcing its policy, the Telephone Protective association, recently formed in Chicago, displayed excellent judgment. The movement seems to have received much encouragement, and there is reason to believe that the new association will pursue a dignified, conservative course. It has gone about this business in a very practical manner, secured good legal advisers, upon whose report its plans will be formed. All the preliminary steps have been taken, an organization has been perfected, and the members are now calmly awaiting the court's opinion before beginning the fight. The interests involved leave no room for doubt that the Bell company will find determined and active opposition if it attempts to regain a monopoly of the telephone field.

THERE is not as much authentic information at hand concerning the extent of electric lighting in large cities as might be desired, but the importance of keeping such a record is being impressed upon municipal officials and electric companies, and in some cities the work of gathering these statistics is now under way. Figures presented elsewhere in this issue show that in Paris a year ago there were five central station companies supplying 5,553 arc lamps and 201,677 incandescent lights to 4,484 patrons at an expense of 5,643,391 francs. The output of those stations combined was reported as 4,858,264 kilowatt hours. Comparatively speaking, this is not a very good showing for the gay French metropolis, but it certainly shows considerable advancement, and the next returns will undoubtedly disclose a far greater increase in the use of electricity for illumination than has marked the history of any preceding twelve months.

ACCORDING to the reports from the Northwest, activity in the telephone field has not been affected by the Berliner decision. Correspondents of the WESTERN ELECTRICIAN announce many new enterprises in that section, and there seems to be no lack of confidence in the ability of rival concerns to compete successfully with the Bell companies. In one instance, at least, when the old concern formally issued an announcement warning the public against the use of telephones put in by a rival company, it made the claim that the recent Berliner decision gave the Bell company the exclusive right to operate telephones. This warning was spurned by those to whom it was addressed, and pronounced a "bluff" by the competing company, which met these claims by the statement that the much-talked of decision did not in any way establish the validity of the claims made in the Berliner patent, but merely reversed the judgment of the lower court, which pronounced the granting of the patent illegal on the grounds that it had been improperly made by the Patent Office, and that the company in whose favor it was issued had used improper means to keep it in the Patent Office until the expiration of the Bell patent. Bell company officials, it is said, are very much annoyed at the persistence with which rival companies reiterate the charges of fraud that were made in connection with the Berliner patent, and assert that the late decision effectually disposes of these charges. It is not to be wondered that the company dislikes the idea of having these charges constantly paraded before the public. If, when the opinion of the United States Court of Appeals is handed down, it is shown that the company kept within the spirit and letter of the law, it will, of course, have good grounds for protesting against further reiteration of these charges. The decision of the court, whatever it may be, must be accepted as final, and private opinion or personal prejudice must give way before the judgment of that tribunal. However, it might be well for all concerned to await the publication of the opinion. That alone can determine the controversy. No one is authorized to speak for the court in this matter, and certainly no one has a right to anticipate the position of the judges in the questions submitted for their consideration. In the meantime conservative men, whose opinions are of value, will not be influenced in their views by reckless statements of either party to this controversy.

AT home and abroad there is reason to rejoice over the prospect for improvement in trade, and American manufacturers will doubtless take occasion to improve the opportunities afforded them. While in this country there is a general revival of business all along the line, there is promise also of a much greater development of our foreign trade than has heretofore been possible. It is true that with existing freight rates American manufacturers will find it difficult to take advantage of the opening of Oriental ports to our products, but the future is filled with glowing promises. In Japan, especially, the feeling toward America is particularly friendly, as is shown by the considerable amount of American machinery in use there. The Japanese have studied the American methods of construction in electrical work; they are operating dynamos and motors of American manufacture, and their telegraph and telephone service is patterned after that of this country. It is believed, too, that American goods would find favor in China, and the United States consul at Shanghai has suggested that "the geographical positions of China and the United States favor closer and more valuable trade relations. The large population of the former invites the produce of the latter, and China is the nation whose present and future wants merit the sedulous attention of the business men of the United States." It should be borne in mind, too, that a provision of the peace agreement between Japan and China requires that China shall hereafter admit into her ports free of customs duty all forms of modern machinery, including machinery for cotton manufacturing, printing presses, electric lights, telephones and many other mechanical devices. Our trade relations with Central and South American countries are also improving, and there seems to be a tendency toward reviving many of the electrical projects that were contemplated at the time of the panic in the Spanish American republics. In many of these Americans were interested as backers or contractors, and in such enterprises machinery made in the United States would naturally be given the preference. It is reported that several power transmission schemes will be put on foot within a few months; that the building of several telegraph lines is contemplated this year and that telephone service will be greatly developed at once. In this latter branch particularly the Americans have taken the lead. At the present time an American company is putting in a plant in Venezuela, which will supply all the government departments as well as business men. The United States consul at Maracaibo has notified the State department at Washington that the telephone service in Venezuela is assuming important proportions, that long-distance lines connect many remote places, and that local exchange service is growing in popular favor. But by far the most pleasing intelligence contained in this report is the announcement of the success of the American company which has been introducing the service there. It is gratifying to learn that Yankee enterprise is recognized and encouraged even in Spanish American countries.

THE problem presented by the question of using safety fenders on the cable and electric cars which furnish the surface rapid transit of American cities is one that is perplexing many a street railway manager. The daily papers clamor for fenders for the protection of the public, and when one is confronted with the shocking death-roll of electric railway operation in Brooklyn and Philadelphia it is not to be wondered at that the press should insist on every possible precaution that can be taken to prevent accidents. But the question is, Do the fenders offer an adequate remedy?

In the old and populous cities of the East the streets are comparatively narrow and crowded with vehicles and pedestrians during many hours of the day. In Brooklyn, in addition, several lines are brought to one down-town thoroughfare, congesting an already busy street and increasing the danger of collisions. When to these unfavorable conditions is added the fact, unfortunately true, that the management of several of the roads adopted the niggardly policy of employing cheap and incompetent motormen and requiring them to make a maximum number of trips a day to earn living wages, it will be seen that all things seemed to work together for evil. Many of these conditions can be remedied, and it is certain that if people are not struck by the cars there will be no use for fenders.

Then, too, the public was careless and often very unreasonable. A compaign of education was necessary. It is not possible to have rapid transit by mechanical means on surface lines and at the same time allow children to use the space between the car tracks as a playground. The excessive speed of the cars was rightfully condemned in Brooklyn; yet when the companies sent the cars through the streets at a lower rate the new order of things was denounced as a ruse to disgust the people with slow speed when it was possible to operate the cars at a moderately high speed with perfect safety. There was much wild, excited talk, subversive of social order, and a confusion of impracticable suggestions. A large portion of the community apparently held that the directors and stockholders of the companies had forfeited all their rights as men and citizens, and lost sight of the sober proportions of justice and right.

But after all other safeguards have been adopted—when the cars are operated by careful and competent motormen paid in such a manner as to have no interest in making reckless time; when the speed is properly regulated with reference to the locality; when the most efficient brakes obtainable are employed; when the public learns the respect and caution due to the improved service—is there still a use for car fenders? This is a question on which conscientious and thoughtful street railway men differ. Many hold that no type of fender has appeared that is of sufficient practical value to justify its use. On the other hand, a leading official of a Baltimore company, in a recent conversation with a representative of this journal, stated that the use of fenders on his system had resulted in the saving of many lives, as shown by the actual reports of employes. If this is the case in Baltimore, Brooklyn and Philadelphia may well profit by the experience. And why could not the American Street Railway association undertake a careful investigation of the whole subject? If fenders are necessary to save life, they must be employed.

## Telephone Protective Association.

As announced last week, the manufacturers of telephones not controlled by the American Bell Telephone company are preparing to fight that concern, and with this purpose have held several conferences in Chicago during the last week. In response to the inquiries sent out by J. E. Keelyn of the Western Telephone Construction company, about fifty letters were received pledging the support of the writers and encouraging the project. The preliminary steps toward forming a permanent organization were taken and it was decided to adopt the name of the Telephone Protective Association of America. The following named officers were chosen:

President—J. E. Keelyn, Western Telephone Construction company, Chicago.

First vice-president—J. R. Johnson, Viaduct Manufacturing company, Baltimore, Md.

Second vice-president—S. J. Turnbridge, Utica Fire Alarm Telephone company, Utica, N. Y.

Secretary—Paul W. Bossart, Minneapolis, Minn.

Executive committee—H. T. Johnson, Manhattan Electrical Supply company, New York; P. C. Burns, American Electric Telephone company, Kokomo, Ind.; H. C. Dodge, Standard Electric & Telephone company, Madison, Wis.; M. O. Anthony, Anthony company, Cincinnati; J. G. Ihmsen, Keystone Telephone company, Pittsburg, Pa.

President Keelyn's address on assuming office follows:

The telephone public is alert to the fact that unstable conditions surround it. It has known that in one place a low rate of rental provides a high character of service, and vice versa in another. The American people in spirit are generous and sacrificing. There seems a necessity at this time for shaping matters to such definite form as to provide against a recurrence of conditions which have operated to the disadvantage of the progress of the art of telephony and its commercial extension. The unscrupulous methods of the past must be kept in mind and measures obtained to counteract their influence. Organized force must be met with organized force. The centralized efforts of the combination should be encountered by opposite centralized efforts where conditions demand it. In this work it is apparent that the welfare of all of us has a common interest. Prejudice should be laid aside and harmonious effort made upon lines which are to the general advantage of all. Healthy competition necessarily involves the elucidation of the strong points of each as well as the weak points of each other, in a prosperous strife for trade. The public desires this character of competition, but it is neither to the interest of the public nor to those engaged in this work that unfair methods be restored to, or illegitimate propensities enlarged upon, or careless imputations or innuendoes developed.

It was determined to await the publication of the opinion of the United States Circuit Court of Appeals in the Berliner case before announcing the policy of the association. The next meeting of the association will be held at Pittsburg immediately following the handing down of this decision. An attorney was selected and instructed to be present at Boston and determine the exact position of the Berliner patent and its effect upon the telephone interests of members of the association, and make a special report to each member in good standing. This attorney, it is understood, if his investigation warrants it, will enter such objections or offer such information as would seem proper toward preventing a form of order by the United States Court of Appeals to go on record as might anticipate the right of defense by others or involve a precedent in other cases. The attorney selected will make a full report to the association at Pittsburg.

Another feature of the policy of the association is to encourage state organizations, like the Ohio association already referred to in these columns. Similar organizations will be formed in every state in the union, and the fight against the Bell companies directed through them by the national organization.

## East Tennessee Telephone Company Forced to Make Reductions.

[From the *Daily News*, Bristol, Tenn.]

Justice is one of the strongest elements in the makeup of mankind when properly appealed to.

The East Tennessee Telephone company refused to reduce the rent of their telephones in Bristol when they were solicited and entreated to do so. In self-defense our citizens held a mass meeting for the purpose of relieving themselves of the oppressive charges of this company. The result of that meeting was that a company was formed among our people, who have given bond and made a contract to furnish the citizens of Bristol a telephone service for much less money than the East Tennessee company was charging for the same service, and since our own company has materialized and is developing an energy which nothing can check, the East Tennessee company seems disposed to give any kind of a service and at most any price. This they have a right to do legally. But the eternal justice of God, which is strongly reflected in his creature man, speaks out and says that our home company must be sustained and supported as a moral duty.

They have complied with their contract. They have done what no amount of reasoning could do, viz., break the back of the telephone monopoly in our town, and we would dislike to think that we have a citizen in Bristol who would patronize an institution which has acted as this company has acted.

We have no war to make against the employes of the East Tennessee company, but we take the broad ground of justice as our platform and speak from that standpoint.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Wizard Telephone company of Council Bluffs, Ia., is in a peck of trouble. The first thing to seriously annoy it was a peremptory demand to know how the president, C. J. Willow, came in possession of a typewriter which was stolen in Denver on January 8th. Willow's explanation, that he had one of his own which was damaged in transit and that the railroad company had supplied him with the one in question, was not considered entirely satisfactory. Later the story was changed, and Willow said that he bought the machine from a man in Kansas City, who was hard up. The two stories aroused the suspicion of Eli Brown, a Council Bluffs man and the only one who has put any money in the company. He thereupon declared that the business of the company could not proceed as long as Willow was connected with it, which brought matters to an abrupt stop, as Willow seemed to be short on money. Brown claims to be about $3,600 out for his connection with the company. He guaranteed board and tailors' bills for Willow and DeLee, the secretary, and in fact about supported them. He notified them that they must either buy his stock or let him get out, but they instead voted to each of the three $5,500 stock, to be paid for by their individual notes. This would have suited Willow and DeLee nicely, as they are both judgment-proof, while Brown has property enough so that a $5,500 judgment would stick. Fearing that they would vote to have suit commenced on the stock, he took measures to bring the business to a standstill, by instigating creditors to sue and attach. Suit for $1,000 attorneys fees, due for work in securing a franchise from the city, was brought by W. H. Ware, and three other suits for $100 each were brought. Willow and DeLee have hidden the books of the company and no statement of the company's affairs can be made. Willow has given people to understand that he possesses patents, but when pressed admitted he had none, but simply a caveat. He says he has made application for patents and that he did not represent to Brown that he had patents. Willow has since resigned as president of the company, and turned over to Eli Brown all his interests, authorizing Brown to act for him. A man named Belford has been with Willow for some time, and though not connected with the company he seemed to be connected with Willow. It was learned that he was known in Kansas City, from which he came, as Bell, and that he was an accomplice of Willow there, who was known as Perry. Bell posed as treasurer of the Trunk Line Telephone company there and gave Perry & Co. large contracts for electrical work, which Perry, as Willow, used to establish his standing with the other members of the company. Mr. Green, manager of the Gate City company of Kansas City, has identified Willow as Perry, and also identified the stock in the Wizard Telephone company's "plant" as stuff which had departed from Kansas City with Perry and which his company had furnished. Notwithstanding all this, Willow declares his innocence.

The Oshkosh Northwestern Telephone company of Oshkosh, Wis., says the Berliner patent decision will not make any difference to it, and that it will build its exchange any way.

Telephone competition at Winona, Minn., is pretty hot. The Winona Telephone company has recently begun operating its exchange, and recently came out in the press with a card, in which it charged the Northwestern Telephone Exchange with doing everything to destroy competition, including offering 'phones free, paid editorials and advertisements against the use of any battery transmitter not furnished by the Northwestern company. In conclusion the new company defies its older rival.

The Northwestern Telephone Exchange has notified the public through the press, "on account of the recent decision of the United States Court of Appeals confirming the Berliner patent," that it cautions all persons using battery transmitting telephones, except those furnished by this company, to immediately discontinue their use. Paul Bossart of La Crosse, in a letter to the *Minneapolis Journal*, calls it a bluff and says the opinion, when made public, which will be about June 10th, will be seen not to cover any territory controlled by the Northwestern Telephone Exchange. The words "Circuit Court," he says, are omitted, making the notice incorrect and misleading. He says the decision determines the right of the Patent Office to issue this patent under circumstances which caused the government to bring charge of fraud in connection with its issue. The claims of the Berliner patent have not been sustained by any court, he asserts, and the notice is nothing but an intimidation.

The New Auburn & Glencoe Telephone company has been formed at New Auburn, Minn., to build a telephone line to Glencoe, about nine miles.

The Home Telephone company of Sioux City, Ia., has let the contract for the instruments in its exchange to the Standard Telephone company of Madison, Wis.

Jones & Winter of Chicago secured the contract to put in the telephone exchange for F. S. Haines and J. A. Melone in Rochester, Minn.

The Marquette County Telephone company has been formed in Ishpeming, Mich., with the avowed purpose of competing with the Bell system, and has let contracts for the construction of a line.

The Hogan Telephone company of Chicago has made a proposition to Spring Valley, Minn., to put in a telephone exchange if 50 subscribers are secured and a local stock company with $3,000 capital stock formed.

The Detroit Telephone company has incorporated at Detroit, Minn., with $10,000 capital stock.

Citizens of Mitchell, S. D., contemplate forming a company to build a telephone line to Sioux Falls, S. D., and Sioux City, Ia., basing their hopes on the "expiration of the Bell telephone patents." If this should prove successful, the line will be extended to the Black Hills. Other companies are projected to cover South Dakota sufficiently to drive the telegraph companies out of business.

The Fountain City Telephone company of Fountain City, Minn., has been incorporated in Fountain City, Minn., and work has been begun on an exchange.

The Wisconsin Telephone company is arranging to give telephone connection in small towns, where five or more subscribers can be secured. A metallic circuit will be put in connecting the subscribers with each other and with the public station for toll line connection. Connection will be made automatically, obviating the use of an operator. Rates will be $2 per month for either residence or business within one mile of the public station.

Neil Wilkin and John Walsh, of the Burlington and Oskaloosa, Ia., exchanges, J. C. Dekolty of the Albia exchange, and members of the Ottumwa Telephone exchange, are taking steps to construct telephone lines throughout the state. A company will be formed at an early date.

The Pierre Telephone company of Pierre, S. D., is putting in a plant for Pierre, East Pierre and Fort Pierre. Connections with other towns will be made in the future.

The Standard Telephone & Telegraph company of Madison, Wis., has secured one of the buildings in the Gill block.

W. J. Bell has the contract to extend the Winona Telephone company's line from Winona to Fountain City, Minn., and thence up the Waumandee Valley.

The Union Telephone company is extending its line from Ono to Rock Elm, Wis., about nine miles.

The Iowa Union Telephone company is completing long-distance connection from Burlington to Columbus Junction, Wapello, Mediapolis and Morning Sun, giving connection with all river points between Keokuk and Dubuque.

V. Mowery and others are soliciting subscribers for a new telephone system in Ottumwa, Ia. They offer to put in an exchange if they secure 90 per cent. of the subscribers of the present company, and they are getting a good number.

The Wood County Telephone company has been incorporated at Grand Rapids, Wis.

The La Crosse Telephone company has let the contract for setting poles for its system in La Crosse, Wis., to Miller & Dolan, Winona, Minn., for $1,837.

The Blue Earth Valley Telephone company of Winnebago City, Minn., has been incorporated, with $50,000 capital stock.

The Northwestern Telephone Exchange has connected Winona, Minn., on a long-distance line.

Telephone connection has been made between Wabasha, Minn., and Minneiska, Minn.

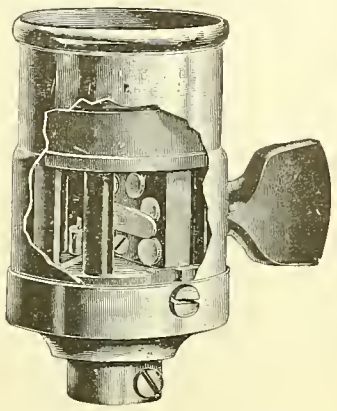
Frank Zeller is an applicant for a telephone franchise in West Superior, Wis.

A telephone line has been run between Austin and Lyle, Minn.

## Baxter Telephone Company.

At the annual meeting of the stockholders of the Baxter Overland Telephone & Telegraph company of Central New York, in Utica, the following board of directors was chosen for the ensuing year: Charles W. Mather, J. B. Turnbull, B. D. Gilbert, T. Jay Griffith, Palmer M. Wood, Andrew W. Mills, Dr. M. O. Terry, Louis Friede, Counteil Munson, S. Mansbach and Charles L. Sharp. A local paper says that at the last annual meeting of the stockholders it was decided to execute a mortgage upon the plant sufficient to pay all the company's indebtedness, which amounts to about $8,000. The plans have not been carried out for the reason that there has not since been a meeting of the board of directors at which a quorum was present. It is the intention of the directors to place the affairs in such shape that there will not be a cent's worth of indebtedness and then to either operate, lease or sell the plant, which is valued at $33,000, to say nothing of the franchise including the rights of Oneida, Herkimer and Lewis counties. The last Bell telephone patent which restrained the Baxter company from operating its lines ex-

pired in February. The injunction remains until dissolved by the courts, but such a motion will not be made until the Baxter company's internal difficulties are straightened out. When the latter company was enjoined it had 324 'phones in operation. It is thought that no difficulty will be experienced in securing long-distance 'phones. The officers of the company promise that if operations are resumed, telephone rates will be materially lowered, for the company has no royalties to pay. There are 83 stockholders in the company, residing in Utica, Clinton, Waterville, Mohawk, Little Falls and Boonville. The officers are: President, C. W. Mather; vice-president, J. B. Turnbull; secretary,



ECONOMIC REGULATING SOCKET.

A. M. Mills; treasurer, Dr. M. O. Terry; executive committee, Louis Friede, C. Sautter, Jr., and Palmer M. Wood, Herkimer.

## Economic Regulating Socket.

The regulating lamp socket of the Electric company, 56 Broadway, New York, herewith illustrated, is known as the "Economic" because, when the light is regulated to the lowest point desirable, a saving in current of 69 per cent. is effected. The regulation is made by simply turning the key. The socket is of the same size and shape as non-regulating makes and is adapted for either direct or alternating current. This socket is of simple construction and is easy to wire.

The Western Society of Engineers will extend the courtesy of one of its rooms in the Monadnock building, Chicago, to the Lehigh University on June 21st, 22d and 23d, in which to hold its local examinations for admission to the freshman class. The examination will be under the direction of H. F. J. Porter, western representative of the Bethlehem Iron company.

## Drop Forged Railway Specialties.

In addition to the valuable line of agencies now controlled by the Central Electric company, Chicago, it has secured the western business for the Billings & Spencer company, Hartford, Conn., manufacturer of drop forgings. Charles E. Billings organized in 1869 the Billings & Spencer company. He had been connected with the Colt's Patent Fire Arms company for several years, and afterward was general manager at the gun factories of E. Remington & Sons. The process of mechanical forging at that time was crude, the work imperfect and the limits of practical application narrow. For a long time the latent possibilities in the system waited for the right man to develop them. It remained for Mr. Billings, organizer and president of this company, to perfect the art of drop forging, which has been done on scientific principles. The products are machinists' tools, bicycle forgings and other mechanical specials which have been adopted as standards both in this country and abroad. While visiting the Edison Machine Works in New York a few years ago, Mr. Billings conceived the idea that commutator segments could be drop forged. After a series of experiments which resulted satisfactorily, an invoice of drop forged pure lake copper commutator segments was shipped to the Edison company. The segments are drop forged from pure lake copper, each one made of a single piece of wrought copper, having a homogeneous molecular structure throughout of the greatest possible density with an increased efficiency.

The Billings patent drop forged commutator bars are now in general use on the street railways and have been adopted by many large electric manufacturing companies.

The successful adaptation of drop forged commutator segments suggested the advantages of producing wrought metal as a substitute for ordinary brass castings in the manufacture and construction of overhead trolley equipment.

The insulating compound used is "colophite," manufactured by S. J. Hoggson, the original inventor of celluloid. "Colophite" is a natural preservative impervious to climatic influences of oxygen, snow, ice and moisture, which are the source of decay in perishable substances. A series of electrical tests has been made, and the results indicated a a resistance of 337,000 megohms. The crushing strength of the center hard rubber disk is 12,000 pounds. The great advantage claimed for the drop forged material is that all the parts that are subjected to strain or wear are made from a material that has a tensile strength of from 65,000 to 80,000 pounds per square inch. The straight line hangers are also made with interchangeable parts with an independent colophite insulated stud with $\frac{5}{8}$ inch thread, drop forged of either Tobin bronze or steel. The unique feature of the straight line hanger is a separate bell made of either aluminum bronze or malleable iron, having interchangeable drop forged yokes of either Tobin bronze or galvanized steel for double and single pull-offs and straight line hangers.

In the cut, Fig. 1, is a sectional view of the straight line hanger showing the interior construction; Fig. 2, double pull-off assembled; Fig. 3, drop forged yoke for single pull-off, furnished either rigid or interchangeable; Fig. 4, standard stud insulated with "colophite" with hexagonal nut threaded either $\frac{5}{8}$ inch or $\frac{3}{4}$ inch long under hexagon head; Fig. 5, dropforged steel bare stud before being insulated; Fig. 6, dropforged bolts for adjustable strain; Fig. 7, adjustable strain assembled, showing the drop forged bolts, right and left, lock nut, aluminum bronze $1\frac{1}{16}$ inch hexagon sleeve insulated by attaching a "colophite" ball strain. Fig. 8 illustrates the preliminary operation of drop forging

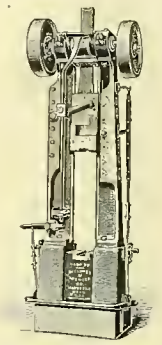
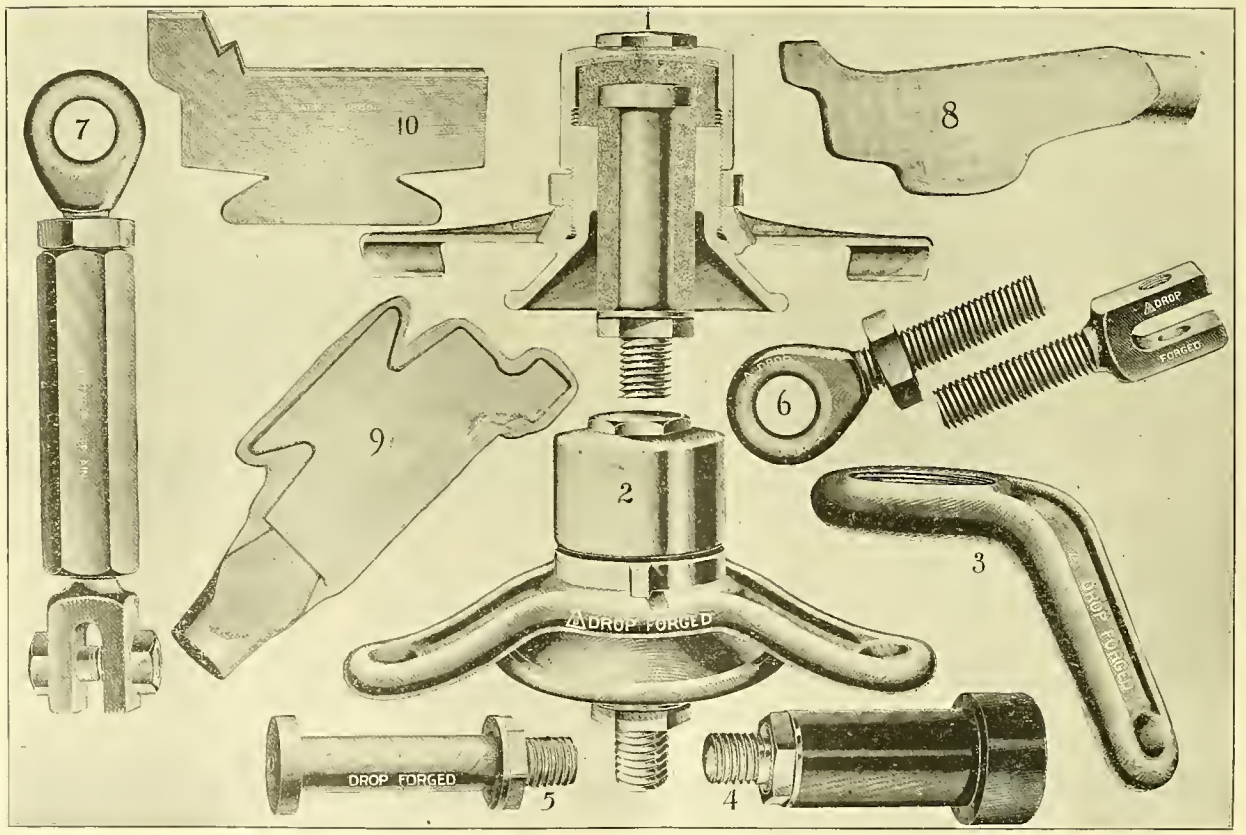


FIG. 11. DROP FORGED RAILWAY SPECIALTIES.

the Billings patent commutator segments, showing a cylindrical unalloyed copper rod shaped to the requisite length, heated to a malleable state. While in this condition it is subjected to the action of successive pairs of dies in a drop hammer. By the first pair of dies the so-called operation of "breaking down," the rod is ready for subsequent forging and bending of arms to the required shape to fit any special commutator. Fig. 9 shows the first result of the "striking up," which produces a bar in an unfinished state to conform to the specified type. The bar is then treated with acid for the purpose of removing oxide. When cold the flashed edges on the bar are trimmed in the usual manner and then the bar subjected to a hardening process and each bar is tempered uniformly thereby giving them all an even and durable wearing surface. Fig. 10 shows a finished bar ready for the No. 12 Westinghouse commutator. The most important feature of the bar lies in its being formed in one solid piece wrought from a single rod by the process of drop forging. It has the grain or fiber of the material always parallel to the outline of the commutator bar, no matter what shape the same may be bent to and still be one metal. Fig. 11 illustrates the drop



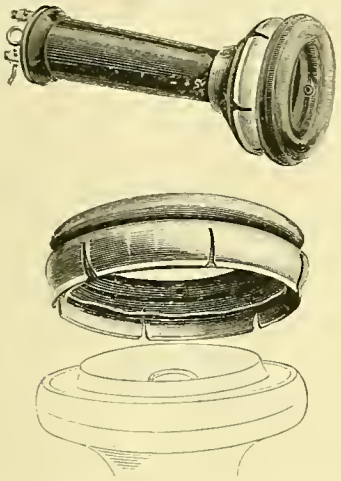

FIGS. 1 TO 10. DROP FORGED RAILWAY SPECIALTIES.

hammer employed for this work. This machine is also manufactured by the Billings & Spencer company.

The Central Electric company is prepared to fill orders for summer renewals and extensions, having a large and complete stock of both dropforged trolley equipment and commutator segments.

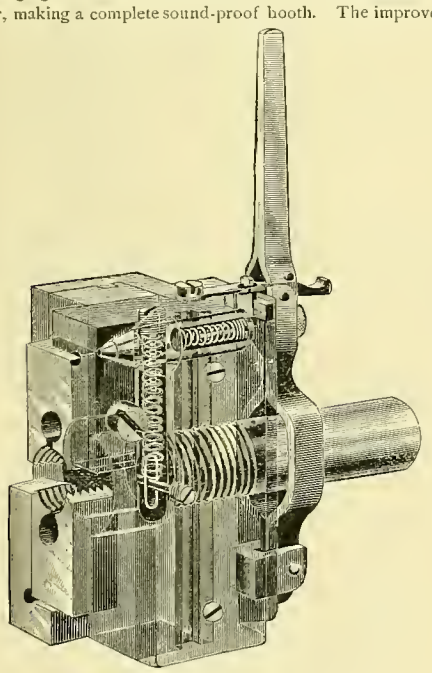
## Pneumatic Cushion for Telephone Receiver.

The illustration represents a simple pneumatic cushion adapted to fit all telephone receivers, and indicates the manner of placing it upon receiver. This device is made of soft rubber, fitted into a metal rim which springs or clamps over the end of the receiver, forming a complete air chamber designed to effectually prevent the buzzing or clucking sounds so an-



PNEUMATIC CUSHION FOR TELEPHONE RECEIVER.

noying to users of the telephone. Recent discoveries have been made and applied, which overcome the two objections to this useful and necessary article. The unpleasant suction, when pressed close against the ear, has been overcome by inserting a small tube in the inflated part of the cushion, letting out the air from between the ear and receiver, but so small that no sound can enter. The objection of having the ear removed so far from the diaphragm has been overcome by enlarging the hole, so that the cushion encloses the entire ear, making a complete sound-proof booth. The improvement is being introduced by C. Maynard Evans, 108 "B," World building, New York. Its touch to the ear is soft, and the distance to the ear drum is more conveniently regulated than with the ordinary hard rubber receiver. It has been adopted and is in use in many banks and public offices, scores of large new office buildings, etc.



GARDNER DIE HEAD.

## Gardner Die Head.

The accompanying engraving shows a die head adapted to screw machines and other purposes, made to open automatically at any desired point, and yet so arranged as to hold the dies very firmly when cutting. The special feature by which this solidity is secured consists in placing each die upon a sliding block, which reaches over and has a bearing the full length of the head, the two blocks being placed side by side in the head, as indicated.

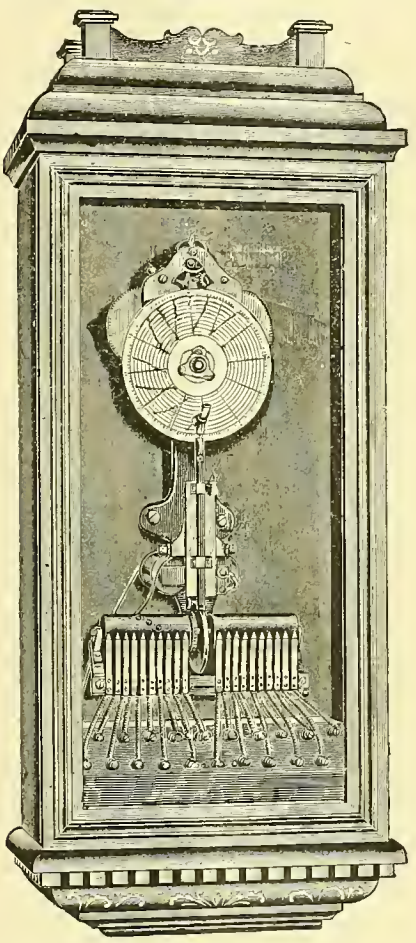
The dies are closed by a taper pin, which is forced into the slides by the lever shown, and when the lever is forced back by a suitably arranged tappet, the dies open quickly by the action of a helical spring.

There are comparatively few working parts in the head, and the long bearings of the sliding blocks make them wear well. It is found that the die will cut threads true to size, will do fine, close work, and will not clog with chips. It is made in four regular sizes, to cut screws from the smallest to 1¼ inches diameter, by Charles H. Besly & Co., Chicago.

## New Watchman's Clock.

The accompanying cut shows a new and improved watchman's electric time recorder, which is about to be put upon the market by W. B. Southgate & Co. of Boston. The advantages of this clock are numerous. A gravity marker and inked ribbon are used for making the record on the dial. This is a great improvement over the old style needle for pricking the dial, or the syphon pen, as it is sure and will not catch in the dial or spatter the ink. This method gives a perfectly plain diagram of the watchman's movements from station to station, and a general glance at the record produced by this clock shows at once any irregularity in the movements of the watchman.

There is but one electro-magnet to produce the record,



NEW WATCHMAN'S CLOCK.

which eliminates the liability of derangement consequent upon a multiplicity of magnets. The simplicity of the construction and the limited number of parts are notable. This time recorder is an entirely new departure in watchman's clocks. It cannot be tampered with; false records cannot be made upon it; it requires no more than ordinary intelligence to set it up and operate it; the clock cannot be opened without making a record of the fact upon the dial. Each clock is capable of recording from one to twenty stations. Ordinary electric press-buttons can be used for operating this clock, or the new improved non-interferable buttons with keys can be furnished when desired. The wiring is simple, and the clock can be set up without difficulty.

## Electric Power the Salvation of Small Towns.

Writing in *The Forum*, Henry J. Fletcher tells us of the decline in population and importance of the small town throughout America. He mentions the rate at which hundreds of townships have fallen off in the last twenty years in the most populous country districts of some of the richest agricultural states in this Union—namely, the region comprised in Ohio, Indiana, Illinois and Iowa. The large city has absorbed the enterprise and all the brainiest, most ambitious young people of these states and left the country neighborhoods dull and dead.

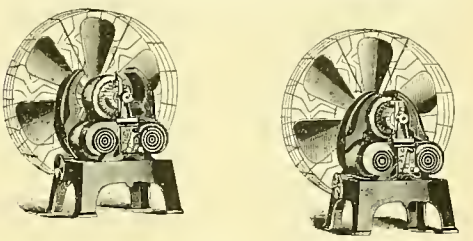
Commenting on this statement, the *Telegram* of Alameda, Cal., says that Mr. Fletcher does not name one of the principal causes of this, which is undoubtedly the steam engine. Steam, considered as a motive power, is the great centralizer of industries. Steam railways build up the city at the expense of the country. Steam operates factories in or very close to the great cities. Water and transportation are to be had most advantageously in the cities. Since the motive power could not go to the operative, the operative had to go to the motive power.

With the advent of electricity all this will be changed. Steam has been the great centralizer; electricity will be the great decentralizer. The water powers all over the country can be utilized once more. They will now produce the electrical current. This can be divided and subdivided infinitely and conveyed any distance. It can run the cheap and convenient trolley between the country villages; it can turn the loom or sewing machine in the home of the artisan. It is within the possibilities that our huge factory system will be abolished when electricity once reaches full development. The "hands" will become individuals again. Humanity will no longer be turned out of a cast-iron mold, one specimen exactly like another.

Factories, with electricity as a motive power, will be run as successfully in the small town as in the city. With electricity here, there and everywhere transportation will become cheap and swift. The individualizing of mankind and of industries will begin again. Electricity will stop the depopulation of the country, and, happily for all, send the tide of people back to the small town.

## The Parmele Fan.

A new fan motor has recently been placed upon the market by the McLean Armature company of Chicago. It differs in one respect from other fan motors, in that it can be regulated to any speed between several hundred up to fifteen or eighteen hundred revolutions per minute. The regulation is accomplished by means of altering the relation between the fields and the armature. One illustration shows the fields open at a point of minimum speed; the other shows the fields closed, at which the armature revolves at maximum speed. By means of the screw on the side the fields are placed at any intermediate point for any medium speed. The Parmele fan has self-adjusting carbon brushes, fan and



THE PARMELE FAN.

fan guard; the feet have rubber tips. The motor is noiseless and runs cool, and in all its parts is a substantial machine.

## New Feature of the Fender Question.

[From the New York *Sun*.]

What part of a street car is its front? This is a question over which the people of San Francisco and some of the street railroad managers are at odds. An ordinance says that fenders shall be attached to the fronts of the cars. The people hold that the front of a car is its forward end. Some of the trolley men insist that the law will be obeyed if they attach fenders to the ends of the trucks, about five feet back from the forward dashboards, and in the rear of the machinery underneath the platforms.

If there is disagreement as to whether the front of a car is its forward end or is a cross section some five or six feet further back, there need be no question as to what does the deadly work. In most instances it is the part of the car or fender that first gets a chance at the victim. If the fender is attached to the dashboard, it is often the fender that kills; if the fender is fastened to the truck, the machinery in front of it and beneath the platform usually does the fatal job.

In view of the reasons for unanimity on the forgoing point, it is improbable that the trolley managers will be permitted much longer to insist that the only fenders they can use are the rat-trap contrivances made of wires and springs and carried where they may or may not gather up the mangled bodies passed back to them. In San Francisco the railroad men talk of going to the courts for a decision as to whether the law is satisfied with the use of such devices. If it comes to this, and if the courts decide that the front of a car is its forward end, inventors will not be restricted to a type of fender which they must know will prove to be worse than useless. If the courts hold that the front of a car is at one-quarter of the distance from the forward to the rear end, the public safety will be increased by throwing off the remaining three-quarters and enacting that fenders shall be carried on only the rear ends of the cars.

The Cincinnati inspector of buildings has issued a permit to the Cincinnati Street Railroad company to erect a power house, boiler and engine rooms at Langdon and Knowlton streets, Cumminsville. The building is to be of brick and iron, the power house part one story high and the rest two stories. The whole plant will be 146 by 189 feet, and the building will cost $25,000. When it is finished power from it will be furnished to the Colerain line, and additional power will be turned on the Avondale line.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, June 1.—The proposal that the elevated railroads of this city be equipped with electric power, which has been discussed at intervals for several years, has been again revived. It is stated that the General Electric company has submitted plans and estimates for the change. The work will require the erection and equipment of immense power houses, the construction of a system of electric supply rails along every mile of road, and, in fact, a complete abandonment of the present system. The change must be so effected that it will not interfere with operating of a single train now in service. The expense will be about $2,000,000. It is understood that if the electric system meets with success in this city it will be adopted by the Brooklyn elevated railroad companies.

The daily papers report that there is a possibility that the New York and Putnam railroad, which is a branch of the New York Central railroad, may adopt electricity for a motive power upon its line from One-hundred-and-fifty-fifth street to Yonkers. Experiments with a new system, which is said to be superior to anything similar, are being quietly made at Van Cortlandt Park. The model car, with which experiments are being made, seems to have mystified the reporters considerably. One of them gives this lucid description: "The machinery is all confined under the car. There is a labyrinth of pipes, tubes and wires. There are two pieces of work on either side of the car, resembling piston rods of an engine, back of which there is an intricate series of pipes, the exact functions of which are a mystery. They lead into a couple of square box-like receptacles made of galvanized metal. These receptacles communicate with a long, round tubular one, about six feet in circumference, which is beneath the platform. A similar one is on the other end of the car. The whole machinery is made of steel, with the exception of the trucks of the car, which are iron. The car will, it is said, generate its own electricity."

There is a report, coming from Schenectady, that the General Electric company has had an offer of 100 acres of land and $1,000,000 cash to consolidate all its factories at one place in New Jersey. The company engineers have, it is said, reported that the saving of expenses by consolidating the factories at Lynn, Mass., Harrison, N. J., and in Schenectady at some point near Philadelphia or New York would offset the loss which would result from selling the factories at the points named.

On Decoration Day the graves of several of the victims of Brooklyn trolley-car accidents were decorated with flowers by the Anti-trust League. In Greenwood there were especial exercises at the grave of 15-year-old Johnny Wolfer. Rev. Mr. Wallman delivered an address, in which he said: "We simply protest that human safety is more important than human greed, and that the protection of human life is more important than the prosperity of corporations. We mean to lay the mighty hand of an enraged and outraged people upon this juggernaut called the trolley and say, 'Thus far shalt thou go and no farther!' We will either stop the awful death rate from this source, greater than in any other city in the Union, or we will put the rails on stilts, or underground, or we will do away with them altogether."

The committee which has been engaged for several weeks in devising a plan of reorganization for the Long Island Traction company, which holds the lease of the Brooklyn Heights railroad, has virtually concluded its task. It is understood that an assessment of nearly $10 will have to be made on each share of the stock in order to enable the company to hold the lease of the big trolley system. Ex-Governor Flower, who recently became largely interested in the company, said that the road was in bad shape, and that there was going to be a radical change in the management. It is understood that Mr. Lewis will soon retire from the presidency, but that he will be continued in some responsible place. For the purpose of forcing an assessment on the stock the present assets of the company are to be sold to the new organization. W. A. H. Bogardus has resigned his place as secretary of the Brooklyn Heights Railroad company, and has fixed July 15th as the date of his retirement. He has received an offer from a business firm in this city. He has served in the capacity of secretary, treasurer and general manager of the Heights road for two years, and was President Lewis' lieutenant during the strike.

The supervising architect of the Treasury Department is considering whether the steam, hydraulic or electric system is the best for the new elevators for the postoffice in this city.

The Kings county grand jury has brought in an indictment for misdemeanor against Albert H. Dollard, president of the Lewis & Fowler Girder Rail company and the Lewis & Fowler Manufacturing company. He is charged with having signed a declaration of a dividend when there was no susplus money to pay it, and when both companies were practically bankrupt. The inquiry by the grand jury showed that two months after the dividend was declared a receiver was appointed for the companies. It is alleged that nearly $170,000 had disappeared, and that an unexpected indebtedness of $80,000 was piled up against the companies. Mr. Dollard is a brother-in-law of Daniel F. Lewis, president of the Brooklyn Heights Railroad company. Mr. Lewis organized the Girder Rail and Manufacturing companies, but for some time had not been active in their management.

W. F. O.

## New England News

BOSTON, May 30.—The building of electric roads in New England seems to be almost without a possible termination. Several new companies have been organized within a fortnight, and beside this old roads are extending in all directions. Hardly a day passes but some definite movement is made looking to the building of a new or the extension of an old electric street car line. Up near Worcester, in the heart of the commonwealth, the towns of Spencer, Brookfield, West Brookfield and Warren have granted franchises to the newly organized Warren, Brookfield & Spencer Street Railway company to build a street railway to be operated by electricity, connecting the villages or Spencer, East Brookfield, Brookfield, Warren and West Warren, and a meeting of stockholders will be held shortly to effect a temporary organization and receive an incorporation under the railroad law. The line is to be 15 miles long, making, with the Worcester & Suburban company's tracks, an electric line 27 miles long from Worcester to West Warren. The capital stock will be $200,000, and it is said that whatever deficiency there may be after the citizens in the locality have contributed will be made up by Boston capitalists.

Winchester is a suburb of Boston, and in that town on the evening of May 22d an enthusiastic meeting of the projectors of the new electric street railway between Stoneham, Winchester and Arlington was held. It was voted to name the corporation the Mystic Valley Street Railway company, and the following list of directors was chosen: Abraham B. Coffin, Winchester; G. Edward Smith, Boston; Onslow Gilmore, Stoneham; Edwin K. Blaikie, Stephen H. Langley and George S. Littlefield, Winchester. The line will cost to equip between $80,000 and $100,000.

A new corporation, just organized in southeastern Massachusetts, is the Brockton & North Easton Street Railway company, the purpose being to extend the Brockton street railway through North Easton. The articles of incorporation are signed by John P. Morse, Judge Warren A. Reed, Horace B. Rogers of Brockton; G. H. Campbell of Lawrence and Edwin S. Webster and Alfred A. Glasier of this city. The capital stock is $50,000.

If the town of Cumberland will grant the franchise, the Woonsocket Street Railway company of Woonsocket, R. I., will build a five-mile electric line via East Woonsocket and Cumberland Hill village to Manville.

On May 17th officials of the Natick & Framingham Electric Street Railway company met a committee of Milford business men in the latter town and went over the route of the proposed new street railway from Hopkinton to Milford, which, if built, will be a continuation of the Natick and Hopkinton line, now in operation, and eventually make a continuous line to Boston. The old Milford & Hopdale company stands ready to grant any concessions in the way of use of its tracks to the new company.

The work of burying the wires in this city is progressing as well as circumstances will permit. The West End road has started to lay its ducts at the corner of Otis and Summer streets for feed wires, and the Boston Electric Light company is at work near its power house. The telephone companies are doing their share in the burial of the wires in the 1895 district. Eight of the smaller companies have combined and are making arrangements to use the same duct so that one trench will accommodate them all. They will not start in immediately, however, as it is desired to avoid too much ripping up of the streets at one time. The wires already buried are working to perfection. Many of the difficulties in the way have been overcome and electrically there has been no weakness shown thus far in the underground system. Franklin street is the northern boundary of the work which is being done this year, and the amount of wire to go underground is 10,000,000 feet. A great deal of accommodation for this work was built last year, inasmuch as the trunk lines of some of the companies were put in at that time, and the result is that while more streets will be opened up the trenches will not need to be so deep, as they will only for the most part have to accommodate branch lines.

It is very easy to make mistakes, but a Boston daily of a very recent date printed a story on its first page from Springfield, descriptive of an "electric carriage capable of attaining a speed of from three to 18 miles an hour which has just been invented by a Springfield man," etc. The carriage was described in detail and seemed such a good thing that the correspondent of the WESTERN ELECTRICIAN wrote to the promoter for the purpose of verifying the story. The reply was received that the electric carriage was not an electric carriage at all, but that it was propelled by a gasoline motor, the "gas being ignited by an electric spark."

No one has ever questioned the value of the electric street car systems which gridiron this section of Massachusetts or the great benefit they have been to the common people in the way of providing cheap transportation. However much those who use street cars most are inclined to howl against monopolies, the general public cannot but admit that the street car line and its five-cent fare is and has been a great blessing, and according to rumor electricity is directly responsible for what is to be a far-reaching benefit to all who travel. For some time the statement has been going the rounds of steam railroad men that with the advent of the summer season the various railroads running from this city would make a reduction in the rates at present existing, on account of the competition which the electric roads have created. The railroad companies have had to compete with an exceptional street car service and have found their receipts on the lines where this competition existed rapidly falling off, consequently they have decided to take the only step left them and reduce fares. While nothing definite has yet been done, it can be stated with absolute certainty that lower fares on the steam roads leaving Boston will come in the near future. President Tuttle of the Boston & Maine says that this question has been constantly before railroad men for months, and he asserts that when the reduction comes it is bound to be on a uniform scale for all distances. General Manager Sanborn of the New York, New Haven & Hartford says that his road is at the point of taking some vigorous action to control the encroachments of the electric lines and that a reduction in the scale of fares may be expected any day.

The electric branch of the New York, New Haven & Hartford road from Hingham to Nantasket Beach and Hull is about completed. The trial of speed and power will be watched by experts all over the country and then the limits of speed, hauling power and brake efficiency of two to 12 cars will be noted. It has been claimed that heavy baggage cars could not be successfully operated by the motor system and that trouble would be found in "braking" and starting the train, but this coming trial will settle all doubts and show whether or not electricity can be practically used as the motive power for railroad cars.

The Globe newspaper company is having two of the Sprague electric elevators put into the Globe building.

An agent of the Harrison Telephone company has been in Boston canvassing for subscribers. It is reported that all of the banks would introduce the system if the company could secure a franchise.

C. S. G.

## Northwestern Notations.

MINNEAPOLIS, May 31.—The Oshkosh, Wis., council has granted J. K. Tillotson, the projector of the Interurban electric line, an extension till October 18th, but a certain amount of track must be laid each month. Work has but very recently been begun on the line, but is now being pushed.

A project is under consideration to build an electric railway between the villages of Mantorville and Kasson, Minn., and to light both places by electricity, using water power. A $3,000 bonus will be asked.

The prospects for an interurban electric line between Kaukauna and Oshkosh, Wis., have been considerably enhanced by the withdrawal of Messrs. Elmore and Vanderzee of Green Bay, leaving the field to Tillotson and Rutan.

A four-mile extension will be made to the La Crosse, Wis., electric car line.

The electric cars of the Twin City Rapid Transit company in Minneapolis and St. Paul are being equipped with a folding step in addition to the gates opened and closed by the motorman. This is to prevent passengers from gaining a foothold on the step after the car is in motion.

Neche, N. D., people think they want an electric light plant.

The newly incorporated La Crosse, Black River Falls & Neillsville Electric Railway company has elected officers as follows: President, Nathan Clark; vice-president, Wm. H. Polleys; secretary, Paul McHugh; treasurer, T. J. McHugh; auditor, Wm. Beirne. A route will be surveyed by way of Mindora, Burr Oak and Melrose soon.

Armour, S. D., will probably grant an electric light franchise to F. D. Day.

J. J. Lemon, owner of Lemon's Beach, wants the Steilacoom line in Tacoma, Wash., extended to the beach.

F. A. Philbrick is an applicant for a franchise for an electric street railway in Baraboo, Wis.

Lake City, Minn., has contracted with Burtis & Howard ~

of Minneapolis for an electric plant of 60 arc and 650 incandescent lights.

A move is being made in Moulton, Ia., to put in an electric light plant.

Willmar, Minn., has voted to put in electric lights.

A 20-year franchise for the Jamestown Electric Light company of Jamestown, N. D., to be not exclusive in consideration of a $2,000 bonus, was rejected by the Jamestown council recently.

Park Rapids, Minn., is considering electric lights.

The project for another interurban electric line between Minneapolis and St. Paul is revived, this time it being announced that the Como avenue line in Minneapolis will be extended to St. Anthony Park and the Como line in St. Paul to the intersection of Snelling avenue, requiring only two or three miles of track. As usual, "it is understood that work will begin at a very early date."

Sleepy Eye, Minn., is arranging to secure a new site and rebuild its electric plant.

An electrical school has been organized at the Y. M. C. A. in Sioux City, Ia. There was an attendance of 30 the first night and they hope to have 60 or more soon.

The street car lines of Sioux City, Ia., have been consolidated under one management and when the arrangements are effected a number of improvements to the plants will be made. Melvin Smith of Sioux City will be president.

Frank Bernatz is considering putting in electric lights and water works at Boulder, Mont.

The Phœnix Electric company of Hudson, Mich., has taken charge of the electric plant at Clinton, Wis., and will operate it.

Plans have been drawn for a dam at Missoula, Mont., to be used in connection with the generation of electric power, and bids are being taken for electric construction.

The Westinghouse company will furnish the electrical equipment for the Moorhead, Minn., plant, at $3,875.

Watertown, S. D., will discontinue the use of electric lights to-morrow,

Arthur R. Roe is the local instructor of an elementary school of electrical engineering, to be established in Duluth, Minn. Fifty or more have agreed to join.

The Sioux City Electric Light company's warehouse at Sioux City, Iowa, was burned with a total loss of $9,500 recently.

Engineer Cole is preparing an estimate of the cost of a municipal electric plant for La Crosse, Wis., to have 200 arc light power. M.

## PERSONAL.

Samuel Bell, Jr., general manager of the Clamond Telephone company, Philadelphia, has been in Chicago for several days.

C. R. Mannsell, superintendent of the Edison Electric Illuminating company of Topeka, Kas., was a recent visitor in Chicago.

P. J. Boucher, who has been for some years identified with the General Electric company as meter expert in the western district, has retired from that corporation to accept a similar position with the Diamond Electric company, Peoria, Ill., in the interests of the Scheefer meter.

A. L. Reinman, late superintendent of the Sawyer-Man company, has accepted a similar position with the American Electrical Manufacturing company of St. Louis, Mo. Mr. Reinman is one of the best posted men in the lamp business, and the American company is to be congratulated on securing his services.

The WESTERN ELECTRICIAN takes pleasure in extending sincere congratulations to Stephen L. Coles, associate editor of the *Electrical Review* of New York, on the occasion of his marriage to Miss Sallie E. Field in New York on June 1st. Mr. Coles is a bright and capable newspaper man, who deserves the popularity he enjoys.

A. L. Fenton, who was for some time connected with A. E. Bowers of New York as assistant sales agent in selling the "Novak" lamp, and more recently connected with the New York office of the Columbia Incandescent Lamp company, has accepted a position as traveling salesman for the Perkins Electric Switch Manufacturing company of Hartford, Conn. Mr. Fenton will have a large territory and will soon leave for an extended business trip. The Perkins company has added material strength to its working force in securing the services of Mr. Fenton.

## ELECTRIC LIGHTING.

Pleasant Hill, Mo., is figuring on putting in electric lights, and desires propositions from those in the business of installing electric light plants. Communications should be addressed to the secretary of the Board of Trade.

The city of Helena, Mont., has awarded the contract for furnishing electric lights in the streets and public buildings to Walter J. Bradshaw. Under the contract which the city will enter into with Mr. Bradshaw he is to furnish 75 arc lights for the streets, and as many incandescent lamps as may be needed in the city buildings, for $950 a month, under a three-year contract; the city having the right to extend the contract for two more years at $848 a month; and to have the right to purchase the plant of the contractor at a price agreed on. Extra arc lights are to cost $12.50 a month, and extra incandescent lamps $1 a month. The city is to grant Mr. Bradshaw a franchise to erect his wires. The contract will run from July 1st. An entirely new plant will be erected.

A bill to foreclose on a bonded indebtedness of $150,000 and for a receiver has been filed against the Chicago Illuminating company in the Circuit Court at Chicago by the American Trust and Savings Bank and John Mason Jackson, the holders of the bonds. The company has been in existence five years. It has a plant at No. 145 Twenty-first street, and supplies electric light over a good portion of the South Side, having upward of 700 customers. Attorney Jacob Newman, who filed the bill, said the company was at present on a paying basis, but it was unable to pay up the back interest on the bonds, and the suit was commenced for the purpose of obtaining a settlement. The complainant Jackson is connected with the Western Electric company. On June 4, 1891, the court is told, the company being desirous of borrowing $500,000 for the purpose of enlarging and increasing its business, issued a series of first mortgage coupon bonds, running for twenty years. Bonds to the amount of $150,000 were sold, and the company used the money in purchasing machinery, erecting its present power house, and generally bettering its plant. The complainant Jackson became the owner of $137,000 worth of the bonds. To secure the payment of these bonds, which were payable at the bank, the company gave to that institution a trust deed upon all its property. By the deed the company was to lose all its title in case of default in the payment of the principal and interest on the bonds. The court is informed that the company has made default in the payment of the interest warrants annexed to the bonds issued, which became due in January, 1893, and since that time. The total amount of interest unpaid is $18,000.

## TRADE NEWS.

Word has been received from the Chicago Edison company to the effect that its supply department sold A. M. Rothschild & Co. in the neighborhood of one-half the order for the colored lamps that are used in the brilliantly illuminated light tower on the corner of this firm's large establishment on State street, Chicago.

The Standard Paint company of New York has recently established a number of foreign agencies, including Africa, China, Japan, India and the leading cities of Europe, from which the well-known P. & B. products can be obtained. The result of this new departure has been exceedingly gratifying, and the company states that although there has been a number of recent attempts to imitate the P. & B., its reputation and sales are being steadily enhanced.

Manager G. Luthy and Electrician Frank Thone of the Royal Electric company of Peoria, Ill., visited Chicago last week. Mr. Luthy and Mr. Thone came to the city to purchase new machinery for an extension of the company's works. The Royal company is a western concern that has worked its way slowly but surely to the front, and through conservative and careful management brought itself into a position such that it is now looked upon as one of the most prosperous industries of this section.

Handsomely printed in black, crimson and gold, the new catalogue of the Columbia Incandescent Lamp company of St. Louis is indeed a "thing of beauty." The lamps of this enterprising company are guaranteed in workmanship and efficiency and find their best market among those who place quality first. Users are promised a uniform and satisfactory service by the Columbia people, and, judging by the company's uniform success, the promise is faithfully kept. The Chicago office of the company is at 1236 Monadnock building.

The General Electric company has received many testimonials from users of monocyclic apparatus, of which the following is a fair specimen. It is from J. K. Mitchell, secretary of the Galesburg, Ill., Gas & Electric Light company: "In answer to yours of the 22d inquiring as regards our monocyclic system, would say, they run nearer perfection than any dynamos and motors we have had in the last ten years. The current is on continually and the dynamos and motors both run cool and practically without attention. It is now two months since installing and there has not been a single fault."

The Brush Electric company has recently purchased the property of the Swan Lamp Manufacturing company and will manufacture and sell incandescent lamps. The Swan lamp is well known throughout the world, not only because it bears the name of the celebrated electrician, Joseph Swan, but because it is so widely used in foreign countries. The Swan Lamp Manufacturing company was organized in 1885 and, until its purchase by the Brush company, rented factory room from the Brush Electric company. The new incandescent lamp department of the Brush company will be under the direct supervision of the superintendent and assistant superintendent, but will be operated by a foreman who has had a long experience in the manufacture of incandescent lamps. The sale of the incandescent lamps and the handling of the business will be done by the Brush company.

A very valuable storage battery catalogue has just been issued by the Electric Storage Battery company of Philadelphia, manufacturer of the chloride accumulator. In its introduction the company says: "In compiling this catalogue, we have endeavored to give such information as will enable any electrical engineer to install and operate successfully a storage battery plant. Comparatively few electrical engineers have hitherto made themselves conversant with the details of storage battery installations, but have left such work to experts in this particular branch. * * * Such an impetus has thus been given to the business that new applications of storage batteries are daily being made, and in view of this constantly increasing demand, we feel that it will be advantageous to give a full and complete description of the apparatus and methods which our long and varied experience has shown us to be essential to the successful operation of storage batteries. Such complete and valuable information on the subject of storage batteries and kindred apparatus has never before been published. The diagrams given will meet the requirements of all ordinary conditions, and the apparatus required in connection therewith is fully illustrated and described." The promise of the introduction is amply made good, and the result is not only an exhaustive trade catalogue but a thorough and practical manual of storage battery practice. The book is really valuable and should be in the library of every electrical engineer. Owing to the labor and expense involved in issuing this elaborate catalogue, the work cannot be distributed gratuitously, but will be sold at $1 per copy.

## BUSINESS.

The Electric Appliance company is highly pleased with the results that are being secured from numerous tests of the Packard lamp made independently by lamp users themselves in different parts of the country. Many of the tests show the Packard lamp to have an efficiency from 50 to 100 per cent. better than any of the other lamps that were available for the test. In several cases it was demonstrated that the Packard lamp would only have to burn a few hundred hours to make its increased efficiency over other lamps pay for the entire first cost of the lamp.

The Wallace Electric company reports some very large orders in the railway department. The company states that it has received a number of large contracts recently, one of which was shipped to the Electrical Supply company, Los Angeles, Cal., who secured a ten-mile contract for a complete railway equipment. The railway specialties handled by the Wallace Electric company, including its own line as well as the line manufactured by the W. T. C. Macallen company of Boston, are splendid devices, electrically and mechanically.

The Metropolitan Electric company of 186 and 188 Fifth avenue, Chicago, announces to its customers and to the trade generally that it will soon issue one of the handsomest and most complete catalogues of electrical supplies ever gotten out. All who desire to keep in touch with the advancements of the electrical business should send for a copy of this elaborate work. The company also reports a good business in the Keystone measuring instruments, Ayer arc lamp windlasses, the Metropolitan incandescent lamps, and the Dayton, Victor and Ries & Scott fan motors.

J. H. Shay, general sales agent for the Munson Belting company of Chicago, Ill., was a recent caller at the New York office of the WESTERN ELECTRICIAN. Mr. Shay had just completed an extended trip through the West as far as the coast, and reported one of the best business trips he had made for a long time. He said that indications were very bright for a return of business this fall. He has had years of experience, and probably no salesman is better known to the electrical trade for pushing qualities, as evidenced by the large number of Munson belts in use in the various central stations and power plants through the country.

W. H. Mackay, who for several months has been assistant to R. B. Corey in the sales of the General Incandescent Arc Light company's productions, has resigned and accepted the management of the New York office of the Columbia Incandescent Lamp company. President J. H. Rhotehamel of this company is to be congratulated in securing the services of a gentleman so long and well known in the electrical trade, both as a practical electrician and as a salesman. Mr. Mackay has fitted himself by experience to be conversant with the manufacture of incandescent lamps, and he will give a good account of the New York office of the Columbia company.

Chas. I. Hills, manager of the New York office of the Columbia Incandescent Lamp company, has resigned, and on June 1st assumed a corresponding position with the Perkins Electric Switch Manufacturing company of Hartford, Conn., with headquarters at 219 Havemeyer building, New York. Mr. Hills, after several years, becomes again connected with the company with which he started in the electrical field. There is no more popular salesman in the trade than Mr. Hills, whose acquaintance extends East and West, and the new incandescent lamp of the Perkins Switch company could have no more enthusiastic sponsor, or one to more fully tell of its winning qualities.

L. M. Moyes of Philadelphia, manufacturer of the Combine safety water-tube boiler, in a recent pamphlet, asserts that his boiler is the standard of the water-tube type. "The model used in devising the Combine," he says, "was formed by the late Messrs. Babcock & Wilcox, whose memory should be held dear by the steam users of the world for their untiring energy in improving the safety steam generator. With a knowledge of imperfections, which were gradually being removed, and many details objectionable from the steam users' standpoint in this model, the Combine was developed, from which these features are eliminated." Mr. Moyes will send his descriptive pamphlet on application.

Purchasers of high class insulated wires and cables will be interested to know that the Chicago Insulated Wire company has recently removed its offices from the Northern office building to 153 Lake street, Chicago. The company is now nicely installed in its new quarters, which, being on the ground floor, offer greater facilities for handling its very prosperous business. The Chicago Insulated Wire company has been one of Chicago's most aggressive concerns in the wire business, and its business has grown remarkably for the hard times. A point upon which particular stress is laid by the company is that it always carries a large stock of wire and cables in Chicago. Many are often put to serious inconvenience by not being able to obtain quick shipments for "hurried jobs," etc., so the facilities of the Chicago Insulated Wire company will undoubtedly be well appreciated by the trade.

Power station men will be interested to know that Western Manager Stanley Green of the Fuel Economizer company of Matteawan, N. Y., recently closed an order for 1,000 horse power Green economizers for the Dominion Cotton

Mills company of Montreal, Can. Mr. Green is continually adding to his large number of sales, the Green economizer having been brought to the front at a remarkably rapid rate through his energetic efforts. There is no question but that such a device as this needs only careful consideration to insure its adoption. There was a time when central station men in the United States looked less carefully at the figures representing coal consumption, but now almost every plant is operated on a closer and more economical basis, and for this reason the question of installing economizers becomes a vital one. It is needless to say that few central stations should be without an economizer, and Mr. Green's rapidly increasing trade, and the numerous inquiries which have been coming to him of late, would seem to indicate that there has been a general awakening on this point.

Competition in the lamp business has led to many improvements in details, and that recently adopted by the Perkins Electric Switch Manufacturing company of Hartford is one of the most original and useful. This company is now packing its incandescent lamps in a manner that should insure immediate favor and the appreciation of customers. In general it may be said that the lamps are now packed by the Perkins company in the same manner that the egg merchant packs his wares. The lamps are placed in compartments in pasteboard cartons, without any paper wrappings, just as one sees eggs packed for shipment. Twenty cartons are packed in a wooden case, each carton holding ten lamps. By this simple use of pasteboard the bulk of the shipment is reduced to a minimum, and thus the supply dealer can economize more closely in the matter of storage space for his lamp stock. The cartons can be removed from the wooden cases and placed on shelves or arranged in any other convenient manner. Practical tests have demonstrated that this method of packing is perfectly safe. A trial order, however, must be given before consumers can appreciate fully the value of this simple improvement.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued May 28, 1895.*

539,786. Conduit Electric Railway System. Ferdinand Barrell, New York, N. Y. Application filed July 19, 1894.

In an electric conduit, the combination with the conduit wall, of a lateral wire support, having a depressed middle or central part and raised supported ends.

539,798. Combined Trolley Head and Wheel. William H. Dalbey, Indianapolis, Ind. Application filed October 11, 1894.

A combined trolley head and wheel is described, comprising the combination of the journal, having tapering ends with the head sections, having tapering apertures adapted to receive the ends of the journal.

539,799. Lantern for Bicycle Riders. William K. L. Dickson, Orange, N. J. Application filed August 4, 1894.

There is a screw, having a resistance coiled thereon, and stationary contact brushes for making contact with the resistance.

NO. 539,838.

539,804. Electro-magnetic Gold Separator. Joseph D. Gibbens and William B. Murray, Portland, Ore. Application filed October 20, 1894.

Claim 1 reads as follows: In a device of the character described, the combination with a stepped extension, of a sluice box, having grooved copper plates thereon, adapted to be filled with mercury for amalgamating purposes, of electro-magnets arranged in gangs, located above the said steps and provided with means for adjusting the same to and from the said steps.

539,825. Electrical Connection. Peter Rieth, Chicago, Ill. Application filed February 28, 1895.

This device has cylindrical terminals in the form of tubes, provided with tapered conical bores open at both ends, and an electrical conductor integrally uniting the terminals, the length of each tubular terminal being greater than the thickness of the body within which it is to be secured, so as to project at that end having the smaller end of the bore, whereby the projecting end may be swaged outwardly, and the tube expanded by a drift.

539,838. Process of Producing Incandescing Bodies for Electric Lamps. Konrad O. E. Trobach, Pankow, Germany. Application filed April 18, 1894.

The system illustrated consists in immersing the substance to be carbonized, such as vegetable textures, in an acid or acids, as citric acid, which will give off carbon when subjected to dry distillation, in which acid is suspended finely divided carbon, with which the substance to be carbonized becomes thoroughly permeated, and then carbonizing the substance.

539,840. Safety System for Railways. Albert L. Ware, Cambridge, Mass. Application filed October 15, 1894.

In a safety system for railways, as shown in the cut, the combination is formed of two parallel main conductors, one of which is of high resistance, a plurality of cross connections, having no definite sign or fixed polarity, each carried by a car or a train, and two of them requisite to complete a circuit of which the main conductors form a part, an alternating dynamo as a current generator in each cross connection, and a translating device in each cross connection, all constructed and arranged to form circuits, the resistance in which varies with the distance apart of the trains.

539,849. Electric Motor. John B. Atwater, Chicago, Ill. Application filed September 24, 1894.

There is the combination of a revolving cam ring track and electrically operated levers, adapted respectively to be pressed successively at intervals against the track, and thereby revolve the same.

539,863. Controller for Electric Searchlights. Elie F. G. H. Faure, John MacHaffie and Sam H. Libby, Schenectady, N. Y. Application filed January 29, 1895.

A switch handle is adapted to control two motors, separately or simultaneously, with springs adapted to be compressed by a movement of the handle in any direction, and acting to bring the handle back to the off position.

539,870. Annunciator. Franklin A. Jennings, Ithaca, N. Y. Application filed March 23, 1893.

In an annunciator, the combination with the rotatable train-designating cylinder and the ratchet secured thereto, of a push pawl engaging therewith, a vertically reciprocating rod connected to said pawl, a lever connected to said rod, a cam engaging with said lever to lift it and said rod and pawl, and release them when raised, and means to rotate said cam,

539,876. Stationary Transformer. Walter S. Moody, Lynn, Mass. Application filed May 15, 1894.

The transformer illustrated has a core composed of laminæ, registering notches upon their inner edges, forming oil channels in combination with primary and secondary windings arranged within the core.

539,877. Electric Arc Lamp. John A. Mosher, Chicago, Ill. Application filed May 1, 1893.

Among the feature claimed are: An upper carbon rod, a pivoted frame, and a feeding train carried thereby, a shunt solenoid, a core connected to the frame, a rocking plate, having notches at its upper end, a dog adapted to enter the notches, pallets carried by the rocking plate, and means for raising the core.

539,881. Armature Coil and Method of Making Same. Otto F. Persson and David P. Thomson, Schenectady, N. Y. Application filed October 6, 1894.

This method consists in winding a coil, having its two sides closely approximated, and then drawing the sides away from each other, at the same time drawing the ends of the coil together, so as to form a six-sided figure, the two haves of which lie in different planes.

539,886. Electric Meter. Elihu Thomson, Swampscott, Mass. Application filed February 18, 1895.

An electric meter, comprising series and shunt coils is described, acting differentially upon a movable armature or coil, a circuit-breaker in the shunt circuit controlled by the movement of the armature, a registering device, and means controlled by the circuit-breaker and operating the registering device.

539,939. Electric Cable. William D. Gharky, Philadelphia, Pa. Application filed October 18, 1894.

A cable for the transmission of electrical energy, consisting of a conductor or conductors forming a core, and an insulating wrapper surrounding the core, a testing wire extending along the cable outside of the insulating wrapper.

539,943. Armature Winding and Method of Making Same. William Hochhausen, Brooklyn, N. Y. Application filed February 10, 1888.

Armature coils are described, the wires of which are systematically disposed upon the head of the armature, and at such part are bent or offset to the direction of the armature axis, so that each will partly underlie and partly overlie the wires which it crosses.

539,959. Shade for Electric Lamps. Albert S. Marten, East Orange, N. J. Application filed February 11, 1895.

The combination with a collar, having the neck and inwardly extending tongue, of a half shade having the curved and grooved end adapted to engage the collar and be held thereto.

539,966. Electric Bell. Charles B. Sterling, New York, N. Y. Application filed March 14, 1895.

The first claim follows: The combination with the bell and the solenoid, of a vertically movable core in the solenoid, a circuit-maker and breaker loosely connected to the lower end of said core, and also movable vertically, a stationary contact to engage the circuit-maker and breaker, a guide for the circuit-maker and breaker to slide in, and electrical connections between the supply conductors and the contacts.

NO. 539,840.

540,008. Electrical Thermometer. George C. Whipple and Henry E. Warren, Newton, Mass. Application filed December 5, 1894.

An apparatus for determining temperatures consisting of two materials which have different temperature co-efficients of electrical resistance, and a device for measuring the ratios of resistances between the materials electrically connected therewith, and an electrical generator to supply current to the apparatus.

540,010. Conduit Electric Railway. Frank B. Widmayer, New York, N. Y. Application filed August 3, 1894.

The features of the invention are: The combination of a main conductor incased in a waterproof covering or tube, a series of circuit completers normally open and arranged at intervals along the road, an electrically propelled car provided with means for successively throwing into operation said circuit completers, each of which comprises a horizontally pivoted lever, having a vertically moving bar connected to one end thereof, and a vertically reciprocating telescoping rod connected to the other end of the lever and working through a stuffing box in the covering or tube, and provided thereto with a contact for closing on the main.

540,012. Telephone Central Station. Gaston d'Adhémar, Paris, France. Application filed June 20, 1894.

In a telephone central station, the combination with a calling annunciator of an electro-magnet, a local circuit for the electro-magnet, and means for automatically breaking the circuit of the electro-magnet of the annunciator, and at the same time returning the drop of the annunciator.

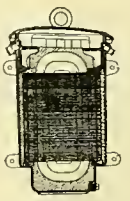
540,025. Controlling Mechanism for Locks. Roscoe A. Palmer, Boston, Mass. Application filed February 4, 1895.

There is in a detachable controlling mechanism for door locks a normally disconnected two-part spindle adapted to be extended through the lock, one member of which is adapted to be operatively connected with a latch bolt, a spindle coupling, an actuator therefor, an electro-magnet to positively move the actuator into operative position, to couple the two members of the spindle.

540,029. Means for Connecting Motors to Car Axles. Sidney H. Short, Cleveland, O. Application filed October 19, 1893.

Claim two reads: In an electric car or locomotive, the combination with an axle and truck frame, of a swinging frame, slotted bearings at the free ends of the arms of said swinging frame, and a motor having trunnions adapted to enter said bearings and move therein.

540,035. Brush Holder for Dynamo-electric Machines. Elihu Thomson, Swampscott, Mass. Application filed February 20, 1893.



NO. 539,876.

The combination of a brush clamp and support for the same, one swinging upon the other and means for maintaining the lamp always parallel to a given frame.

540,054. Locating Faults in Electric Railways. John C. Henry, Westfield, N. J. Application filed January 24, 1894.

A supplemental return conductor for an electric railway is connected at intervals to the track or ground return, and divided into sections normally connected together, and means are provided to measure the current flow between the sections.

540,060. Conduit Electric Railway. William E. M. Jackson, San Francisco, Cal. Application filed October 25, 1893.

Included in this arrangement is an insulating support comprising an open spiral, non-conductive, a containing cup and a cover combined.

540,073. Electric Heater. Charles J. Reed, Philadelphia, Pa. Application filed June 5, 1894.

This electric heater consists of a heat radiating tube, having a conducting lining attached to its inner surface, the opposite ends of the conducting lining being connected to current conductors.

540,076. Secondary Battery. William L. Silvey, Dayton, O. Application filed January 21, 1895.

In a secondary battery there is the combination with the battery plates, having recesses of a porous medium separating the plates, and a porous separating medium occupying the recesses in the battery plates, whereby each battery plate of one electrode is prevented from coming in contact with the other electrode.

540,090. Electric Passenger Register and Recorder. Joseph W. Ellis, Albany, N. Y. Application filed January 12, 1895.

This device employs successive keys, having pivoted pusher ends, detents acted on by pusher ends, and circuit-closing slides so freed for retraction, with electric circuits closed by the respective slides, and "On" and "Off" registers in circuits respectively.

540,168. Electrical Exchange. Alexander E. Keith, Frank A. Lundquist, John Erickson and Charles J. Erickson, Chicago, Ill. Application filed November 7, 1894.

This is an automatic electrical exchange comprising the combination of a flat, continuous, non-sectional switchboard, having mounted thereon a series of rows of electrically interconnected contact points, a series of connectors arranged parallel with the switchboard, and means for operating the connectors to interconnect the wires of the system.

540,187. Closed Conduit System for Electric Railways. Herluf A. F. Petersen, Milwaukee, Wis. Application filed March 26, 1894.

An underground conduit and its contained conductors a contact carrier arm arranged to normally extend into the conduit, and carrying contact shoes for engagement with the conductors, a movable connection between the upper end of the arm and its support upon a car, and hangers supported beneath the car, and having spring connections with the arm for permitting vertical and lateral movements of the arm.

540,216. System of Electrical Distribution. Ernst G. P. Oelschlaeger, Charlottenburg, Germany. Application filed April 6, 1895.

A system of electrical distribution is described, comprising a source of alternating currents, a transformer, the primary coil of which forms a part of the feeder circuit, and through which a current of constant mean amperage is transmitted, and two translating devices adapted to operate at different potentials, connected in parallel across the secondary circuit of the transformer.

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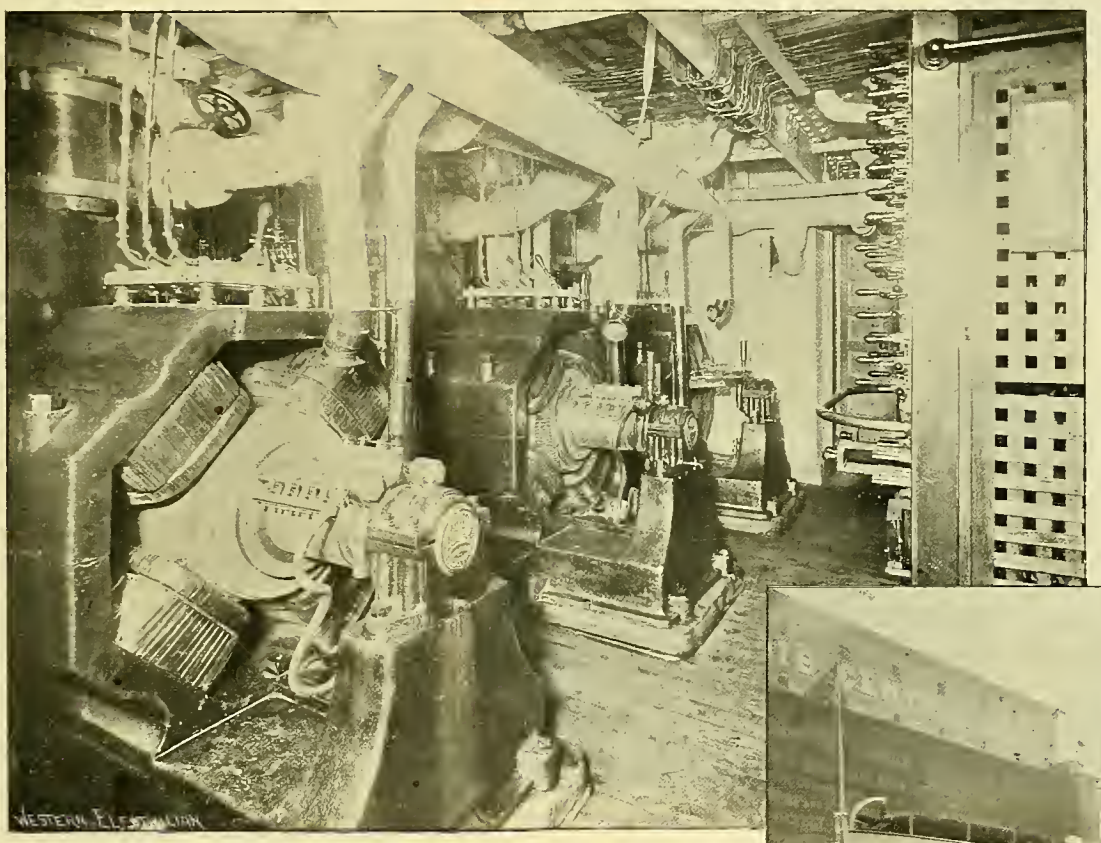
## Electrical Equipment of the Steamship Northwest.

What the new St. Louis and St. Paul are to the American commercial marine on salt water the scarcely less imposing Northwest and Northland are to the fleet which is upholding the credit of American shipbuilding on the Great Lakes. The Northwest is a magnificent steel steamship of 5,500 tons, 386 feet long, with twin screws, engines of 7,000 horse power and a speed of 21 miles an hour. With a crew of 150 men and accommodations for 800 passengers, she is completely equipped for a trip across the Atlantic if she could find a navigable channel to the seaboard. The Northwest was placed in commission in 1894, and paid her first visit to the port of Chicago last week, her regular trips being between Buffalo and Duluth in connection with the Great Northern railway system. The WESTERN ELECTRICIAN takes advantage of this visit to illustrate and briefly describe the electrical plant of this fine vessel.



Dynamos and Switchboard.

FIG. 1. ELECTRICAL EQUIPMENT OF THE STEAMSHIP NORTHWEST.

The general appearance of the boat is well shown by the smaller picture on this page, which is a reproduction of a photograph made just as the Northwest was being towed from her dock in Chicago into the main channel of the river. The larger view shows the electrical plant. This consists of three compact engine-dynamos installed by the Fisher Electric company of Detroit. The engines are of the triple-expansion, vertical marine type and are supplied with steam at 250 pounds pressure from the main boiler plant of the ship, which comprises no less than 28 Belleville tubular boilers built for marine service. The engines are driven at 250 revolutions per minute, and are each rated at 60 horse power. It is interesting to note that 28 engines are necessary for operating the varied machinery of the vessel, including pumps, steering gear and ice machines.

The dynamos are four-pole compound wound machines designed for an output of 300 amperes each at 110 volts. The total lighting capacity of the plant is thus 1,800 16 candle power lamps, and the boat is wired for 2,000 sockets. Two machines are ample, however, to carry the maximum load. The dynamos are connected in multiple, and a novel feature is the air blast for each commutator, as shown in the illustration. The draft is obtained from the general piping system used for ventilating the ship.

The switchboard, shown on the right in the larger picture, is of white marble, with bronze trimmings. To economize space, the switches are arranged with horizontal throws. Whitney instruments are used, and 29 circuits are here controlled. Great care has been taken with the wiring, and the vessel contains about 16,000 feet of Grimshaw wires and cables. A special form of lamp socket is used, and a large proportion of the lamps are completely encased in globular ground glass shades screwed into the fixture. Connected with the lighting circuits and distributed in various parts of the boat are 14 fan motors for ventilation. These are each of one-quarter horse power, and made by the Fisher company.

Fig. 2 shows an electric elevator—an unusual installation for shipboard use. This elevator runs from the cold storage rooms in the hold to the kitchen between decks, a distance of about twenty feet. The mechanism is on the level of the electric lighting plant and is shown in the picture. The motor is a five horse power four-pole Fisher machine geared to a drum hoist. It consumes 35 amperes, and is equipped with an electro-magnetic brake and an automatic cut-off. This elevator is designed to be used in hoisting meats and provisions to the cooks and is not used as a passenger elevator. In Fig. 2 is also shown, at the left, the Blake condensing pump used in connection with the dynamo engines.

A large searchlight is mounted on the forward part of the superstructure for use when necessary. It is a French projector and was exhibited at the World's Fair. It takes 125 amperes of current, and the light of the arc is said to be intensified to 1,000,000 candle power. The light can be controlled from the bridge and thrown in any direction.

An elaborate electric signaling system, worked by dynamo current, is provided, by which the commanding officer on the bridge can control all the movements of the vessel, the casting of lines, etc., without issuing a spoken order.

General View of the Ship.

## Electrical Trap for Sneak Thieves.

On the fifth floor of a large manufactory on the West Side of Chicago is a department employing a number of girls, who have been complaining for several months of thefts committed in their dressing room on the sixth floor while they were at work. Silk handkerchiefs, veils and money disappeared from time to time with increasing frequency, until the management began to realize that it was time steps were taken to detect the thief. As the dressing-room was kept locked, the key being accessible only to those employed in the department where the losses were reported, it was decided that one of the girls using the room was rifling the pockets of the others.

Accordingly, a trustworthy girl was taken into the confidence of the management, a double wire was sewed in the lining of her cloak, connecting a spring jaw in the pocket with the two hooks on which the cloak hung. The jaws were placed in contact with one of the wires and insulated from each other by a small tongue of leather placed between them while forced apart, and this tongue was sewed to the bottom of a purse. Each of the two hooks (which were of brass) supporting the garment was held in place by a long brass screw which went through the partition and connected with a wire on the outside of the dressing-room. Here the wires were carried along under a moulding, through the floor, to a single cell battery, and a bell, placed in series, was hidden in the room where the girls were at work fifty feet away. A switch was placed in a convenient position, which broke the circuit, until the other arrangements were completed. After closing the switch the only opening in the circuit was at the spring jaws, which would be brought together by removing the purse and insulating tongue. The trap had been set but three hours when the bell rang, and the owner of the cloak hurried to the room where the garments were kept and there found the guilty girl; and upon this evidence the girl was immediately accused and discharged after she had admitted her guilt. The apparatus employed was designed by George H. O'Connor of 185 West Randolph street, Chicago.

It is said that the Baltimore tunnel electric railway will be in operation within a week.

## MacDonald Electrically Operated Clutch.

An interesting electrically operated clutch, in the nature of a life-saving device, has been designed by T. H. MacDonald of Bridgeport, Conn., and is illustrated by the accompanying cuts. A wire is carried along the shaft just above the pulleys, and is connected to the magnets, as shown. The return wire is carried in a zigzag course all over the shop, and finally returned to the magnet at the c tch. At as many intervals as may be desired in the room a piece of steel wire is passed over the copper wire just mentioned, and the ends are made fast to a ring within easy reach of any employe. In case anyone is caught in the machinery the shafting may be instantly stopped by pulling the steel wire and thereby breaking the copper conductors. Should anyone get caught in the shaft the wire would be broken by his body as it was thrown over the shaft and the entire machinery would stop. The magnets are energized by closed circuit batteries. Five gravity cells are sufficient for the entire outfit. The pawl that trips the clutch is the armature of the magnet. If, therefore, anything should happen to the batteries, the trouble would be at once made known by the machinery stopping.

An examination of Fig. 1, which is a sectional elevation,

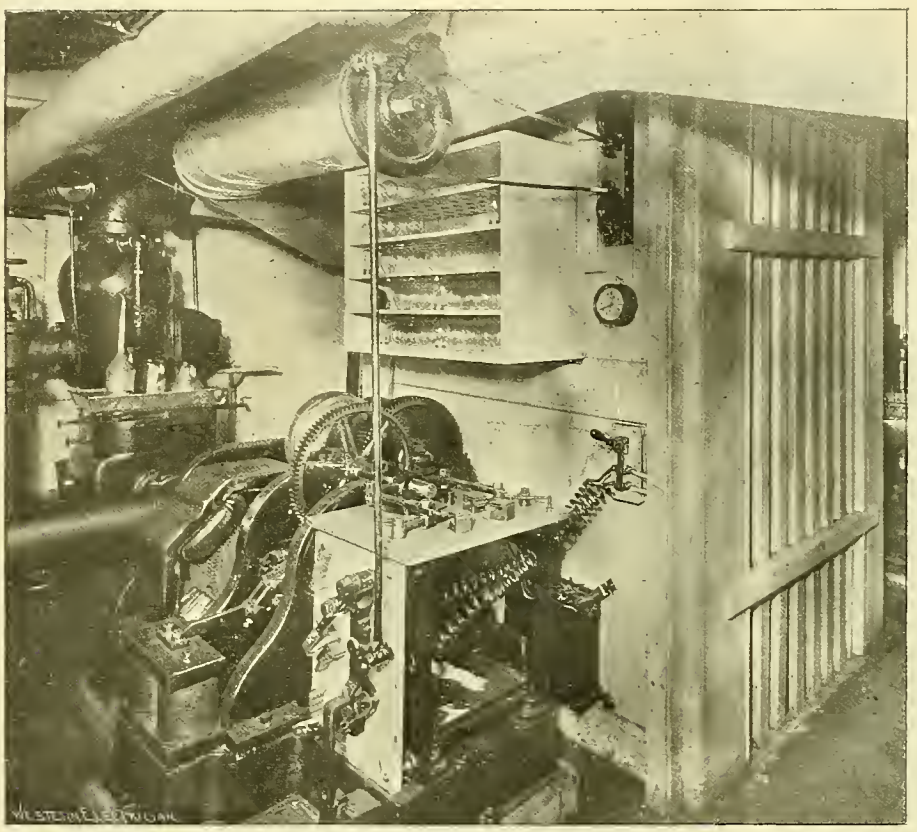


FIG. 2. ELECTRICAL EQUIPMENT OF THE STEAMSHIP NORTHWEST.—AN ELECTRIC ELEVATOR.

will reveal the features of this device. On the shaft *a* is the main power pulley *c*, which is mounted loosely. The collar *d* is rigid on the shaft and is formed with the radial arms *e*, to which are pivoted rocker bars having the wedge blocks *f* secured to their inner faces. Projecting from the pulley is the hub *g*, arranged to contact with jaws carried by the rockers *h*. These jaws extend outside and inside the hub and are provided with friction blocks in order that they may obtain a firm grasp upon the hub. The rocking of the bars will cause the jaws to grasp the hub or to release it, as the case may be. Splined so as to slide freely on the shaft is a sleeve formed with an annular groove, in which is a loosely encircling strap. Pivoted to the arms *e* at *i* are bell crank levers having friction rolls at the ends of their short arms. The levers *j* are pivoted to lugs projecting from the sleeve and their outer ends are pivoted to the long arms of the bell cranks. The upper end of the lever *k* is pivoted to a hanger and it is connected with the strap on the sleeve. The movement of the lever moves the sleeve along the shaft. When this lever is moved toward the pulley the jaws grasp the hub; the reverse movement releases the hub.

Journaled in the bottom of the hanger is a roll over which is passed a cord, one end of which is fastened to the lever *k*, while from the other end is suspended a weight, *p*, the function of which latter is to normally draw the lever away from the pulley so as to release the clutch.

Pivoted to the lever near its upper end is a lock dog, *l*, which when the lever is thrown toward the pulley to operate the clutch, will fall by gravity into a notch in the hanger and thereby retain the lever in such position against the action of the weight. When this dog is lifted out of the notch the weight will operate to disengage the clutch. Pivoted to the hanger is a lever, *m*, having its end nearest the pivotal point provided with a friction roll which, when the dog *l* is within the the notch, extends immediately below the dog. The other end of this lever extends outwardly and is weighted as shown. When this weighted end of the lever drops, the other end will be forced against the dog and will thereby lift the latter out of the notch and release the clutch.

Secured to a bracket, *n*, which extends from the hanger, are electro-magnets *o*.

A metallic housing, *q*, is secured to and depending from any suitable ceiling block (not shown), and has contained in it a metallic pin insulated from the housing by a hard-rubber block.

A pin extending through the bottom of the housing, and having a free vertical play therein, is normally projected upwardly by a spring confined between a cross pin at the upper end of the pin and the floor of the housing. Depending from this pin is a cord, *r*, at the lower end of which is any suitable handle.

The conductor wire *s* is connected with the housing and *t* is a similar wire which extends from the magnets and is connected with the pin, so that it will be readily understood that when the pin is in the position shown at Fig. 1 the circuit will be closed, and when it is drawn away the circuit will be open.

When the lever *m* is in the position shown at Fig. 1 and the electrical circuit is closed its lever will be held by the attraction of the magnets, but when the circuit is broken, the lever will drop and thereby cause the power to be removed from the shafting.

These devices for opening and closing the electrical circuit are located all over the factory in as many places as are deemed fit, so that the motion of the shafting may be instantly stopped by almost any workman at any part of the factory. The lever *m* drops out of the field of the magnets upon a lift finger, *u*, pivoted to the hanger, from the opposite end of which finger hangs a cord, *v*, by means of which the finger may be elevated to raise the lever into its horizontal position against the magnets.

In Fig. 2 is shown the position which the parts assume after the lever has dropped. It will be seen that this lever must be elevated before the dog *l* can drop into its notch. The cuts are reproduced from the *Iron Age*.

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It is reported that negotiations are in progress by which the Metropolitan and Alley elevated roads of Chicago are to be operated under one management. If the proposed consolidation is carried into effect, electricity will be used for power transmission on both roads, as it is now so successfully on the Metropolitan system. The combined lines would connect a wide extent of territory on the South and West Sides of Chicago.

## Electrical Transmission of Power.

The New England Cotton Manufacturers' association devoted considerable attention to the subject of electrical transmission of power at its Providence convention. Several papers in this line were presented and discussed, and much interest was shown in the subject. A. C. Rice of Dayton, Ohio, read a paper on "Water Power Development and its Cost." An interesting contribution by C. A. Stone and E. A. Webster was presented under the head of "Electrical Driving of Textile Establishments," and another paper on the same subject was read by Sidney B. Paine of the General Electric company. John Eccles of Taftville contributed a paper entitled "Operating by Electricity from a Distance." These papers are summarized:

### Water Power Development and Its Cost.

Mr. Rice's paper on this subject dealt with a power shortly to be developed on the Chattahoochee river at Thornton Shoals, Ga., where it is expected to develop 14,000 horse power, under a working head of 35 feet, and transmit it electrically to Atlanta, a distance of about 7½ miles. The dam will be 35 feet in height, and have a base of 100 feet, running with the stream. The power house will be 48 by 323 feet, of steel construction. The power plant is divided into thirteen units of 1,000 horse power each and two of 500 each. The turbines are of the horizontal type, arranged in pairs. The entire cost of the plant is estimated not to exceed $46 per horse power, delivered at the switchboards in the power house. Mr. Rice assumed the operating expense per year would be $4.20 per horse power, estimated as follows:

| | |
|---|---|
| Interest on investment at 6 per cent | $38,640 00 |
| Insurance and taxes at 1 per cent | 6,440 00 |
| Depreciation | 5,000 00 |
| Two men at $2,000 per year | 4,000 00 |
| Four men at $1,000 per year | 4,000 00 |
| Oil and waste | 300 00 |
| Incidentals | 500 00 |
| Total | $58,880 00 |

In this paper mention was also made of another proposed plant of 36,000 horse power under a working head of 12 feet, divided into units of 1,000 horse power, arranged for electric transmission. Assumed cost of the entire plan will be $73 97 per horse power, delivered at the switchboard in the power house on an investment of $2,663,200, including the water power and real estate. The estimated cost of operating this plant on the same basis as the Chattahoochee river plant will be $6.09 per horse power.

From another power, it is intended to develop 20,000 horse power under 28 feet head in units of about 1,300 horse power each. This power will also be transmitted electrically, and will be delivered to the switchboards at the estimated cost of $46.62 per horse power on an investment of $932,500, including water power and real estate. The approximate cost of operating calculated on the same basis as the other two powers would be $81,775 per annum, an average of $4.09 per horse power.

### Electrical Driving of Textile Establishments.

The first of these papers was the joint production of Messrs. Stone and Webster, and was substantially as follows:

The practicability of electrical power transmission over distances up to 25 miles can be no longer questioned. There are at present in the United States a large number of plants, varying in size from 1,000 to 5,000 horse power, which are daily transmitting power over considerable distances, and giving good service at a reasonable expense for maintenance. For short distances where there is no serious objection to mechanical drives, and when with no transformation whatever the power could have been transmitted with but a small loss, it is absurd to attempt to effect a saving by transforming power already existing in the form in which it is to be used, into electricity, and then retransforming this electricity into power again.

The Pencoyd Iron Works of Philadelphia has been gradually changing over its entire transmission plant from mechanical to electrical methods. The power was originally transmitted by means of shafts and belts, but a trial was made of transmitting power electrically, using a separate motor for each machine or group of machines, and the results were found to be so satisfactory, from the standpoint both of economy and convenience, that at present the shops are operated almost entirely by electric motors, a total of over a thousand horse power, mostly in small units, being used.

There is little objection to direct current if properly designed and sufficient in capacity to run under low voltages at a moderate rate of speed. The recent forms of induction motors possess several decided advantages over the direct current type. They are simple in construction, consequently less liable to injury and break-down, and have no commutators, which is one of the principal sources of trouble in the direct current machines. They also possess advantages in starting and stopping, especially in starting under heavy loads.

There are five well-defined places where electric power transmission can always be used to advantage, with standard forms of machine.

1. Where large water power is available at a considerable distance from a mill which is in need of more power than can be obtained from the water privilege at the mill itself.

2. When owing to separation of the mill buildings or peculiar local requirements it is desired to transmit power farther than can be done by belting, in order to avoid the installation of individual steam plants in each building.

3. Where small water privileges are available at various points along the stream, but in order to become useful the power must be concentrated at one point, without too much expense for maintenance and operation of the individual parts of the system.

4. Where, for various reasons in selecting a mill site it

is desirable to locate it at a considerable distance from the source of power, usually on account of the fact that the land immediately adjacent to the privilege is not suitable for a location.

5. Where, for special reasons, it is important to do away with shafting through the mill, and avoid on account of fire risk or other reasons the ordinary belt holes between floors.

There are, perhaps, fifty plants in this country which come under the first head. At least six different systems of transmission are in use for this work, and in places where the plants have been properly installed each is giving good results.

One of the earliest long-distance plants was that built by the Westinghouse company for the San Miguel Mining company at Telluride, Colo. The distance of the transmission is about 14 miles. At the power station a Pelton wheel is used, coupled directly to a generator of 700 horse power capacity of the single phase alternating type. The power is reconverted by three motors at the other end.

One of the earliest plants in New England was one designed by the authors for S. E. Warren & Co. for the transmission of about 250 horse power from Saccarrappa to Cumberland Mills, Me., a distance of about a mile. This plant has been operated very successfully for about five years.

### Operating by Electricity from a Distance.

Mr. Eccles gave a description of the electrical transmission plant by which one of the mills at Taftville, Conn., is operated. This installation was described and illustrated in the Western Electrician of May 5, 1894. Concerning the operation of this plant Mr. Eccles said:

There being no plant in Baltic to use the great water privilege, E. P. Taft, treasurer of the mills at Taftville, decided to carry a part of the power there going to waste by electricity to Taftville, a distance of four and a half miles. This has been successfully done, and they are now running electrically their weaving mills of 1,700 looms, besides generating current for 1,200 electric lights, and furnishing power to the street railway. The mill was formerly run by two Harris-Corliss engines, 20 by 48 and 22 by 48, using 375 horse power, and an additional one of 125 horse power when the lights were on, consuming on an average of 40 tons of coal per week, at a cost of $8,000 per year.

The water power is utilized by three double 42 inch horizontal wheels, one double 27 inch wheel, the former developing 800 horse power at 157 revolutions, and the latter 300 horse power at 244 revolutions, making 1,900 horse power in all. The wheels are in line parallel with the main shaft that runs the electric generators, and are arranged by clutches and quills so as to run any one separate or in unit. The plant consists of two three-phase 350 horse power generators of such design that a temporary overload of 50 per cent. may be carried for a short time. They run at 600 revolutions, and drive the two 350 horse power motors at Taftville at precisely the same speed. They are connected by two sets of wires so arranged that by means of switches either generator can drive one or both motors. The loss in the wires at full load is 7 per cent., and in the motors and generators 5 and 7 per cent., giving a total loss of about 18 or 20 per cent. from main shaft at Baltic to the main shaft at Taftville. The motors carry 34 inch belts, and are perfectly controllable. The speed even when running in connection with the Norwich street railway, to which they furnish power from the Baltic plant, is practically constant. They have also an electric locomotive, used to move freight cars from Taftville to the mills. The cost of 78 cents a day a car with horses is reduced with the locomotive to eight cents a day.

### Electrical Driving of Textile Establishments.

The second paper bearing this title was read by Mr. Paine and was listened to with marked attention. In his preliminary remarks, the author took occasion to impress on the minds of the members the fact that the electric dynamo was not a generator, strictly speaking, but a translating device, for the reason that it receives power in the form of mechanical energy, and transforms it into electrical energy. This is transferred in its new form by means of conducting wires to the motor, where it is re-transformed and appears again as rotary motion to be then applied to the driving of the machinery either directly or through small shafts and belts. The electric system, therefore, affords but another means of transmitting power from the prime motor to the point of its ultimate application. Concerning the subject proper, he said:

In planning a plant of which steam is to be the motive power the engineer must decide upon the best location for the receipt of the fuel, the facilities for the transportation of the coal from the cars or wharf. He must provide also for an adequate supply of water of proper quality for steam and condensing purposes; he must have in view the economical disposition of the ashes. While the boilers, chimney and engine must be placed upon solid foundations, it is equally essential that the engine house be placed as near as possible to the manufacturing building and be so located that the power may be delivered at the proper point and at right angles to the main shafting. If water wheels are to be used, he must determine the best location for the dam, giving proper consideration to the questions of flowage foundations, anchorage and head of water; he must enter the canal at the most advantageous point, and make it as short and as direct as the topography of the country will permit. He must secure a suitable mill site adjacent to the canal, and must erect the buildings upon solid foundations. He must make adequate provision for the receipt of supplies and the shipment of the manufactured product. No one of these conditions can be considered separately or independently of the rest, and the result must be a compromise in which the best efficiency of each is sacrificed to the necessities of the combination.

When electricity is used, the engineer is not so hampered. The generating station is located where the power may be produced most easily and economically. Independent consideration is given to both transmission and distribution, and only such conditions are adopted as will give the highest degree of efficiency, everything considered. Within reasonable limits, the manufacturing buildings may be located without regard to their relative position to the power house or to their distance from the source of power. The mill site may be selected with a view to obtain cheap and solid foundations, and at such points as will secure the best conditions for manufacturing. It is not necessary, as is oftentimes the case with the mechanical system, to subordinate everything else to the power, the cost of which is one of the smallest items entering into the value of the finished product.

The electric motor is independent of the prime mover

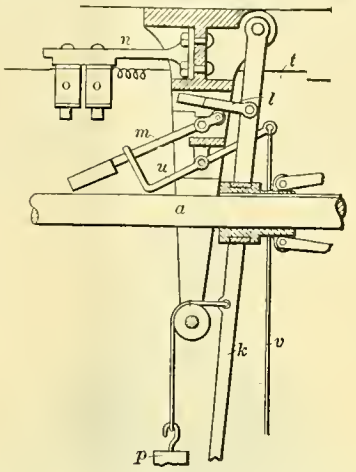


FIG. 1. MACDONALD ELECTRICALLY OPERATED CLUTCH. —ARRANGEMENTS OF PARTS WHEN POWER IS REMOVED FROM SHAFT.

both as to location and direction of rotation. There is no loss, by reason of angles in the line of conductors. There is nothing to explode or drip. Inasmuch as there is no mechanical strain upon them, they will not break down or give way, neither are they effected by atmospheric changes, as are belting and ropes. Since there is no movement to the wire, it is possible to transmit the power into rooms, into which it would be impracticable or exceedingly awkward to transmit it by mechanical means. The speed of the shafting is limited only by considerations of safety, and by the size of pulleys available on the machines to be driven, and is determined without reference to that of the prime mover. The several rooms in the mill may be divided into independent sections, each driven by its own motor, permitting the operation of either without driving the belting and shafting in other portions of the mill. This provision also insures against stopping the entire plant, in case of accident within the mill buildings. The generating plant also may be divided into several units, delivering their currents into a common conductor. In the event of an accident to either one of these units, if spare capacity has not been provided, the load may be reduced to the capacity of the remaining units by the switching off of such motors or lamps as will least interfere with the general system. The time thus lost may be made up by running overtime only the machinery temporarily stopped. These provisions are

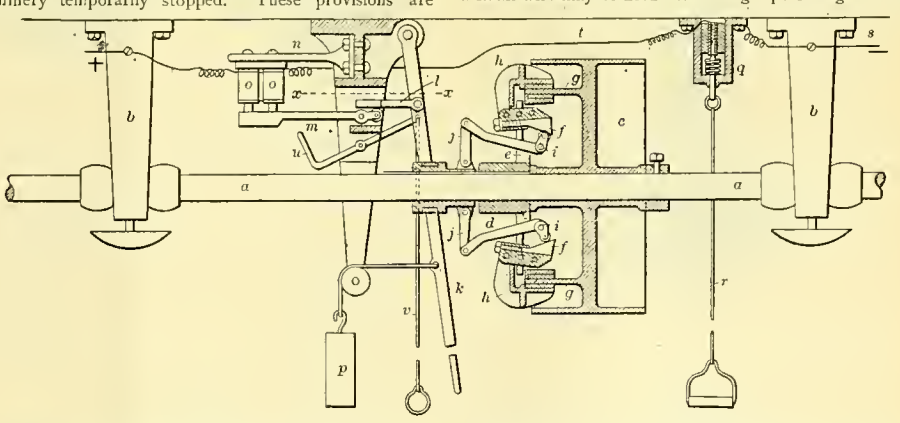


FIG. 1. MACDONALD ELECTRICALLY OPERATED CLUTCH.—SECTIONAL ELEVATION.

recommended, not on account of any greater liability of the electrical plant to accident, the liability being even less than in the case of the mechanical transmission, but rather because of the possibility of trouble with such shafting or belting as is retained, and because of the great flexibility obtained, in that any section which may be behind in its production may be operated independently overtime.

In a mechanically driven plant it is practically impossible to determine continuously the amount of power consumed by each section of the mill. With electricity, a continuous record of the same may be easily kept. When any change is made in the product, the variation in the amount of power used may be determined, and each department charged with its true proportion of the total cost of the power delivered by the prime mover. An abnormal increase in these indications may lead to the location and correction of a faulty transmission.

The limit to which the sub-division may be carried will depend largely upon the relative economy of the motors employed, and upon the uniformity of the load. If the load is very variable, a smaller and consequently less efficient motor may be used, as the saving of the power, which would otherwise be used by the idle shafting, will compensate to a greater or less degree for the lower efficiency of the smaller motor. By reason of the above sub-division, the diameter of the shafting and the width of belting on any section are determined solely by the amount of power necessary to drive that section, and are independent of the total power provided by the mill. In the Columbia Mills, at Columbia, S. C., the largest shaft is 3 inches in diameter, and but two belts as wide as nine inches are used. [This plant was described and illustrated in the Western Electrician of May 5, 1894.]

In the No. 4 mill of the Pelzer Manufacturing company, Pelzer, S. C., which is being equipped with an electric drive of 2,600 horse power, the largest shaft is three inches in diameter, and the largest belt eight inches in width. In this mill, the saving in first cost of the shafting and belting, as compared with an identical mill driven with the mechanical system, will amount to nearly $10,000. The belt tower and all its accompaniments are omitted, amounting in this case to a saving of over $3,000. The removal of the belts does away to a great extent with the frictional electricity, so troublesome in cotton mills.

The electric drive invites concentration of the manufacturing buildings, reducing the cost of superintendence and management. Water powers, more or less widely separated, may thus be brought together for utilization, or steam power can be generated in one large plant with interchangeable units, and transmitted to the several mills, with convenience and efficiency.

In a mechanically driven plant, the friction load increases as the machinery is put on. It is therefore difficult to determine the efficiency under load, and the ratio which the power delivered by the prime mover bears to the amount realized at the machine, as it is constantly changing, depending not only on the load, but also on the condition of the bearings, and on the alignment of the shafting. On an electrically driven plant, however, the actual loss between the generator shaft and the motor shafts remains practically constant. The efficiencies of generators and motors under varying loads are determined before they leave the shop, and the loss in the conducting wire may be easily measured, so that the efficiency of the plant as a whole may be easily computed, and will be found to be much more uniform and nearer the maximum at all times than on the mechanically driven plant. The combined mechanical and electrical losses in the generator, and in the engine or water wheel to which it is coupled, are very little, if any, more than they would be in the same engine or water wheel, and the first belt on a mechanically driven plant. The loss on the wiring of the mill and the motor is no more than the loss on the shafting and belting, even under the best conditions as ordinarily determined. The efficiency of the plant as a whole is therefore fully as high as where the power is transmitted mechanically if the power house is located near the mill buildings. On long-distance transmission, its superiority is immediately and strikingly apparent.

The efficiency of an engine or water wheel drops very rapidly as the load is reduced. A generator or motor loses efficiency under these conditions to a much smaller degree. The loss in the conducting wire is in direct proportion to the load, so that the efficiency of the system as a whole will remain nearly constant.

Since the amount of copper in any transmission line varies as the square of the length of the line, the distance to which it would be possible to economically transmit the current would be very limited were it not that the size of the wire also varies inversely as the square of the voltage. The allowable loss in the line depends upon the value of the power which drives the generator. If the power is cheap, a small wire may be used with a larger percentage of loss in transmission. If the power is expensive, it will be worth while to put more copper into the conductor, and reduce the transmission loss. A lower efficiency of the plant when operating at full capacity is oftentimes more economical than a higher efficiency, especially when the load is variable, and is at its maximum for only a short period of time. The application of the electric drive to machine shops or other places where there is liable to be much idle machinery is especially advantageous. Electrical transmission adapts itself particularly to the enlargement of an existing plant. This is difficult with a mechanical transmission, as the size of the main shafting and belting will not permit it, and much power would be wasted by reason of the indirectness of the drive. The writer had been informed by the agent of one of the best known mills in New England that on a portion of his factory erected subsequently to the main buildings, but 64 per cent. of the power delivered to the jackshaft appears at the countershaft.

So far as safety is concerned, the underwriters admit that a properly constructed electric plant is as safe as the best

mechanical drive. With overhead motors, there is no opportunity for an operator to receive a shock except by design, and the voltage used in the mill is not dangerously high. At the generator dangerous voltages are sometimes used, but every precaution is taken to reduce the danger to a minimum. The only one who is exposed to danger is the attendant at the power house, who is of a higher grade of intelligence than the average operator, and has been thoroughly trained in the care and handling of the machine. For that matter, the danger is no greater than in an ordinary engine room.

The revival of the alternating current system dates back about ten years, and it was not until considerably later that successful attempts were made to utilize it for driving a motor. Until that time the electric drive using direct current was open to many objections. The generators and motors required the use of a commutator, and care was required to avoid sparking at the brushes. This sparking caused depreciation and heating, and endangered the operation of the entire plant. The distance of transmission was limited by reason of the comparatively low voltage allowable at the motors, making the first cost in most cases prohibitive where the distance between the generator and the motors exceeded one and a half miles, and neither incandescent nor arc lamps could be properly operated from the power wires at even that distance. To-day it is perfectly feasible by the alternating system to transmit the current twenty-five miles, and use the same system for the lights as well as power. The commutator on the motors was with its sparking particularly dangerous in cotton mills, and the regulation was poor, the speed variation on changes from full load to no load being in some cases as high as 6 per cent., and the motor would burn out if too heavily overloaded. The induction motor has no commutator, can be constructed to show a speed regulation of within 2 per cent. on changes from full load to no load, and if too heavily overloaded, it will stop and wait without injury to itself, until the overload is removed. In addition to the induction motor, there is another type of alternating current machine known as the synchronous motor. It is to all outward appearances similar to the generator. This is a most useful machine where strong starting effort is not required, where the use of brushes would not be an objection, and where exact speed regulation is a necessity, as it will run synchronously with the generator although separated from it by many miles. As it is designed for the same voltage as the generators, it is not necessary in a majority of cases to use transformers. It may be installed, in many instances, at a cheaper first cost per horse-power than the induction motor.

The statement is often made that the first cost of an electric transmission when added to that of an hydraulic or steam plant is so high that it does not pay. The author assumes a mill of 65,000 spindles, manufacturing standard sheetings weighing 2.85 yards to the pound. Assume that each generator is coupled directly to a pair of water wheels, operating under a head of about 36 feet, the power house being located in the neighborhood of the mill buildings. To drive and light this mill, the wheel should be capable of delivering 3,000 horse power to the generator. The cost of such a plant would be, approximately, $40 per horse power, or $1.85 per spindle. The interest on this investment would be $2 per horse power per year. The value of the additional help in the power house would not exceed 40 cents per horse power per year. If the brushes last only one year, cost of renewal would be but one cent per horse power, and if the bearings of the generators and motors lasted but four years, they could be renewed at a cost of seven cents per year per horse power. To light the above mill there would be required about 1,500 incandescent lights, 500 twenty candle power, and the balance sixteen. Assuming that two-thirds of these lamps would be renewed each year, the cost per

Charles F. Foster.
ELECTRICITY AT THE ATLANTA EXPOSITION.

horse power per year would be eight cents. The power house may be fireproof, and if located away from the mill building need not be insured. The motors and inside wiring of the mill should be covered by insurance. Assuming a rate of four-tenths of one per cent., the cost per horse power per year would be seven cents. Allowing thirty-four cents per horse power per year for oil, waste and incidentals we have

| | |
|---|---|
| Interest | $2 00 |
| Labor | 40 |
| Repairs | 11 |
| Lamps | 08 |
| Insurance | 07 |
| Oil, waste and incidentals | 34 |
| Total | $3 00 |

The above figures do not cover the cost of generating the energy, as their purpose is entirely to show the increase in the operating expense, due to the adoption of the electric system, provided no economies are effected thereby, but they do cover the cost of lighting the mill, and in order to be comparable there should be added to the expense of operating the mechanical system, the maintenance cost of lighting, which would be about twenty-five cents per horse power in the case of an isolated electric plant, or eighty-five cents per horse power if gas costing $1 per thousand feet were used. In the mill cited, the annual operating expense for both lighting and driving the mill would be equivalent to an addition to the cost of the cloth of one thirty-eighth to one thirty-fifth of a cent per yard, or seven and a half to eight and one-seventh cents per hundred pounds (depending upon the running time) less than one per cent. of the cost of the cloth. Oftentimes a reduction could be made in transportation expenses alone of more than this amount by reason of the freedom permitted in the selection of the mill site. In the case of the electric plant of the Pelzer Manufacturing company the annual expenditure for coal required by the engine in No. 3 mill amounted to about $10,000. This will be entirely saved by the substitution of the synchronous motor, and will more than equal the entire operating expense, including interest, of the electric plant, driving both No. 3 and No. 4 mills, and lighting the latter. In other words, the cost of power for these two mills, and the cost of lighting one of them, would be no more than if the steam engine had been retained in No. 3 mill and No. 4 mill had been located adjacent to the water power and driven therefrom mechanically.

The saving in the cost of construction will often amount collectively to nearly the first cost of the electric plant. Such savings would be made in the foundations of a mill located on solid ground, as compared with the same mill erected beside a water power, in the omission of the canal, in the reduction in shafting and belting, in the construction

H. M. Atkinson, Chairman of the Committee on Electricity.
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of the buildings, in the omission of the belt tower, and of the lighting dynamos which would otherwise be employed. A very small increase in the production will more than balance the operating expense of the electric plant. On certain classes of work this increase in output is especially marked. In the printing room of the Dunnell Manufacturing company of Pawtucket, R. I., electric motors were substituted for individual engines on ten machines, with an increase of more than 25 per cent. The quantity of seconds produced had also been reduced. In mills already constructed the electric drive may profitably be applied in replacing mechanical systems, awkwardly situated, or working at a disadvantage, and buildings or rooms, to which it is now impracticable to carry power, may be utilized for manufacturing purposes.

## Chicago Edison Company.

At the annual meeting of the Chicago Edison company held on Monday this summary of the business of the year was presented to the stockholders:

| | | |
|---|---|---|
| Gross income from electric current and merchandise sales | | $1,437,042 53 |
| Operating, repairs and renewals and general expense | | 953,377 77 |
| Net income—all sources | | $ 483,664 76 |
| Interest on bonds and debentures | $155,128 00 | |
| Dividends paid | 319,038 21 | |
| | | 474,166 21 |
| Balance carried to surplus account | | 9,498 55 |
| | | $ 483 664 76 |

The balance sheet is as follows:

| | | |
|---|---|---|
| Plants, real estate and franchise | | $7,226,430 02 |
| Material in storeroom and unfinished work unbilled | $135,959 12 | |
| Accounts and notes receivable | 199,422 31 | |
| Cash | 207,749 78 | |
| | | 543,131 21 |
| | | $7,769,521 23 |
| Capital stock | | $4,400,000 00 |
| Subscription certificates (exchanged for stock May 14, 1895) | | 547,300 00 |
| Bonds and debentures | | 2,325,300 00 |
| Surplus account and insurance fund | | 267,758 73 |
| Accounts and notes payable | $229,917 90 | |
| Open accounts | 8,244 60 | |
| | | 229,162 50 |
| | | $7,769,521 23 |

The old officers were re-elected.

## Centennial of American Commercial Liberty.

On June 8, 1795, the session of the United States Senate was convened which ratified the Jay commercial treaty with Great Britain, securing commercial liberty as the natural complement of the political independence acknowledged twelve years before. The centennial of commercial liberty, coming, as it does, when the country is reviving from a great business depression, is to be celebrated by the issuing of a work entitled "One Hundred Years of American Commerce," the object of which will be to stimulate the growing business confidence by showing the great progress which has been made in all branches of industrial life. Hon. Chauncey M. Depew has accepted the editorship of the work, which will consist of one hundred chapters by one hundred Americans, each writing of that branch of trade with which he is identified. The work will be brought out as a centennial edition of the oldest commercial paper in America, the *Shipping and Commercial List and New York Price-Current*, which was founded December 19, 1795, as the voice of the new commercial life inaugurated by the Jay treaty.

## Electricity at the Atlanta Exposition.

There seems to be no doubt at the present time of the success of the Atlanta exposition which will be opened September 18th and continue during the remainder of the year. As these are the most delightful months in which to visit the Empire State of the South, there is no doubt that the attendance of northern visitors will be very great. Many states have followed the example of the federal government by officially recognizing the enterprise and providing for representation. Of course the management is making strenuous efforts to collect a representative lot of electrical exhibits and make the electrical exhibit one of the most important of the entire exhibition. Readers of the WESTERN ELECTRICIAN are familiar with the steps already taken in this line. A description of the electrical building and a cut made from the architect's designs were published in this journal on March 9th, and an official statement of the plans of the department of electricity, the scope of its powers and the work already done were set forth in detail in an article by H. M. Atkinson, chairman of the electricity committee, in the number of May 4th. In this issue is presented portraits and brief biographical sketches of the gentlemen engaged in this department.

H. M. ATKINSON, chairman of the committee on electricity, has been a resident of Atlanta for nine years, going to that city from Boston in September of 1886. He is a nephew of Hon. Edward Atkinson, the distinguished statistician. He began business in Atlanta in the service of the great cotton house of S. M. Inman & Co., and later went into business for himself. He is vice-president of the Southern Banking & Trust company, president of the Georgia Electric Light & Power company, a director of the exposition and a member of the finance committee, as well as chairman of the electrical committee. Mr. Atkinson represents a number of important financial interests of New England, and has induced eastern capitalists to make considerable investment in Atlanta enterprises.

HON. H. E. W. PALMER is one of Atlanta's leading attorneys, and a man of prominence in public affairs. Under President Cleveland's first administration he was assistant United States district attorney for the northern district of Georgia. He was for seven years the general southern agent of the Thomson-Houston company, and later of the General Electric company. When the exposition was first organized, Mr. Palmer was unanimously elected director-general, and had entered upon the duties of this office with his accustomed zeal when he was stricken with typhoid fever, which forced him to give up all work for many months. As the position of director-general required constant and arduous labor, Mr. Palmer resigned, but his interest in the enterprise remained unabated, and his valuable services have been in constant demand by the committees on which he has been placed.

JAMES R. WYLIE is one of Atlanta's most public spirited men. He is vice-president of the Merchants' Bank, one of the strongest financial concerns in the South, and has large

Luther Stieringer.
ELECTRICITY AT THE ATLANTA EXPOSITION.

interests in many other enterprises. He has always taken an active part in exposition work, and has occupied a prominent place in former expositions. His experience in management and details has already proved valuable. In addition to his connection with the electrical committee he is chairman of the grounds and buildings committee, one of the most important of the exposition.

J. H. ALLEN is another man who brings to the committee much valuable experience in exposition work. In addition to his connection with the electrical committee he is chairman of the machinery committee. Mr. Allen is a man thoroughly versed in mechanical matters, and has had long experience in such work. His acquaintance with electrical and mechanical men is very extensive. He is the business manager of *Dixie*, the leading industrial journal of the South. Altogether he is certainly well equipped by experience for his position on the electrical committee.

GENERAL CLEMENT A. EVANS is one of Georgia's most distinguished men. He is a leading citizen of Atlanta, and takes an active interest in her progress and welfare. During the recent gubernatorial campaign, preliminary to the

Democratic convention, Gen. Evans was Atlanta's choice for governor, and would have gone into the convention with over one-third of the votes of the state pledged to his support if he had not, in the interest of party harmony, withdrawn before all the counties had acted. He is a man of fine judgment and business ability. His influence, not only in the state but throughout the South, has gained much for the department, and his counsel is highly valued by the committee.

LUTHER STIERINGER is well known to everyone who has had any experience in exposition work. He has attended all the great exhibitions within the last decade, including those at Paris, New Orleans, Philadelphia and Chicago. He designed the electric fountains at the World's Fair, is an inventor of great fertility and resource, and is the owner of a number of patents, from which he derives a large royalty. He was consulting electrical engineer at the World's Fair and now bears that relation to the Cotton States and International Exposition. His opinion is highly valued by electrical companies.

CHARLES F. FOSTER, engineer of the mechanical and electrical departments of the exposition, won distinction in the installation of machinery at the World's Fair. He took up the task eight months before the opening, when everything was in confusion, and brought it out in good shape on time. For this great service he received the highest commendation of Chief Burnham, the director of works, who congratulated President Collier of the Atlanta Exposition upon securing the services of a man of so much ability. Mr. Foster began his career in the engineering department of the city of Boston, afterward going to Lawrence, Mass., as assistant engineer of the water works at that place. He later became chief engineer of the Manchester Cotton Mills of Manchester, N. H. From Manchester he went west to become general superintendent and chief engineer of the St. Louis Cotton Mills, where he remained five or six years. Later he was manager of the Heine Safety Boiler Works of St. Louis. From St. Louis he went to Chicago and accepted the position of mechanical engineer of the World's Fair. Since the close of the Columbian Exposition he has been in the practice of his profession on his own account.

## Milwaukee Street Railway Reorganization.

[Special correspondence of the WESTERN ELECTRICIAN.]

Within a year the Milwaukee Street Railway company, now in the hands of receivers, will be reorganized. This is the outlook at present. Word comes from New York that Frederic Olcott, Arnold Marcus and William Nelson Cromwell have been appointed a committee under a plan already assented to by a large majority of the holders of the company's securities. The plan provides for a new company which shall issue first consolidated 5 per cent. mortgage bonds for $7,000,000 and capital stock to the amount of $7,000,000. Half of the capital stock, it is provided, shall be 5 per cent. preferred stock and the other $3,500,000 common stock. The company shall be authorized to increase its first mortgage bonds and its preferred capital stock to the amount of $1,000,000, the proceeds of which shall be used for improving the system.

Of the $7,000,000 first consolidated bonds it is provided that $1,500,000 worth shall be placed in a trustee's hands against outstanding first mortgage bonds for the same amount. The remainder of the bonds, amounting to $5,500,000, are to be divided pro rata among the holders of the present consolidated first mortgage bonds, under which division these outstanding bonds will receive 61.765 per cent. in new bonds. The preferred capital stock is to be divided among the holders of the present first consolidated bonds at 38.244 per cent. of their par value, and out of the remaining preferred stock the outstanding unfunded coupons under the present first consolidated mortgage shall receive an equal amount of stock at par. The coupons due on outstanding first consolidated mortgage bonds will receive 61.756 per cent. in cash.

Of the $3,500,000 of common stock the sum of $2,550,000 is to be given in exchange for $1,275,000 second mortgage consolidated mortgage bonds of the old company. The remaining $950,000 of the common stock to be issued will be divided pro rata among the stockholders of the present company The holders of most of the securities in each class have assented to this plan. The Central Trust company of New York is named to receive securities under the agreement and will issue certificates therefor. Henry C. Payne is of the opinion that the reorganization will be effected in about a year. He has no doubt whatever about the issue of bonds, but says that the issue of $7,000,000 of stock will be a matter of negotiation between the security holders.

The employes of the Milwaukee Street Railway company have been notified by Receiver Payne that the old wages will be maintained by the receivers. Before the appointment of receivers the men had decided to ask for 20 cents an hour for week-day work and 22 cents an hour for Sundays. During the past year they received 19 cents an hour for every day in the week. When the receivers were appointed the men feared that an attempt might be made to cut their wages below the figures that prevailed last year. A committee of them called upon Mr. Payne and asked that an agreement to pay 19 cents an hour be signed by the receivers, but Mr. Payne informed them that the receivers could enter into no such contract, but that they might feel assured that the same wages would continue to be paid. The committee went away apparently satisfied.

Many of the aldermen and city officials are up in arms against the receivers of the Milwaukee Street Railway company, especially Henry C. Payne. In the petition for the appointment of receivers the trials and tribulations of the company at the hands of the Common Council were set forth and it was claimed in effects that by its harassing of the company with threatened adverse legislation the credit of the company was so impaired that it found itself unable to borrow money with which to pay interest and for other necessary purposes. In an interview which was published the day after the receivers were appointed, the same statement was made in a much stronger form by Henry C. Payne, who was vice-president of the company. He said that the proposed taxation of the company by the city was unfair and that but for the constant agitation of measures before the Common Council restricting the income of the company it might never

Capt. James R. Wylie. Gen. C. A. Evans.

Hon. H. E. W. Palmer. J. H. Allen.

ELECTRICITY AT THE ATLANTA EXPOSITION.

have been found necessary to seek relief in bankruptcy. The aldermen and other city officials at once took offense at these statements and declared that it was the inflation of street railway securities, not the action of the aldermen or any of them, that had caused the company's trouble. "If allowed to go unchallenged," said Alderman Muenzberg, "Mr. Payne's statement will damage the credit of the city. He makes it appear that this city of 275,000 inhabitants is not able to support a street railway. He and the other men who managed the street railway deals are simply seeking to shift the responsibility. The truth is that when this monopoly of the electric lighting and street railway businesses was created, the property was mortgaged and bonded for twice what it was worth and of course nothing could come of it but bankruptcy. The property of the Milwaukee Street Railway company is very valuable, being worth from $5,000,000 to $6,000,000, but it is far from being worth $12,775,000, for which it is bonded." Another city official, in commenting upon the claim of Mr. Payne about unjust taxation, pointed out the fact that the company has not paid a cent of the increased taxation and has gone so far as to bring about the passage of a law that will reduce its taxes very materially.

At the next meeting of the Common Council Alderman George Thuering introduced a resolution that at once stirred up a fight among the aldermen, some of whom are strong supporters of the company, while others oppose it upon very slight provocation. The resolution recited the statements made by Payne and pronounced them untrue; set forth the fact that while the records of the tax commissioner's office showed an assessment of only $2,800,000 against the company, it was bonded for about $13,000,000; charged that the financial interests of the city and of the enterprises doing business in the city and depending upon outside capital must necessarily suffer if this libel were to go unanswered; denounced the statements as utterly untrue and sought to direct the city attorney to attempt to intervene in the case in court and if possible have the objectionable statements stricken out.

Mr. Payne did not show the white feather. At the same meeting of the Common Council, having heard of the move contemplated by Alderman Thuering, he sent in a communication in which he declared that he reiterated and emphasized every statement made in the interview to which the aldermen, or rather some of them, took exception. He said that the council had not enacted any of these obnoxious measures into ordinances, and the company had nothing to complain about so far as the Common Council as a whole was concerned. His criticisms, he said, applied only to a small minority of the council. These aldermen had been diligent and persevering in their efforts to harass the company. During a number of months, he said, the aldermen, as they knew, had before them ordinances to reduce the fare on street cars below five cents. He called attention to the fact that at the last meeting of the council committee at which the measure was considered, he had promised if the ordinance were not passed that he would extend the transfer system to all the lines in the city. He told the committee at that time, he said, that the company was in financial distress and that the agitation of such measures impaired the credit of the company. The council killed the ordinance by a vote of two to one and he supposed that the low-fare agitation had reached an end. Acting upon this belief he got a pledge of two-thirds of the money needed to carry the company through without its going into bankruptcy and there was little if any doubt of his getting the balance. At this critical juncture, Mr. Payne stated in his communication, Alderman Thuering reintroduced his resolution to compel the company to sell 25 tickets for $1 and to give a passenger at least one transfer. This at once destroyed all hope of getting additional capital, for, while he endeavored to point out that the previous action of the council was sufficient evidence that it would not follow the lead of such an unreasonable and unreasoning faction as that which was responsible for the new ordinance, he was unable to overcome the feeling of men with money to invest that they did not care to imperil large sums where they would constantly be subject to such attacks upon their investments. Mr. Payne concluded by expressing to the council as an official body, and to the majority of the aldermen individually, his sincere thanks for their kindness and consideration. But to the four or five members who "have been so persistent in their unreasoning and illogical hostility" to the great street railway enterprise Mr. Payne said that he regretted to say that he was compelled to charge to a large degree the responsibility for the disaster which had overtaken the company and which he deemed unfortunate for the best interests of the city of Milwaukee. C.

## Lake Street "L," Chicago, to be Electrically Operated.

It is stated on good authority that the directors of the Lake Street Elevated Railroad company of Chicago have definitely decided to operate the line by electric power. A contract has been entered into by which the West Chicago Street Railway company will furnish electric power to the Lake street people at the cost of production, with 10 per cent. added. This will obviate the erection of a power plant by the Lake street company, but will very materially reduce the operating expenses of the elevated road when the necessary changes in rolling stock and structure have been made. Current will probably be supplied from the 12,000 horse power station of the West Chicago company on Western avenue.

## Low Street Car Fares in Chicago.

The following announcement of interest to Chicago people is made in a cable dispatch dated London, June 8th: Charles L. Bonney, vice-president of the Chicago General Railway company, has been collecting data here relating to omnibus and horse car traffic for the purpose of perfecting a scheme for better service and reduced fares in Chicago. The principal omnibus company of London carried over 133,000,000 passengers in 1894, at an average fare of 3½ cents, equal to six rides for 20 cents. Each vehicle here, while requiring a driver and a conductor, is limited to twenty-six passengers, and they have to be provided with seats. In spite of this the company paid a dividend last year of 8 per cent. Mr. Bonney says that when he returns to Chicago he will make a proposition to the municipal authorities of that city for a basis of six fares for 20 cents, and he proposes to introduce other innovations.

An electric railway is to connect Syracuse, N. Y., with Oneida Lake, twelve miles distant. The company, which has been capitalized at $300,000, will cater to summer pleasure travel.

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CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—The Western Electrician—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. This is a claim which can be made by no other Electrical Journal in the United States. Electrical merchants and manufacturers *desiring western trade* will appreciate the unequaled value of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

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RECENT activity in electrical construction work has had the effect of booming the copper market. During the last few weeks there has been a steady advance, and copper wire has taken a boom the like of which has not been seen for years. On Saturday, June 8th, it was quoted at figures which indicated an advance of $70 a ton in less than two months. At that advance one of the street railway companies of Chicago is said to have placed an order for 1,000 tons of wire, making the outlay $70,000 more than it would have been a few weeks ago. The story told in jobbing houses is one of an eager demand, insufficient immediate supply to meet it, and an advancing tendency in prices. Many mines are working day and night.

AT last the trolley railway system has been put to a use to which even the New York papers cannot cavil. It is now an instrument in spreading the gospel. It appears that on Monday night of last week a party of men and women connected with the Passaic street mission, in Passaic, N. J., chartered an electric car on the New Jersey electric railway, and went by way of Paterson to Singac and back. Wherever they saw a group of people on the sidewalks or rural roadsides the car was stopped, and the evangelists sang hymns and exhorted the bystanders to seek salvation. The idea is a novel one, and while it is difficult to see how it could be carried out without interfering with the regular traffic of the line, it is possible that some persons might be impelled to better living who could not otherwise be reached. Let the car be run slowly, with fenders to mitigate possible accidents; then invite some of the Brooklyn preachers who have lowered the standard of their calling by sensational and perfervid diatribes against the whole trolley system to find a more useful field for exercising their talents on the gospel car.

NEW ENGLAND, the stronghold of the Bell interests, has shown signs of dissatisfaction with the present arrangement for telephone service. Boston capitalists have formed a company at Framingham and a petition is now before the local authorities for a franchise. In other parts of the state there is growing disquietude, and in Melrose and Manchester companies have perfected organization and begun the work of establishing competing lines. The New England Telephone company is contesting every inch and the new enterprises will doubtless have a stormy time ahead of them. But the prize is worth the effort, and the newcomers are evidently determined to press their claims. The community is in sympathy with the movement, as it promises lower rates for telephone service and a considerable expenditure for material and labor in extending the old system and introducing the new.

IF natural ability and enterprise, combined with experience and influence, conduce to prosperity, surely the success of the electrical features of the Atlanta Exposition is assured, for the men engaged in the management of the department of electricity combine these qualifications. They are men of affairs, prominent in social, professional and commercial life in Atlanta; they have commanding influence in political circles and are eminent among their townsmen, who respect them for their public spirit and loyalty. These men are contributing their efforts and influence to make the exposition reflect credit upon the South, and they are working in harmony with the engineers under whose supervision the electrical display is being prepared. They should receive co-operation from everyone who is interested in electrical matters and they should have no trouble in securing interesting exhibits. Their aim is to make the electrical department of the exhibition in every particular worthy of the exposition and the industry. They deserve to be successful.

IT is encouraging to note the interest that is manifested by manufacturers in the subject of utilizing electricity in the operation of factories. An example of this kind was found in the recent meeting of the New England Cotton Manufacturers' association at Providence, where a considerable part of the time devoted to the reading of papers was occupied by discussions of the subjects of utilization of water power, electrical transmission, and the electrical driving of textile establishments. All of these subjects were of pressing importance to the members of the association, and they displayed good judgment in securing papers on these topics by competent men. Other organizations would do well to follow this example. Electrical manufacturing companies and engineers are always willing to discuss subjects of this kind with representatives of industries where machinery is employed that can be electrically operated. These meetings afford excellent opportunities for interchange of views and when properly conducted are a source of much benefit to all concerned. The papers read at the Providence meeting are summarized in this issue, and a perusal will show that they contained much valuable information.

IT is to be regretted that a fatal accident due to the electric current has already occurred on the electrically operated Metropolitan elevated road in Chicago. On Monday a workman employed on the structure started to climb to the top. In doing so he grasped one of the conducting rails, and as his body was in contact with the metal structure he received the heavy operating current through his body at the pressure of 500 volts. He was unable to release himself, but fellow workmen finally pulled him away and removed him to a place of safety, where he died in ten minutes. It is strange that a man familiar with the operation of the road could have been so careless as to touch the "live" rail with his bare hand while on the structure, but the poor fellow paid the penalty of his rashness with his life. The current used on this road is very powerful, and at the potential of 500 volts it is dangerous. In this case the contact was prolonged for several minutes, and it proved fatal. We trust that the management of the road will use every precaution in instructing its men and providing them with insulated tools and appliances. And it owes a still more imperative duty to the public in providing plainly lettered warning signs at all stations, where passengers may attempt to cross the tracks.

CAN it be possible that Col. Payne's popularity is on the wane? The Milwaukee aldermen have had the audacity to question the wisdom of the policy of the street railway management and they have boldly asserted that "nothing could come of it but bankruptcy." Heretofore the Milwaukee colonel has been on pretty good terms with the city fathers; he has secured valuable franchises from them and such other privileges and concessions as he desired, and although the aldermen have at times proved troublesome to the companies, these differences were invariably adjusted to the latter's satisfaction, thereby enhancing the value of Mr. Payne's services to these corporations. The gallant colonel was the hero of many bloodless battles and he generally came off victorious. But now it seems the colonel has incurred the displeasure of the council by announcing that the policy of the city fathers in harassing the street railway company by threatening hostile legislation made it impossible for that corporation to raise money with which to meet its obligations, impaired the credit of the concern and made it necessary to go into the hands of a receiver. The council, or at least some members of it, resented these charges and in reply claimed that the system of financial engineering adopted was the cause of the disaster. It is pointed out that while the assessed valuation of the company's property is $2,800,000, the concern is bonded for nearly $13,000,000. To an outsider it would appear as if the trouble were due to a combination of causes. There is no doubt that the financial policy of the company was at fault, but the aldermen contributed largely to the trouble by persistently nagging the management and giving outsiders an idea that the concern was in constant danger of adverse legislation. The result of all this is that the stockholders suffered, and Milwaukee investors will doubtless blame both the aldermen and the colonel for this disaster.

FOLLOWING the example of steam railroads of other states, those of New York are evidently preparing to shut out any competition that may be threatened by the extension of electric lines. During the last session of the Legislature an amendment was enacted in the law relating to paralleling existing roads, striking out the words "This shall not apply to street surface roads." The result is that all the electric roads of the state are thus brought within the provisions of this act. Attention is drawn to this bill at this time by the ruling of the General Term of the Supreme Court This ruling is important in that it sustains the refusal of the state railroad commission to permit the construction of a new railroad which would parallel an existing railroad, and because of the bearing it will have upon the extension of the network of electric lines that have been constantly growing in every part of the state. Early in the year the Amsterdam, Johnstown & Gloversville Railroad company applied to the state railroad commission for a certificate to the effect that the company had complied with the provisions of the law, and "also that public convenience and necessity require the construction of said railroad as proposed by the articles of association." The new 14 mile road proposed was to begin at Akin, a small settlement three miles west of the Amsterdam station of the New York Central, and parallel the Central to Tribe's Hill and Fonda and thence to run northward to Johnstown, parallel with the Fonda, Johnstown & Gloversville railroad and the Cuyadutta electric railroad; while between Johnstown and Gloversville it was to parallel three more railways. Although petitions were presented showing that the road was favored by many residents of the section to be served and the present rates charged were exorbitant, the commissioners declined to issue the permit, giving as a reason that they considered the movement ill-advised and "inviting superfluous competition." This solicitude on the part of the state officials was not appreciated by the promoters of the proposed road and they accordingly appealed to the General Term, but without success. It was decided that in spite of the numerous petitions the road was not needed; in other words the dissatisfaction of the people with the present condition of affairs and their demands for relief were disregarded and they will be compelled to patronize the old companies. In the opinion accompanying the decision, Justice Herrick says: "The propriety and necessity of constructing a road was not left to be determined by enterprising, but perhaps ill-informed or ill-advised citizens, or by those seeking by threats of destructive competition to levy tribute upon existing roads, but was placed in the hands of accredited officers of the state, who should act for and in its behalf in determining whether the interests of the state and of the community immediately affected would be promoted by the building of the road." In another place the court holds that "local sentiment, aroused by the alleged misuse or abuse of an existing franchise, affords no sufficient reason for granting another franchise upon the ground that public convenience and necessity require the construction of another road." It advises the people who petitioned for a new road to go before the commission and ask for a reduction of rates if they are dissatisfied. Not until such a petition shall have been made and refused by the commissioners will the courts consider it advisable to go into the question of necessity for a new road.

## Proposed Power Bridge at Buffalo.

Visitors to the electricity building at the World's Fair will remember the elaborate model of a power bridge exhibited by A. C. Mather, designed preferably to utilize the power of Niagara river without turbines by the use of an undershot water wheel supported by a bridge structure, on which, also, is placed a large number of dynamos driven by belts from the wheel beneath. The power of the river is thus utilized by this power bridge for electrical distribution. The model was not shown in operation at the exposition, or at least for a brief period only, and did not attract the attention which it perhaps deserved. The inventor has the utmost faith in the project, however, and has kept steadily at work upon it. At present, after the passage of an enabling act by the New York Legislature, the mayor of Buffalo is considering the scheme. Mr. Mather is a successful inventor and business man in other lines, and he says that he will invest $100,000 of his own money in an experimental span of the bridge, to demonstrate the feasibility of the whole project.

The bill referred to allows Mr. Mather to put a bridge fitted with power wheels across the Niagara River at Buffalo. The conditions are, briefly, that he shall first erect an experimental span; that he shall give proper bonds to the state engineer and surveyor for the removal of all piers, foundations and structures in case the experiment is not a success; that he shall maintain a draw of not less than 200 feet in such position as will best suit the purposes of navigation, and that he must begin construction within two years and complete it within five years, but that this period shall not commence until the Canadian government gives its permission to the project, provided that permission shall be obtained within two years. The bridge is to be adapted to all kinds of traffic, providing facilities for electric cars and other vehicles, and a small toll, to be approved by the state engineer, may be charged. Finally, Mr. Mather has the power of condemnation of property, if necessary, to obtain land for approaches to the bridge. This bill has been sent to Mayor Jewett for his approval or disapproval.

The experimental span which Mr. Mather purposes to put up has stone abutments supporting a steel truss bridge 65 or 70 feet above the water, and a steel girder supporting a steel undersbot wheel. This wheel is 200 feet long and 40 feet in diameter, and its bearings are mounted on four powerful hydraulic cylinders, by which, Mr. Mather, says it can be raised instantly 10 feet above the river or sunk 10 feet into the current. "The construction of the wheel is such, and the bracings so placed," said Mr. Mather, "that if it were made of one solid piece of metal of the thickness of half its diameter it could not be stiffer than this system of bracing now makes it. The torque is also provided for and the whole design I submit to the criticism of eogineers and people familiar with iron work and its construction." Mr. Mather says that manifestly the power generated by this wheel could not be taken from the axle. Instead, it is taken from the circumference of the wheel by link-belts. These belts have tighteners which keep them always taut and help to regulate the strain. The wheel is to weigh over 5,000,000 pounds. The bridge itself is so designed by the inventor as to have at one side a house containing the dynamos, next it a roadway and track for electrical cars, and finally a footway. The draw is to be 200 feet long, or considerably longer than that in the International bridge. If the bridge should be built there would be ten spans. Mr. Mather said it is proposed to hang five, six, seven or eight power wheels beneath it, as deemed best.

The remainder of Mr. Mather's scheme looks to the transformation into electricity of the power generated by the wheel. This part of the project presents, of course, no particularly new problem. The dynamos are placed upon the bridge in direct connection with the power belts.

Mr. Mather has bought considerable property in the vicinity of the proposed bridge, some on the American side of the river and more on the other. When Mr. Mather was asked where the experimental span would go up, he said that this would depend on what site shall be decided best for the bridge.

The first single span will be built so that it will form one link in the bridge if the project is completed. "But it will be somewhere between Ferry street and the Front," said Mr. Mather. The speed of the current passing through the river channel at this spot is, he says, 700 feet a minute. The river is about 2,000 feet wide and has an average depth of from 15 to 18 feet. When he was asked what amount of horse power he figured that each wheel would produce he said that of course it would depend upon the depth to which the wheel entered the current.

## Proposed Dam at Minneapolis.

It is announced that the Pillsbury-Washburn Flour Mills company has begun work on a dam across the Mississippi river at Minneapolis. It will be about 900 feet long, and will be located about four blocks below the present dam at St. Anthonys Falls. About 10,000 horse power is expected to be secured, which will be used partly to generate electric power. A three-story power building will be built, 220 by 100 feet, on a granite foundation, with an iron roof and fireproof floors. The plans provide for 40 turbine wheels. The cost will be about $700,000, and it will take 18 months to complete the work.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Standard Telephone & Electric company is now making telephones in Madison, Wis. The war between it and the old company for an exchange there goes merrily on. Both have made unusual exertions to secure the fields and the Standard now has 300 subscribers while the old company has increased its list 75, making about 250. Many of the new ones are conditioned, giving the subscriber the right to change if a new exchange is put in. It will be a finish fight, as two companies cannot make expenses. The Standard company says that the Milde patent does not conflict with the Berliner, so the recent decision does not affect the company. It has put in a telephone system at Tomahawk, Wis., using the Milde patents.

The Western Union Telegraph company at Winnebago City, Minn., has ordered its employes not to use the local telephone lines in transmitting messages, owing to pending litigation. The Winnebago line does not use the Bell instruments.

Negotiations are pending to build a telephone line from Bonested, Gregory county, S. D., to Wheeler, Edgerton, Bloomington and Armour. The line will be a continuation of the Stuart, Neb., line to Bonested.

It is understood that the new telephone company at Ottumwa, Ia., has secured 90 per cent. of the old company's subscribers. The new company proposes to extend a line to Hedrick and Fremont, there connecting with the Oskaloosa company's line.

Dr. Bradley, proprietor of the Lisbon, N. D., telephone line, has contracted to put in 28 new telephones in Lisbon and that, with the Milnor line, it is claimed, will put the whole on a paying basis.

The Northwestern Telephone company is about to build a 90 mile extension of its system from Fargo to Grand Forks, N. D. Condemnation proceedings for the right of way have been begun. The Northwestern Telephone Exchange has been offering telephones free at Winona, Minn., to the city, where the Winona Telephone company has just begun operations. Since the Berliner decision the offer has been withdrawn. The Northwestern Telephone Exchange will build a line from Cummings to Portland and Mayville, N. D., if given sufficient encouragement.

W. P. Veitch and George S. Luce have been granted a telephone franchise to build a telephone line between Winona, Minn., and Bluff Siding, Wis.

## Telephone News from New England.

[From the Boston correspondent of the WESTERN ELECTRICIAN.]

The fact that the United States Circuit Court of Appeals has declared the Berliner patent valid does not seem to deter New England capitalists from moving in the direction of establishing rival telephone lines. There is a movement on foot to establish a telephone system in Framingham, a large manufacturing center in Massachusetts. A company has been organized under the name of the Framingham Telephone company and capitalized at $150,000. The company applied to the board of selectmen for the right to introduce telephone service and has a concession for 65 years. Behind the project are A. W. Worthley, H. H. Hunt, George H. Conant, Moses S. Case and M. F. Maher, all of Boston, except the latter, who is a Framingham man. These gentlemen are already interested in similar enterprises. They propose to introduce a system of modern improvements of which they have control and to compete with the New England Telephone & Telegraph company, their maximum monthly rate for houses to be $2 and for stores and places of business $2.50, against the New England's rates of $3.50 and $4.25 for similar service. A public hearing on the matter was held in the town June 4th. The petition naturally was opposed by a representative of the New England Telephone & Telegraph company. The selectmen took the matter under advisement.

A new telephone company is being organized in Melrose and has asked permission to erect poles and string wires. The company agrees, if it can obtain 100 subscribers, to establish a local exchange and cut prices to about one-half the present rates. William E. Barker of Melrose and a number of prominent business men are interested.

A new telephone company has been organized in Manchester, N. H., with John B. Hall as president and George Leighton as treasurer. Agents are at work securing subscribers under a four-year contract at $30 per annum for office and $20 for house service. As soon as a sufficient number of subscribers have been secured work will be begun on the erection of the line.

## American Institute of Electrical Engineers

The general meeting of the Institute will be held at the Cataract House, Niagara Falls, N. Y., beginning on Tuesday, June 25th, at 10 A. M. and continuing four days. The date of this meeting has been fixed with a view to accommodating all who may wish to visit the Falls during the most desirable season. Members are requested to invite their friends, either ladies or gentlemen. Among the objects of engineering interest which it is proposed to visit are the new works of the Niagara Falls Power company, the Niagara Falls Park and River railway on the Canadian side, the aluminum plant of the Pittsburg Reduction company, the plant of the Carborundum company, the central station of the Niagara Falls & Buffalo Electric Light & Power company.

Should a sufficient number of favorable responses be received, reduced railway rates may be secured. The hotel rate will be $3.00 per day and upward, according to room, at the Cataract House. Those who prefer will find the International convenient. The convention rate of one and one third fare for the trip has been granted by the Trunk Line association, conditional upon an attendance of one hundred members and guests. This covers the Grand Trunk (in part), N. Y. C. & H. R. R. R., West Shore, N. Y. O. & W., Erie, D. L. & W., L. V. R. R., C. R. R. of N. J., P. & R., B. & O., C. & O., Pennsylvania, and other minor lines. Similar concessions are expected from other lines, east, south and west, the roads already mentioned covering only the territory east of Niagara and north of Pittsburg, except New England. It should be remembered that the rebate is dependent upon the attendance of 100 who have paid fare, otherwise no benefit is secured.

Wherever the number warrants, arrangements will be made for a special car.

The secretary has issued a preliminary programme, announcing the following list of papers:

"The Substitution of Electricity for Steam in Railway Practice" (inaugural address), by the president, Dr. Louis Duncan of Baltimore.

"Properties of Fuse Metals when Subjected to Short-circuits," by Walter E. Harrington of Camden, N. J.

"Location of Grounds in Armatures, Fields, etc.," by Clarence E. Gifford of Jamestown, N. Y.

"Some Features of Alternating Current-Systems," by Chas. P. Steinmetz of Schenectady, N. Y.

"Theory of General Alternating Current Transformer," by Chas. P. Steinmetz of Schenectady, N. Y.

"Compounding Dynamos by Armature Reaction," by Elihu Thomson of Lynn, Mass.

"Existing Commercial Applications of Electrical Power from Niagara Falls," by W. L. R. Emmet of Schenectady, N. Y.

"Alternating Current Curves," by Dr. C. E. Emery of New York.

"Electric Power in Factories," by Prof. Francis B. Crocker, Messrs. Benedikt and Ormsbee of New York.

"Some Observations on a Direct connected 300 Kilowatt Monocyclic Alternator," by Profs. Dugald C. Jackson and S. B. Fortenbaugh of Madison, Wis.

"On Mechanical Models of the Electric Current," by Prof. Brown Ayres of New Orleans, La.

"On the Cause of Death in Electric Shock," by Albert M. Bleile, M.D., of Columbus, O.

"Long-distance Power Transmission at 10,000 Volts" (the Pomona plant), by George Herbert Winslow of Pittsburg.

"Notes on the Reconstruction of a Small Central Station Plant," by Franklin Leonard Pope of Gt. Barrington, Mass.

"On Rating the Performance of Electric Power Plants and Transmission of Varying Loads," by Prof. Wm. S. Aldrich of Morgantown, W. Va.

"Work of the Westinghouse Electric & Manufacturing Company for the Cataract Construction company of New York," by L. B. Stillwell of Pittsburg.

## Texas Gas and Electric Light Association.

An organization of gas and electric light companies was formed at Houston, Tex., on May 22d, under the title of the Texas Gas and Electric Light association. Among those present were the following named, who became members:

W. M. Brooke, Central Electric company, Chicago; P. Bauer, secretary and general manager Texarkana Gas & Electric company; J. H. Fitzgerald, superintendent Houston Gas Light company; L. T. Fuller, Calvert Water, Ice & Electric company; James T. Fuller, Calvert Engineering company; E. F. Gibbon, superintendent Corpus Christi Electric Light company; W. E. Holmes, superintendent Austin Gas Light & Coal company; W. T. M. Mottram, electrical engineer, Dallas; Harry L. Monroe, General Electric company, Dallas; J. P. Nenna, McKinney Electric Light company; S. G. Peticolas, Houston General Electric company; Scott Van Etten, Houston Electric Manufacturing company; Homer Starr, manager Gonzales Electric Light & Power company, and E. Jay Sugru, Hensler Oil company, St. Louis, Mo.

The following named persons were not present, but they had expressed their intention of joining and had helped in getting up the movement. They were accordingly voted

members: C. D. Brann, superintendent Trust Electric Light & Power company, Galveston; J. R. Cullinane, secretary Denison Electric Light company; J. R. Ellis, superintendent Sherman Gas Light company; J. L. Griffith, secretary Waco Gas company; J. Hicks, president Arkansas & Texas Ice & Coal company, Marshall; A. E. Judge, president Tyler Electric Light & Power company; H. D. Kampmann, president San Antonio Gas company; J. C. Lord, superintendent Fort Worth Light & Coal company; Thomas D. Miller, manager Dallas Gas & Fuel company; J. D. Ollger, secretary Cleburne Electric Light & Power company; J. W. Oz-ment, president Edison Illuminating company, Palestine; F. R. Starr, Jr., superintendent Luling Electric Light & Power company; J. H. Swift, general manager Longview Electric company.

W. E. Holmes, of the Austin Gas Light & Coal company,

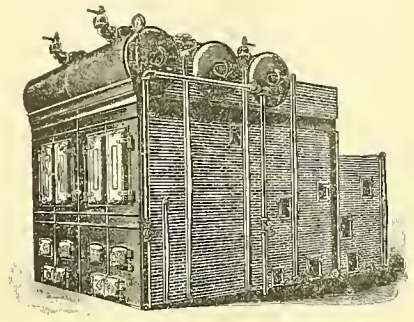


FIG. 1. COMBINE SAFETY WATER TUBE BOILER.—ELEVATION.

presided at the preliminary meeting, and Homer Starr manager of the Gonzales Electric Light & Power company, acted as secretary. The chairman announced the object of the meeting to be:

The promotion and advancement of knowledge, scientific and practical, in all matters relating to the construction and operation of gas and electric light plants and the distribution and sale of their products.

The establishment and maintenance of a spirit of fraternity between the members of the association by social intercourse, and by friendly exchange of information and ideas on the above mentioned subject matters.

And the inducement and extension of more cordial and friendly relations between the manufacturers of gas and electricity and their patrons, based upon mutuality of interests.

A committee on permanent organization, consisting of Messrs. Fuller of Calvert, Bauer of Texarkana and Fitzgerald of Houston, was appointed. The committee prepared the following report, which was adopted:

1. That we organize the Texas Gas and Electric Light association.

2. We recommend that the following permanent officers be elected: A president, vice-president, secretary and treasurer combined and an executive committee consisting of three members.

3. That our first president shall be W. E. Holmes of Austin; vice-president, P. Bauer of Texarkana; secretary and treasurer, Homer Starr of Gonzales.

Messrs. Bauer, Fuller and Fitzgerald were appointed a committee on constitution and by-laws.

The subject of dues and initiation fees was then taken

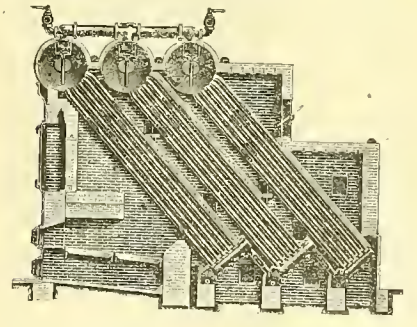


FIG. 2. COMBINE SAFETY WATER TUBE BOILER.—SIDE ELEVATION.

up. Upon motion of Mr. Fuller, the committee on constitution and by-laws was instructed to fix the initiation fee of active members at $5 and of associate members at $2.50, which should include the dues for the first year. The regular annual dues thereafter should be $3 for active and $2 for associate members.

Messrs. Brooke, Gibbons and Mottram were appointed a membership committee.

C. D. Brann of Galveston and Thomas D. Miller of Dallas were elected members of the executive committee, to hold office for two years, and Messrs. Fuller of Calvert and Fitzgerald of Houston were elected members, to hold office for one year. The committee was authorized to call a meeting, if it was thought advisable, some time this summer to pass on new applications for membership and to arrange such other things as might be necessary or convenient in preparation for the next annual meeting, which shall be held on the second Tuesday in May, 1896.

The secretary was instructed to tender a vote of thanks to the newspapers and magazines which had kindly published notice of the intended meeting.

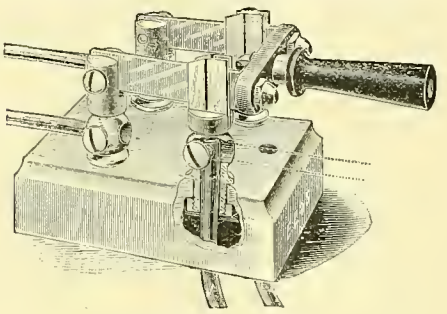
A vote of thanks was also given Mr. Fitzgerald of Houston for his kindness in arranging for the meeting and for attentions shown; also to the president, Mr. Holmes, for his efforts, to which the organization of the association is largely due.

## Jack-knife Switch.

The Electric Engineering & Supply company of Syracuse, N. Y., has for some time been furnishing to the trade a neat and practical jack-knife switch, with a carrying capacity from 15 to 25 amperes. This switch, which is shown in the accompanying cut, is mounted on a porcelain base, fitted with combination terminals which will admit of both a top and a rear connection, the wires being held in either case by the same screw. It is small and compact, being only 2½ inches long by 1⅞ inches wide, and is 1¾ inches high, base included. This little switch has become a great favorite in the construction of panel board work, and has supplanted many snap switches. The company also furnishes switches of this style without the porcelain base, so that they can be mounted directly upon the slate.

## Combine Safety Water-tube Boiler.

Advancement in details of design and construction are shown in the Combine safety water-tube boiler herewith illustrated, which is manufactured by L. M. Moyes of Philadelphia. The boiler is "sectional" and of the class of the water-tube type, in which the steam and water drums are arranged and located transversely to the flow of gases from the furnace to the outtake to chimney. The broad claim by Mr. Moyes of continuous and positive circulation throughout the entire boiler system is a very important and valuable



JACK-KNIFE SWITCH.

one. The cuts show a perspective elevation of a battery of 616 horse power, Fig. 1; a side elevation showing an assembled boiler, Fig. 2; transverse sections, through the front steam and water drum and furnace, and through the rear steam and water drum, Fig. 3; details of tubes, manifolds and distributing drums assembled are shown in Fig. 4. In elevation the boilers present a neat and compact appearance. The steam and water drums are encased in blocks of makite moulded to the radius of drums; the bench formed by break in the lines of brickwork in the rear of the steam and water drums, as shown in the elevation, is utilized for the carrying of main flue, with a number of batteries, or the stack, with one battery or one boiler, reducing very considerably the floor space required. The fronts of boilers are of cast-iron of handsome design and are supported entirely free of the brickwork around the boiler; the frame upon which the steam drums rest is formed of I-beams braced and tied so as to be self-supporting, and is also independent and separate from the brickwork. The side elevation presents a fairly good idea of the arrangement of the boiler; the tubes (standard four inches by 18 feet) on an angle of about 45 degrees are expanded at the upper end into the tube sheet in steam drum, and the lower end into the tube seats in manifolds. The manifolds for power plants are open hearth cast-steel thoroughly annealed, making this section of the boilers, it is claimed, stronger and more enduring than forgings. Each manifold has an area almost equal to an eight inch tube. Opposite each tube is a hand-hole closed with an inside and outside plate also of steel. The seat on the outside face of the manifold and face of the outside plate are machined so as to form a perfect joint without packing. The inside plate forms an almost perfect joint without packing, thereby removing all pressure from outside joint. Each manifold is connected to a distributing drum by a five-inch nipple; for ordinary high pressure the distributing drums are also annealed steel. The sections are connected to each other by circulating tubes set at the same angle as the tubes, and are five inches in diameter. Each distributing drum has a separate blow-off valve. In the operation of the boiler the gases, as will readily be seen, have a very long contact with the heating surfaces in their flow from furnace to outtake. As indicated by arrows, the circulation of water and flow of steam generated in the tube are upward in the two forward sections into the two front drums, with ample disengaging space, thence by the connecting devices to the rear drum (into which the feed is also being delivered) downward in the rear section to supply by the many connections the water of displacement. The ingenious and mechanically designed connections between sections provide for all and every possible strain of expansions. The steam drums rest on I-beams in such manner as to remove all carrying strains from the tubes. The transverse section through the front steam drum shows the separator dry pipe in each drum. The section through the rear drum shows feed water sump; the feed pipe is con-

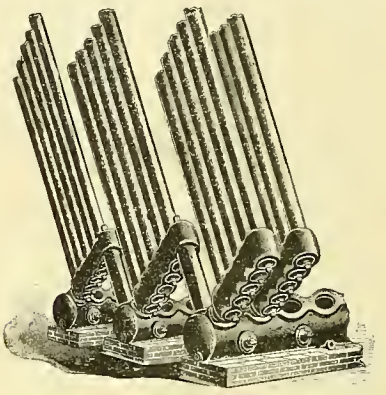


FIG. 4. COMBINE SAFETY WATER TUBE BOILER.—DETAILS OF TUBES.

nected to the sump, and into it the feed water is delivered. The sump is of cast-iron, on which is placed loosely a light cast-iron cover, which continues to within a short distance of the end of the sump, forcing the feed to travel its entire length, and in doing so acquiring the temperature of water in circulation in the boiler, before coming in contact with it, thereby depositing many of the impurities in solution and suspension, which is removed by the use of the blow-off valve attached for that purpose. Should the deposit in sump accumulate through inattention to such an extent as might interfere with the passage of the feed in sump, the cover, being placed on loosely, would be forced off by the accumulating pressure, due to the feed delivery, and thus enable the feed to enter into circulation. The circulating and compensating tubes, by which the steam drums are connected, are shown in the side elevation, also the cross steam pipes on top of the drums, to which are attached safety valves. These cross pipes are of steel with flanges cast on. Forethought is displayed in the facilities for the removal and replacement of damaged tubes. A tube from any section in the boiler can be easily removed without interfering with adjoining tubes. The removal of a deposit from the inner surface of tubes is either by introducing the scraper, at the lower end through the hand-hole, or at the upper end from the steam drum. The smallest steam drum used on this boiler is forty-

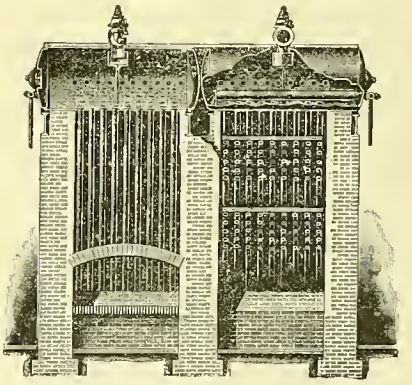


FIG. 3. COMBINE SAFETY WATER TUBE BOILER.—TRANSVERSE SECTION THROUGH FRONT AND REAR DRUMS.

two inches in diameter, giving ample space for men to operate when cleaning tubes. The chamber at the lower end is also sufficiently roomy for the cleaning. The facilities for cleaning tubes have been based on the practice of many years' experience with this type of boiler. A specially designed scraper and handle is used. The manner of connecting the tubes to the manifolds, also the connections between manifolds and the connections between manifolds and distributing drums are shown in Fig. 4. The hand-holes shown in distributing drums are covered and protected in the same manner as those in manifold. The same fittings are used in both cases. An important feature in the Combine is that it admits of being shipped as an almost completed unit. Each boiler is shipped in three sections, the sections consisting of steam drum, tubes, manifolds and distributing drum. These are assembled and tested at the works, only requiring the connecting of the same at the point of erection to form the perfect

boiler. What will be at once apparent with a survey of the Combine is the simplicity of form the boiler assumes when a finished product. All sections are connected by expanded tubes or nipples, without a single bolt or threaded connection in its entire aggregation. The tubes forming the heating surface are practically straight. The slight conform in the two tubes in each section made necessary for alignment in entering tube holes in drums is perfected at the tube mills, virtually during the process of manufacture. The tubes of conform are in every respect interchangeable into the different sections. It will also be observed there are no departures from the established lines of the standard boilers of the water-tube type. The assemblage of heating surfaces, their building up with standard tubes, drums and manifolds, and their relation to each other, the travel of gases in contact with heating surfaces, the circulation of water and flow of steam due to the devices invented by Mr. Moyes, are identical in their dispositions as in the better known boiler with which he has for so many years been connected. This takes the Combine at once from the ranks of the experimental class. Mr. Moyes will make a specialty of boilers for power plants, but the Combine is also adapted for office and other large buildings where sufficient head room is at times a difficult problem to solve. It is built in units ranging from 50 horse power to 600 horse power, and is capable of carrying a working pressure up to 200 pounds per square inch.

## Moissan's Experiments.

The investigations of Moissan with the electric furnace have again come under discussion recently, owing to a late lecture of the French chemist on his work. These experiments have been closely followed in the WESTERN ELECTRICIAN and no doubt a summary of Moissan's account of his work will prove interesting, though the subject has been pretty thoroughly covered in these columns as the investigations proceeded. The celebrated chemist recently gave the first connected account of his discoveries to the Congress of Learned Societies held in Paris. This lecture was reported in *Le Génie Civil*, from which the following summary is made :

The results obtained from working on minerals at very high temperatures are remarkable. Chemical substances like chromium, tungsten and titanium have been produced by means of the electric furnace as pure metals, for the first time in large quantities. These researches have been directed to the effects of electric heat rather than to electrolysis, the chemical action of the electric current, so that they leave out of account one of the most important products of the electric furnace, aluminium with its alloys, as it is not yet clear how far the reaction in its formation is due to chemical action and how far to heat. Moissan's furnace is extremely simple and in its various forms has been described and illustrated in the WESTERN ELECTRICIAN. The difference between this furnace and those used hitherto is that the material to be heated does not come into contact with carbon or carbon vapor. The apparatus is a true reverberatory furnace—an electric reverberatory furnace with movable electrodes. The last point is important, inasmuch as the ability to move the electrodes makes it easy to establish the arc, to extend or to shorten it at will; it greatly simplifies the experiments, and has made it possible to grapple with questions that could not be solved before. By means of this apparatus and the use of high temperatures, Moissan was able to reproduce diamonds, to crystalize metallic oxides, to reduce oxides until now thought impossible of reduction, to fuse refractory metals, to distil lime, silica, zircon and carbon, to volatilize in quantities metals like platinum, copper, gold, iron, manganese and uranium. Some of these bodies, which could not be even liquefied, such as magnesium, uranium, tungsten and molybdenum, can be turned into gases by the electric furnace. He has often handled in his investigations the gas vaporized from lime and that from silica.

The operation of the apparatus is very simple. The current is brought by two pliable wires to the carbon electrodes, whose diameter varies according to the power of the dynamo. The contact is established, the arc flashes, and by advancing or withdrawing the electrodes a powerful spark of constant length is given out, depending on the amount of electric power and the conductivity of the metallic vapors that fill the furnace. From the outset there is a strong odor of hydrocyanic acid arising from the combination of the nitrogen in the furnace with the acetylene, which forms at once. The purple flame of cyanogen at first lights up the electric arc, then the color disappears, and the light becomes dazzling. The quicklime of the oven soon melts and flows like wax, and then boils; the electrodes become redhot in a few moments, torrents of vapor break out on all sides in constantly increasing volume. The lime distils plentifully and covers the supports of the electrodes with a white scale. So with the use of currents of 300 or 400 horse power we have in the middle the enormous heat produced by the electric arc, a few centimeters lower down the crucible containing the material to be reduced, and below that a layer of seething quicklime. The fact that the lime is a poor conductor is fortunate, for it shuts up in the smallest possible space the greatest heat that the electric arc can give.

It has been possible by using this apparatus, with such modifications as the experiments demanded, to study a whole series of simple bodies that hitherto were mere laboratory curiosities owing to the lack of means to obtain them. Chromium, which Vauquelin discovered, has been used in many ways. Its oxides and other combinations have been quickly applied to industry. That alloys of it were not formed and that it was not used as a metal was due to the difficulty in preparing it; it had never been produced in large quantities, and to utilize its important qualities for the manufacture of chrome steel, an alloy, ferrochrome, had to be made in the blast furnace. The electric furnace enables us to reduce the sesquioxide of the metal with carbon and obtain pure chromium in a form different from any obtained before. The metal does not oxidize; it can be filed like iron and takes a beautiful polish. It is less fusible than platinum, and can now be used for all alloys without passing through the ferrochrome stage, which has the inconvenience of containing 10 per cent. of carbon. In a single experiment 20 kilograms of molten metallic chromium were turned out. Whenever it shall be needed, therefore, this process can be used commercially. Its alloys with aluminium or copper are interesting; 5 per cent. of chromium added to pure copper gives it almost double resistance and makes it more impervious to the action of moist air.

Molybdenum, which had never been melted, can also be obtained in large quantities. The metal has a very fine grain and a brilliant surface; it can be filed, and, at red heat, can be forged on the anvil. Tungsten was only known to chemists as a powder. In the electric furnace its preparation is very simple; a mixture of tungsten oxide and carbon yields in a few moments slugs of well melted metal covered with a beautiful layer of blue oxide of tungsten. It is less fusible than chromium or molybdenum, but still can be easily liquefied. It does not seem to have much affinity for carbon, like the other metals described; it is produced with no great precaution, and is one of the purest bodies yet obtained. Metallic uranium had been procured in very small quantities with great difficulty by reducing uranium oxide with an alkaline metal, and always contained impurities. With the high temperatures of the electric arc, it is obtained in a few moments. It is a metal of great hardness, with a brilliant fracture, and if slightly carburated, has the curious property of giving out, when struck against a flint, sparks of much greater intensity and energy than those produced by steel.

These simple metallic bodies melt at very high temperatures. To them may be added other metals occurring in rather rare minerals, such as zirconium, vanadium and titanium, which have also been produced. In examining them, currents of very different power were used; at first the four horse power machine of the Paris School of Pharmacy, the 45 horse power machine of the Conservatoire des Arts et Metiers, and finally machines of 100 to 300 horse power of the electric lighting establishment of the Edison company. M. Moissan comes to the conclusion that the intensity of heat increases with the intensity of the current, contrary to the opinion commonly held that the electric arc possesses a constant high temperature. With the smaller machine, for instance, he obtained the protoxide of titanium; with the next larger he could not get beyond the nitride; with the largest he got first crystallized carbide and then titanium itself. This metal catches fire in fluorine, decomposes water only when at a red heat, and has the strange property of burning in nitrogen at a high temperature, producing titanium nitride. It combines readily with carbon and silica. Its melting point, like that of carbon, is very high, but whereas the latter turns to gas without liquefying, titanium first becomes liquid and is then volatilized in the electric furnace.

In his investigations he uses the word "carbide" again and again. All simple bodies form with carbon, definite, crystallized combinations, stable at high temperatures, which will open up a new chapter in mineralogical chemistry. Some decompose cold water, sending out acetylene, formene, or ethylene; the hydrogen carbides thus obtained are very pure. The simple bodies form also borides and silicides well crystallized and so hard that some can cut diamond. They will probably play an important part in the manufacture of steel, and we shall soon know whether, like chromium, they will harden it and give it new properties.

A new chemistry of high temperatures is in process of formation, and commerce will in all likelihood derive from it new applications. The treatment of metals by the heat of the electric arc will become more and more common; the impurities of coal will no longer need to be added to ores; waste and fluxes will disappear; the mixture to be acted on will be brought at once to the required heat; the transformation will be rapid.

An example will prove this: Last year M. Moissan demonstrated that it was easy to obtain by the electric furnace a calcium carbide which decomposes cold water as energetically as does sodium; but while sodium makes hydrogen, the carbide disengages acetylene gas, rich in carbon, and with illuminating power superior to that of ordinary gas. In America, England and Germany, factories are rising to prepare this carbide, in order either to replace or to enrich lighting gas.

## Opposition to Electric Railways in Quebec.

[From the New York *Sun*.]

The blacksmiths, horseshoers, harnessmakers and hackdrivers of Quebec have made an energetic protest against the granting of a permit to build an electric street railway in the city, for the reason that it will interfere with their means of earning a living. We suppose it is bound to do that for a time, while it will surely furnish other work to a good many of them. Above all, it will enable the rest of the people of the city to reduce their current expenses, for horse travel is far more costly than electric travel. There is no use in trying to resist the introduction of the natural agencies of power or the new inventions in mechanics. Such attempts can never be successful anywhere.

## Trolley Memorial Day in Brooklyn.

[From the Washington *Evening Star*.]

If the overhead trolley had as firm a hold in every city in the country as it has in Brooklyn, Memorial Day would soon be devoted to mourning for trolley victims. Special services were held in the city of churches, at which the graves of the trolley-killed were decorated, while trolley-maimed and other orators discoursed fervidly of trolley evils to the few Brooklynites who have escaped injury.

## The Reduction of Refractory Metals.[1]

The increasingly common use of means of decomposing highly stable substances, such as metallic oxides having high heats of formation, on a scale greater than that generally adopted in the laboratory, has within the last few years attracted the attention of the technical public to questions, intellectually interesting, and possibly commercially attractive, which would otherwise have remained untouched save by the eclectic few. No one has done more, in this country, to spread and popularize a knowledge of the properties of those metallic elements, which are more familiar by name than by appearance even to professional chemists, than Prof. Roberts-Austen. In continuation of previous expositions, he recently gave a *résumé* of modern work in this direction, in the form of a lecture at the Society of Arts, illustrated by well-chosen experiments. Seeing that the title of the discourse was "The Reduction of the Rarer Metals from their Oxides," it is evident that the term "rare" was used in reference to the metals in their isolated state, that is, palpably as metals, and not in the chemical sense of "rare," viz., very seldom found, whether in the metallic state or as a compound. Chromium—and, until the last few years, aluminum—may be called rare in the former, but not in the latter sense. By accepting the less usual connotation, a good many fairly commonplace elements may be elevated to a temporary position of rarity, and brought within the scope of a paper with the title already quoted.

At present three distinct methods of reducing refractory metals are in common use. It is proper to remark that by "refractory metals" is meant that class of metals, the heats of combination of whose oxides are too high to allow of their commercial reduction to metal by means of carbon at temperatures up to and including those of the blast furnace; the canon is not absolute for certain metals, notably those of the alkalies, which are sufficiently volatile and may be reduced by means of carbon in spite of their essentially refractory character.

The first of these three methods, in point of antiquity, general applicability and inherent interest, is the purely chemical process of performing the reduction in two or more steps, some intermediate compound forming the stepping stone. The most familiar illustration is the reduction of aluminum from alumina via aluminum chloride. Carbon will not reduce alumina at ordinary furnace temperatures; sodium is also ineffective; carbon will not reduce aluminum chloride. But carbon in the presence of chlorine will convert alumina into aluminum chloride, and sodium will reduce this latter with ease. The general aim in this method is to convert the refractory substance into a compound less markedly refractory, so that it can be dealt with by some fairly cheap reducing agent—the position is sapped, not stormed. Of all the compounds of aluminum which have seemed likely to serve as half-way houses in the process of reduction, the sulphide has always been one of the most attractive to the devisers of processes. It is not easy to prepare the sulphide, the reaction of carbon disulphide on alumina needing a high temperature for its accomplishment, but the task is light compared with the commercial reduction of the sulphide to aluminum; the metal manganese is the only likely candidate for the contest. Fortunately, the utilization of aluminum sulphide has been achieved by other means. A variant of this general method is to use some reducing agent, itself frequently obtained by two or more steps, more powerful than carbon under the particular conditions of experiment. The reduction of chromium by the action of aluminum on chromic oxide is a case in point. The aluminum for this purpose may be looked on as carbon that has suffered a sort of chemical step-up transformation (the transformer having, by the way, a somewhat low efficiency), and it is able to accomplish the reduction with corresponding ease. This manner of utilizing the energetic essence as distinct from the material accidents of the carbon, is of particular value, when—as often—the metal to be reduced has a tendency to form a carbie. The carbon, being represented solely by its astral body, is secure from material union. Both chromium and manganese are much used in steel making, where the fortuitous introduction of carbon is undesirable, and the preparation of these metals and of their alloys with iron, free from carbon, is consequently of industrial moment.

The second method is noteworthy for its extreme neatness and simplicity, and the certainty that the reducing agent will not introduce foreign matter into the reduced product. It is, of course, electrolysis. Unfortunately, as the metals to be reduced are *ex hypothesi* refractory, they cannot be dealt with in aqueous solution until someone has discovered a new kind of water less readily electrolyzed than the ordinary variety. The adoption of fused baths presents many difficulties, largely arising from the attack of the vessels in which the electrolysis is carried out; but that these are not insuperable is proved by the flourishing state of the aluminum industry, the bulk, if not the whole, of which now depends on the electrolysis of alumina or its salts. It is here that the utility of aluminum sulphide is shown, for although its chemical reduction is difficult, its electrolysis can be accomplished, and presents certain advantages over that of the oxide dissolved in a fused halogen salt of aluminum, which is the more usual electrolyte.

The third general method is that involving the employment of the electric furnace. On account of the high fusing point and boiling point of carbon, this element can be trusted to stay at its post by the refractory oxide until a temperature is reached at which reduction of the oxide takes place. When once this is accomplished the carbon escapes as the gaseous oxide CO, and reverse reaction is thus minimized. But the very merit of carbon is the bane of the process when a pure metallic product is required. At the high temperatures requisite for reduction carbides of great stability are formed, and from these the pure metal can only be obtained by repeated fusion with the oxide of the metal under treatment, in order to successively oxidize portions of the carbon by an oxidant from its nature incapable of reacting upon the metal itself. The *rationale* of the action of the electric furnace in reducing refractory metals is totally distinct from that of the electrolysis performed upon a fused

1. From the London *Electrician*.

salt of the same refractory metal. The latter is, above all, as systematic and selective as the former is chaotic and indiscriminate. Each serves special ends.

In considering experimental work of the nature of that touched upon in the foregoing lines, a certain sobriety of thought and statement is indispensable. There is but little lately accomplished in the production of any of the refractory metals which has not been performed years ago by the chemist engaged in purely scientific research. The only justification for satisfaction concerning these larger scale experiments, and their easy and brilliant execution, is the consequent device of industrial methods and the discovery of some means of utilizing the products Much nonsense is talked about possible new structural metals, the orators forgetting that the abundance of an element on the earth's surface is a weighty factor in its utilization. Glucinum is no doubt a nice material for many purposes, and its reduction is not beyond our means; but unhappily, there is, so to speak, none of it. Even given abundance and fair ease of production, a "new" metal must be shown to be in some respect better than the older group before it can be more than a curiosity. Much more is to be hoped from persistent and enlightened experiment on the influence of small quantities of the more refractory metals on those longer and better known in the metallic state, with the view of obtaining alloys superior to those in common use.

## Three-phase Installations.

An interesting power transmission plant is in course of installation at Bayonne, N. J., where the three-phase system of the General Electric company will be employed to operate the machinery of the Tide Water Oil company. This company is allied with the Standard Oil company, and is engaged in exporting the refined products of petroleum. The nature of the process is such that spark-proof apparatus is imperative, and multiphase apparatus was selected as best fulfilling the peculiar conditions. The generators will be a 550 volt three-phase General Electric machine having eight poles and a capacity of 75 kilowatts. The several induction motors will be of five, ten and fifteen horse power. Some of these are spark-proof, and have a permanent resistance in the armature circuit. A special interest attaches to these motors, as they will be employed in places where there exists an ever present danger of explosion from gases, which a spark could readily ignite. They will be used to operate pumps, elevators and other machinery. The switches will be of special construction, with blades immersed in oil. The generator also supplies current for about 525 lights scattered throughout the different parts of the works. Regulation of the lighting circuits will be effected by special revolving regulators of novel design.

The Oakland Gas & Electric company of Oakland, Cal., will use a three-phase transmission plant for general power work. Current to a number of induction motors ranging from one to fifteen horse power will be supplied from a 75 kilowatt three-phase machine, and there will be extensive lighting in connection with the plant. The generator current (2,000 volts) will be reduced at two centers of distribution to the necessary potential, and the secondary network will cover a territory of 1,200 feet in every direction from both centers. From these points pressure wires will be run back to the power house, and the voltage will be there controlled by potential regulators.

A plan somewhat similar will be followed by the Fall River Electric company of Fall River, Mass., but, instead of three-phase, monocyclic apparatus will be used. Two 75 kilowatt generators will be used, and the output will be used for lighting purposes, during the dark hours, supplying current during the day for general power work. The motors will be of the General Electric induction type, ranging from one to ten horse power, and will be wound for 110 volts, to which pressure the current generated at 2,000 volts will be reduced.

The first application of the three-phase long-distance system to street railway work will be made by the General Electric company of Lowell, Mass., where a plant is in course of construction for the Lowell & Suburban Street Railway company. Its special features will render it one of the most interesting three-phase installations ever effected. In the first place, the generators will deliver both alternating and continous current, and when not in use for transmission work will be run in parallel with the railway generators now in the station. They will be wound for delivery of low voltage current at the alternating side, and this current, raised to 5,000 volts, will be carried to two sub-stations, one nine miles and the other fourteen miles distant from the generating station. The sub-stations will each be provided with suitable step-down transformers of the air-blast type, as well as two rotary converters. These machines are constructed to maintain at the commutator brushes a voltage of 5,000 volts at no load and 550 volts full load. Another transformer sub-station for 400 incandescent lamps will be installed six miles from the generators. The success of this plant will go far toward solving the problem of the operation of railways over long distances, taking the current from the one power station.

## New Periodical for Students of the National School of Electricity.

Apparently encouraged by their success in establishing the National School of Electricity, the promoters of that enterprise have determined to extend the field of their operations and publish a newspaper which, it is inferred, will be a sort of organ for the school, working along the same lines and in conjunction with that institution. The first number of the *Electrical Journal*, as the new paper is called, has been published and it is dedicated "to the interests of electrical progress and education." It modestly asserts that "it does not aspire to a leadership in scientific thought nor has it the lofty ambition to excel its splendidly equipped contemporaries." The paper is neat and handsome in appearance, is to appear twice a month, and, as is usual with the Hornsby enterprises, puts the name of Prof. Barrett prominently to the front.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, June 8.—Chief Engineer William B. Parsons presented a report on Tuesday to the Rapid Transit commissioners regarding the general manner of operating the proposed routes, their equipments, and the location of the stations. Mr. Parsons said: "Electricity undoubtedly offers the greatest advantages as a source of power. It should be generated at a central station, located so as to obtain coal conveniently, and conveyed to the motors of the trains by solid conductors. As the railway proposed will be both in tunnel and on viaduct, these conductors will probably be placed between the rails. It is at present neither necessary nor advisable to use separate electric locomotives, but to place motors under one of the regular cars and to have such car at the head of a train, actiog as motor car." He referred to the successful operation of the Metropolitan elevated railway in Chicago and commended it. No action was taken.

The rumor of the removal of the General Electric works from Schenectady is emphatically denied.

An unusual accident occurred in Evergreens, formerly Ridgewood, Long Island, on Friday of last week. Frank C. Kebellein, a young man from Brooklyn, was walking along Cypress avenue. In front of Deckelman's Picnic Park, near the main entrance, is an electric light on an iron pole. As Kebellein passed by he raised his hand to his mouth, and threw away the cigar which he was smoking. As he did so, his hand struck the electric light pole, and he fell dead. The pole had become charged with electricity, and the current passed through Kebellein's body, killing him instantly.

The Edison Electric Illuminating company of New York has mortgaged to the State Trust company as trustee all its property rights and franchises for a period of 100 years, in the sum of $15,000,000. Gold bonds of five per cent. will be issued from time to time by the company in order to pay off indebtedness mostly incurred by the absorption of smaller companies and their plants.

Complaint is made every day that the electric cars in Brooklyn are now too slow, and that the new regulation providing stopping places at "designated places 600 feet apart" is proving very annoying. It is said that the new stopping places are arbitrarily and inconveniently located without reference to crossings. In a recent article on the subject the *Sun* voices a renewed objection to the gong. It says: "It is noticeable, too, that although the cars are now run so slowly that everything on wheels is always ahead of them, still the everlasting clanging of the gong has not abated. Fulton street is still like a boiler foundry. The motormen get as much amusement out of jumping on the gong and playing tunes on it as they did when it was a new plaything. One hears all the time the jingling rhythm of 'Four, four, four years more,' 'Over the fence is out, boys,' and other musical measures pounded out on a deafening gong. One day last week a car was crawing along Fulton street in the neighborhood of a street piano which was playing 'The Sidewalks of New York,' and the motorman danced an accompaniment on the gong to the time of the tune for a distance of two or three blocks, grinning delightedly all the while."

W. F. O.

## Buffalo and Niagara Falls.

BUFFALO, June 6.—The annual meeting of the Niagara Falls Power company was held at the Cataract Construction company's office on June 1st. The board of directors was elected as follows: L. W. Pettibone, C. B. Gaskill, Peter A. Porter. W. Caryl Ely, Benjamin Flagler, F. A. Dudley, William S. Humbert of Niagara Falls, Coleman Sellers of Philadelphia and Charles A. Sweet of Buffalo. The directors subsequently elected the following named officers: President, Dr. Coleman Sellers; first vice-president, Benjamin Flagler; second vice-president, Charles A. Sweet; secretary, James S. Milner; treasurer, Edmund S. Wheeler.

The new dynamo of the Niagara Falls Hydraulic Power & Manufacturing company, rival of the Niagara Falls Power Companp, has been started and electricity carried through the new Falls street conduit to the International Hotel. Mr. Schoellkopf stated that the trial was entirely satisfactory.

The trolley companies are beginning to make use of the open cars in Tonawanda and on the roads between Niagara Falls and Buffalo. The busy season for the lines is now opening in promising style. More cars are placed in service and are running at short intervals. The connections with the excursion boats are made as they were last summer. The excursion boats and the trolley lines work together on rates to the Grand Island resorts.

The authorities have ordered t e cootractors on the Buffalo & Niagara Falls Electric Railway to stop the erection of the trolley poles on Payne avenue until the exact distance between them is decided upon. The owners of property along the street who have lawns are objecting because the poles are placed too close to their property. Others claim that there is not space enough between the poles to allow the street its full value as a thoroughfare. The excavating is done up to the Central's tracks, where it is stopped pending arrangements to cross them.

The temporary injunction that was served on the Buffalo, Tonawanda & Niagara Falls Railroad company last Saturday will be argued in the Supreme Court, Buffalo, on Monday next. The injunction is a temporary one and restrains George P. Smith from laying tracks across the Long Bridge. The injunction was issued by the highways commissioners of the towns of Tonawanda and Wheatfield. The tracks are laid up to the bridge on the north end and preparations are being made to extend the line as soon as satisfactory arrangements with the officials can be made. Mr. Smith has petitions in circulation on both sides of the creek. The north side petition has already about sixty signatures attached to it asking that the company be allowed its lines across the bridge. It is being signed by nearly every taxpayer to whom it has been offered.

F. C. P.

## New England News.

BOSTON, June 6.—The last of the belongiogs of the fire alarm headquarters have been transferred from the city hall to the new building on Bristol street, and hereafter Superintendent Flanders and his men will strike their signals from that quarter. For thirty years the fire alarm has been located in the city hall, but the best electric alarm equipment that can be had has been installed in the new building. The headquarters for the fire alarm is located on the fourth floor of the building. The annunciating, transmitting, switching and testing apparatus is in a room on the south side of this floor. The room on the north side contains the current generating machines that are to take the place of the countless gravity cells which make the battery room of the average fire alarm headquarters a hard place to handle. Here also is the switchboard for the power current that runs the generators, and the great board by which the electricity from the generators is divided or combined and switched to any circuit or combination of circuits in the operating room. In the southeast corner of the room is a telephone station. The drops, plugs, switches and automatic apparatus are newly patented and of the same efficiency as those used in the best branch telephone station in the city. Here all the men, houses and stations of the department can be put into communication with each other, and wires to the central office of the New England Telephone & Telegraph company create a fire alarm station in every office and home where there is a telephone. The wires are carried to the top of the building from underground cables. After connection with the lightning protectors they are distributed on the back of the annunciator board, which forms the west side of a hollow square enclosing the operating devices. On the annunciator board are several additions to the 40 circuits which originally centered at city hall, and provisions for 70 circuits of all kinds, giving a big margin for new circuits and new boxes whenever the growth of the city may make them necessary. In some respects there is provision for 84 circuits. In front of the annunciator board is a recording instrument in principle very much like the Morse register, often seen in back country telegraph offices. Instead of one writing wheel or pen, however, there are 50 in connection with 50 electromagnets. Back of the annunciator board are bells, both single stroke to give the box to the ear, and vibrating, to indicate commotion in a group of circuits. A bar-locking device in the front of the board is a new feature. By depressing a handle for whatever circuit an alarm comes in on, the operator throws the box into connection with every engine house and the alarm is rung without further action. He can depress only one handle at a time. One down locks the bar against all the others, each circuit thus being kept from interference with another. There are three distinct devices by which a heavy current is shunted to the ground and off from the delicate coils of the office which it would demoralize and ruin. The first is an arrangement by which a current of greater intensity or quantity than that in constant use moves an armature that trips a string, which breaks a circuit. The second is a glass tube containing a three-inch length of wire that is used by the overcharge. The third is the old-fashioned but ever reliable arrangement of brass plates having a sheet of mica between them. This thin insulation, enough for an ordinary current, is ruptured by an overcharge. On the lower part of the north board are the rheostats by which the quantity and force of the current from the generators are regulated. The coils of wire giving the resistance are compactly grouped and out of sight on the back of the slate board, their terminals appearing on front in brightly burnished plates and copper set in a circle. In the back room is the high-tenison switchboard, where is

manipulated the electricity that operates the motor-generators. The city will bring in its own current here, with terminals from the Edison people to fall back upon in case of emergency. Here are ammeters, voltmeters and rheostats. There is room for 56 motor-generators, but only a few will be needed. One of these generators does the work of 1,500 battery jars. Near the motor-generators stands a distributing board six feet square, built up of brass plates on a slate base, 1¾ inches thick. By it 40 generators can be connected to 80 circuits in any manner. Vertical strips of brass represent the generator terminals, while short intermediary plates stand for the legs of the circuits.

The new electric street railway in Manchester, N. H., is expected to be ready for passengers about July 1st. Through the principal business streets the company is using center construction and side construction through the residential section. The railroad commissioners have granted the Manchester road permission to cross the Concord and Montreal road in the construction of an electric road to Lake Massabesic and the same board has also acted favorably on the petition of the Nashua Street Railroad company for permission to issue new stock and bonds for the extension of the road to the state line to meet the electric road from Lowell.

Chancellor Rowell has refused the injunction asked by the Estey Organ company and ex-Governor Levi K. Fuller, to restrain the Brattleboro, Vt., street railway from using electricity as a motive power and from extending its line in the village of Brattleboro Junction. Judge Rowell gave as his reasons for refusing the petition that the railroad had a right to use electricity as a motive power; that the preliminary steps had been taken as required by the statutes and that the building of the street railway as proposed constituted no additional burden on the soil.

George A. Lord lectured before the Society of Electrical Engineers in this city May 26th on the multiple series and multiple arc and three-wire systems.

The town of Hull will issue $60,000 electric light bonds at 5 per cent., to mature in 1912, and a sinking fund has been established to redeem the bonds.

The West End Street Railway company has again won in its fight against free transfers, the upper branch of the Massachusetts Legislature having refused to pass a bill granting free transfers.

Diplomas have been granted to 30 graduates of the electrical engineering department of the Massachusetts Institute of Technology, class of '95. C. S. G.

## Northwestern Notations.

MINNEAPOLIS, June 8.—The Des Moines Rapids Power company at Keokuk, Ia., has contracted with the city to furnish 15,000 electrical horse power, involving an expenditure of $500,000. A municipal electric light plant will be put in.

The La Harpe Electric Light & Power company of La Harpe, Ia., has been incorporated with $15,000 capital stock.

Work will be begin on the electric car line between Gladstone and South Gladstone, Mich., soon.

A franchise for an electric car line from Cedar Falls, Ia., to Waterloo will be asked soon.

The Missoula General Electric company is taking bids to build a power dam across Hell Gate canon of the Missoula river at Missoula, Mont.

The Credits Commutation company of Sioux City, Ia., which is building the Pacific Short Line bridge over the Missouri river there, has changed the plans to allow electric cars to use the bridge to South Sioux City. It is a shrewd move to head off building other bridges.

John Hart, night inspector for the Hartman Electric company of Duluth, Minn., was instantly killed while examining an electric light which had gone out.

The Illinois Central has found it to its interest to put a damper on E. H. Martin, the genius who has invented a transmitter and receiver which works to perfection on a barb wire fence. He used it on the company's fence between Webster City and Williams, Ia., and it was so successful that the company claims it interfered with the business of the Western Union Telegraph company. An effort will be made to put it through where it will not interfere with the railroad.

The Duluth Street Railway company figures that business for May of this year was 95 per cent. better than for the year previous. C.

## PERSONAL.

G. G. Luthy of the Royal Electric company, Peoria, Ill., was a visitor in Chicago last week.

Alexander Dow, city electrician of Detroit, formerly one of the best known of Chicago's electrical men, is reported to be seriously ill of typhoid fever.

Arnold Spiller has resigned the superintendency of the Buckeye Electric company, Cleveland, O. He carries with him the good will and esteem of all with whom he has been associated during his connection with the Buckeye company. After a brief vacation in England Mr. Spiller will make an extended tour on the continent of Europe. His London address will be 2 St. Mary's road, Canonbury, N.

By a recent change in the Chicago office of the Southwark Foundry & Machine company, Frank W. Bunn, the retiring representative, has been promoted to a responsible position in the main office in Philadelphia, while Edward M. Hagar has been secured to succeed him. Mr. Bunn has filled the position with conspicuous success, and his Chicago friends will regret his removal while rejoicing at his advancement. Mr. Hagar, his successor, is a thoroughly trained mechanical and electrical engineer, a recent graduate of the Massachusetts Institute of Technology, and a young man well fitted for the responsible position he holds.

George W. Hommell, general superintendent of the Milwaukee Street Railway company, has tendered his resignation, to take effect July 1st, and it has been accepted. His assistant, G. W. Kuemmerlein, has been appointed acting superintendent, and the work done by Mr. Hommell will be divided between General Manager Wyman and Mr. Kuemmerlein. The latter is a very old employe of the road. Mr. Hommel went to Milwaukee in 1888, before the Villard syndicate got control of the street railways of that city. He had been connected with New York city lines. The climate of Milwaukee has never agreed with his health, and it is understood that this is the cause of resigning.

## ELECTRIC LIGHTING.

There is in the market an inquiry for an electric light plant and for an ice factory to go to the south coast of Haiti.

It is said to be probable that all the electric light and electric railway interests of Chattanooga, Tenn., will be consolidated, with a new line to the Chickamauga National Military Park.

## ELECTRIC RAILWAYS.

The work of putting in the foundations for the Northwestern elevated electric railway in Chicago has been begun.

The capital stock of the Chicago City Railway company has been increased $1,000,000 for the purpose of making a number of electrical extensions.

A company consisting of several prominent business men is being organized with a capital of $650,000 to build an electric railway from East Las Vegas, N. M., to Taos, via Mora, with branches to the Montezuma hotel and to the coal mines. The company will also control water powers and irrigation plants and furnish electric power and light. Two-thirds of the capital has been taken. The road will be built this summer. Three power plants will be used, each of 1,000 horse power, one for steam, the others for water power. A prominent eastern engineer has been engaged. The company wants information of turbines, engines and boilers. The electrical equipment has been selected. Address Robert L. M. Ross, East Las Vegas, N. M.

## MISCELLANEOUS.

The *Bee* of Sacramento, Cal., proposes that an "electric carnival" be held in that city in September.

A dispatch from Butte, Mont., June 8th, says: The first step in the reorganization of the big Anaconda Mining company was taken to-day in the filing of articles of incorporation of the Anaconda Copper company, with a capital stock of $30,000,000, divided into 300,000 shares of $100 each. The formal reorganization and election of officers will take June 22d. The object of the reorganization is to place the stock of the company on the market. The articles of incorporation filed to-day cover all of the Anaconda company's possessions in the state.

Electric power will be used for operating exhibits in the new machinery hall on the state fair grounds at Springfield, Ill. The building will be 500 feet long, with 176 feet extreme width, and 125 feet mean width, and with two handsome towers, one on each wing of the building, 135 feet high, with a large dome in the center. The distance from the ground to the top of the dome will be 134 feet. The machinery shed will extend to the rear of the main building for 374 feet and will be covered with slate and glass. A veranda twelve feet wide will run round this portion of the building, set on brackets. The building will be constructed of brick, steel and tiling, with concrete floors.

## TRADE NEWS.

The Mason Electric Equipment company, selling agent for the Medbery overhead material for electric railways, has removed to more convenient and larger quarters at 307 Dearborn street, Chicago.

W. C. McKinlock, secretary of the Metropolitan Electric company, Chicago, has just returned from a southern business trip. He secured some profitable orders and reports a decided improvement in business.

The Meston alternating current motors of the Emerson Electric Manufacturing company of St. Louis appear to be having a heavy sale. These machines are particularly neat in appearance and are satisfactory in performance.

General Manager J. M. Young, of the Solar Arc Lamp company of New York, left on June 1st for an extended trip through the principal cities of the South and West. He reports trade as better than he expected and a good sale for the Commercial lamp. Mr. Young expects to be in Chicago about the 20th of this month.

Referring to its famous graphite paint, the Jos. Dixon Crucible company of Jersey City, N. J., says: "An experience covering a quarter of a century and over has demonstrated that the peculiar flake graphite, mined at Ticonderoga, gives the best results. When the paint is brushed out each flake laps over its fellows, after the manner of fine fish scales, forming a covering of great elasticity and durability."

C. L. Merritt, general manager of the Hogan Boiler company of Middletown, N. Y., announces that he is now in a position to submit proposals upon all kinds of stationary and marine installations of water-tube boilers, and that the orders already received assure the company a large trade in the electrical field.

Julius Andrae & Sons company of Milwaukee is doing a large telephone business. One of the most interesting of recent private line installations is a connection for the city of Milwaukee between the engine house on shore to the end of the intake tunnel for the water works, 2,000 feet out in the lake and 85 feet below the surface of the water. Without telephone communication it would be difficult for the tunnel miners to work in safety.

The Cushman United Telephone company, with offices in the Chicago Stock Exchange building, has issued a catalogue exploiting the Cushman telephone. As is well known, Dr. S. D. Cushman claims to have invented the telephone in 1851, and the company is organized to manufacture and sell telephones and telephone supplies, to build and equip telephone exchanges throughout the United States, and through its different departments construct and equip telephone exchanges in the shortest possible time and in a most satisfactory manner.

Bids will be received until June 25th for the electric lighting plant for Bellefontaine, O. Specifications can be examined at the mayor's office or at the office of E. P. Roberts & Co., Cuyahoga building, Cleveland. The specifications call for two arc dynamos of a total capacity of 100 lights, and lamps and line complete, also 650 light alternating current dynamo and converters; one 100 horse power and one 60 horse power engine; two 60 by 16 boilers; heater, pump, injector and piping; gas engines, 150 horse power, in two or three units, with shafting.

The Electric Appliance company, Chicago, is doing a nice business in Jaeger miniature lamps, for which it has just taken the general western agency. The complete line of Jaeger goods includes mounted and unmounted series lamps, battery lamps, dental lamps, theatrical lamps, lamp bases, shades and holders. The Electric Appliance company carries a complete line of these goods in stock in Chicago, and is prepared to quote special figures on quantity orders. The company has a special catalogue of these goods, which it will be pleased to furnish on application.

The Ball & Wood company of New York will supply the engines for the new plant of the Edison Electric Illuminating company of Paterson, N. J., and is to be congratulated on securing this fine contract. The equipment will consist of five of the company's new type of vertical engine, 600 horse power each, two of the same type of 700 horse power each and one of 300 horse power. This station is expected to be a model one in all respects, and for many months the officers of the Paterson company have been gradually working up the details and investigating appliances.

General Manager Samuel Bell, Jr., of the Clamond Telephone company of Philadelphia, in company with Consulting Telephone Engineer F. W. Dunbar, was in Chicago last week at the Auditorium. Messrs. Bell and Dunbar came west with a view of looking into the telephone situation and consulting relative to the matter of opening up western business. The Clamond company has spent an immense amount of time and money in perfecting its instruments. The Clamond telephone was designed for universal service. It is remarkably strong and simple in construction, having no complicated parts, and is especially adapted for speaking tube systems in factories, hotels, etc. It is claimed that the Clamond transmitter has superior microphonic properties and is most reliable for long as well as short-distance communication. The company lays great stress on the fact that M. Clamond's patent is based upon an entirely original scientific principle which is distinct from, and in no particular similar to, any existing microphone. Briefly, it is a battery transmitter in which the circuit cannot be broken, and is, therefore, the company claims, far superior to any transmitter in which the electrodes are a solid substance and in varying contact. An essential portion of the microphone is the plastic element, very sensitive and so efficient in action that it transmits the voice in a singularly perfect manner. The company further emphasizes the fact that eminent counsel have passed upon its patents and concur in the opinion that the Clamond invention does not infringe any existing American patent. Parties in search of a thorough and simple telephonic equipment will make no mistake in corresponding with Mr. Bell.

## BUSINESS.

The Standard Telephone & Electric company should now be addressed at Madison, Wis. This company employs the Milde long-distance microphone, said to be the best in existence for exchange work.

"Storage Batteries for Telegraph Work" is the title of a recent pamphlet from the Electric Storage Battery company of Philadelphia. The title is self-explanatory. The brochure is one of a series on storage battery applications.

The Sulzer-Vogt Machine company of Louisville, Ky., manufactures electric elevators, and has just issued a new catalogue as a supplement to its general elevator catalogue. This company says that the electric elevator is "now the most economical elevator."

The Metropolitan Electric company, Chicago, has secured an order for its portable fire hose bridge from the Chicago Transit company. The company also reports a good demand for the P. & B. products, Solar arc lamps, N. I. R. wire, Dayton ceiling fans and Keystone instruments.

C. E. Woods & Co., special electrical engineers, of 1616 Monadnock block, Chicago, are kept busy in planning and supervising electrical work. At present, it is stated, they have 28 dynamos under design and are in charge of 200

miles of electric railway and 8,000 horse power in water power plants.

The old reliable H. W. Johns Manufacturing company, with office at 240 Randolph street, Chicago, is putting out a steady stream of its insulating materials—vulcabeston, moulded mica, etc. In the production of insulated line material for electric railways, and all insulation needed in electrical manufacture this company occupies a leading position. A recent catalogue gives complete information.

In the Williames "vacuum" system of steam heating exhaust steam is utilized without back pressure on the engine, so that the cost of both power and heat is no greater than the cost of power alone; and when applied to plants in which live steam only is available for heating at high pressure it is almost equally valuable. In several instances an initial boiler pressure of two and one-half pounds has been sufficient to insure better circulation and more efficient heating than had previously been obtained from the same piping under pressure of eighty pounds. The system has in every case, it is said, shown an actual saving effected by its use of from 10 to 40 per cent. in fuel alone, while its advantages in many other respects, such as increased efficiency of engine and boiler capacity, immediate circulation, absence of noise and freezing in pipes, etc., make it of great value. This system is owned and operated by Warren Webster & Co. of Camden, N. J., and is heartily indorsed by a large number of users.

The Fiberite company, Mechanicville, N. Y., manufacturer of the Medbery material, is furnishing a most complete line of street railway equipment, using aluminum bronze metal, and for insulation a composition that is absolutely waterproof and practically indestructible, beside standing the highest electrical test. The company makes everything that pertains to overhead equipment of electric railways, and the fact that the works have been running twenty-four hours a day for over a year is proof of the high standing of the products. Among the latest improved specialties attention is called to the Medbery insulated cross-overs, circuit breakers and aluminum bronze trolley wheels. The latter are guaranteed to wear longer than any brass wheel now sold, and being made of aluminum bronze they are superior in every way to the ordinary wheels. While the metal is very soft and ductile it is also very fine and tenacious, and will not wear the trolley wire; in fact, it is claimed that at the price these wheels are sold they are the most economical wheel made. The company has also recently brought out a superior line of railway station switches, which are finding a ready market, and the new principles involved show great advancement in this direction. A full and complete catalogue can be had of the selling agent, the Mason Electric Equipment company, 307 Dearborn street, Chicago.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued June 4, 1895.*

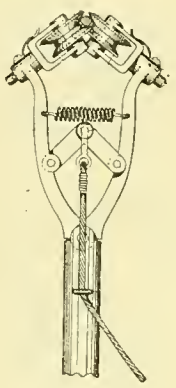
540,239. Telephone System. William W. Dean, St. Louis, Mo. Application filed February 21, 1895.

In this arrangement telephone lines extend to spring-jacks upon multiple switchboards at the central station; there are a battery at the central station, a branch conductor extending from the pole of the battery to each of the telephone lines, whereby all of the spring-jacks are included in circuit with the battery, a testing plug adapted to be connected with any spring-jack and a responsive device in circuit with the plug and adjusted to respond to the battery current when the same flows to the plug through two of the branch conductors, but adapted to remain quiescent when the current flows to the plug through only one of the branch conductors, whereby a test may be made to determine whether a line is busy.

540,244. Electric Heater. Edward E. Gold, New York, N. Y. Application filed January 29, 1895.

The combination with coils of plates of insulating material, having projections and end projections, rods passing through the projections to unite the plates, whereby they are protected from contact with the coils, and end frames for supporting the plates.

540,305. Closed Conduit Electric Railway. Michael F. Flynn, Stamford, Conn. Application filed July 28, 1894.



NO. 540,340.

A conduit, a contact rail thereon, lead and return conductors in the conduit, a shaft arranged in the conduit, with its upper end in circuit with the contact rail, contact arms on the shaft adapted to make contact with the respective conductors, and switch arms projecting from the upper end of the shaft on opposite sides of the contact rail, are the features claimed for the invention.

540,323. Electro-magnetic Winding. Osborn P. Loomis, Bound Brook, N. J., and Charles A. Pierce, Lynn, Mass. Application filed March 9, 1895.

A winding or coil for an electro-magnet is described, comprising a sectional tape composed of sets of strips of metal, placed flatly together, with their respective ends non-coincident and joined together so as to form smooth overlapping joints.

540,325. Electric Trolley for Canal Boats. Alonzo C. Mather, Chicago, Ill. Application filed December 1, 1893.

Two overhead parallel trolley wires or plates are braced and insulated in such a manner that they may be combined with a trolley, having a raised central portion attached to a canal boat, so as to have a vertical movement only, and thus act as a guide for the boat.

540,333. Electric Arc Lamp and Carbon. Charles A. Pfluger, Chicago, Ill. Application filed October 13, 1894.

Two claims are made for the lamp, as shown in the cut: First, the combination of the feeding mechanism with two carbon electrodes, each of which is oblong in cross-section and formed of carbon, having a varying texture from the external surface toward the center; and, secondly, the combination of a carbon feeding mechanism with two electrodes, each elliptical in cross-section and composed of an outer wall of carbon, with an inner carbon material also elliptical in cross-section and varying in texture from the outer wall.

540,340. Trolley Pole with Locking Wheels. Thomas Thompson, Newark, N. J. Application filed October 29, 1894.

The cut shows at a glance the features of this device. There is an arm, having a bar pivoted near the end; trolley wheels are mounted obliquely, one in advance of the other. There are also a spring for moving the bar toward the arm and toggle links connecting the bar and arm, with a cord attached to the joint of the toggle links to actuate them.

540,341. Electric Burglar Alarm. James Tomney, New York, N. Y. Application filed May 2, 1892.

The circuit extends through premises to be guarded and to an office where watch is kept. A signaling instrument a commutator or equivalent contrivance and resistance devices, a circuit changer separate from the commutator for bringing into circuit temporarily a predetermined resistance at the time of closing the guarded premises are located in the guarded premises.

540,351. Dynamo-electric Machine. George De Camp, St. Louis, Mo. Application filed September 24, 1894.

The features of the machine are: A base, field magnets whose cores are formed integral with the base, a bearing between the field magnets, a shaft mounted therein, an armature mounted on the shaft to revolve parallel to and alongside of the field magnets, and pole pieces, one formed integral with the base of the machine, and the other with the cap piece, fixed to the cores of the field magnets.

540,358. Electric Switch. John O. Heinze, Jr., Lynn, Mass. Application filed December 4, 1894.

There is the combination with the contact pieces, of one or more blades, a shaft to which the blades are attached, one or more boxes on the shaft for receiving one end of each blade, a handle for actuating the shaft, a pin secured to the shaft and moving therewith, a spring having a seat for receiving the pin and holding the shaft in a fixed position when the blades are in contact with the contact pieces, and means for moving the shaft from engagement with the spring as the blades leave the contact pieces to permit the spring to exert its tension on the shaft, and thereby give an increased impetus to the shaft.

540,398. Electric Heater. John E. Meek, Denver, Colo. Application filed February 5, 1894.

A heating conductor is interlaced with the threads of a flexible, non-conducting fabric.

540,404. Electric Arc Lamp. Henry Radcliffe, Milwaukee, Wis. Application filed March 19, 1895.

In this lamp there is the combination with a suitable casing, of a carbon holder, and a movable arm secured thereto, and passing within the casing, but insulated therefrom, another carbon holder secured to the casing, but insulated therefrom, a nut or block secured to the movable arm but insulated therefrom and a screw rod in engagement with the nut or block.

540,443. Automatic Switch. Artemas H. Hobart, Bridgewater, Mass. Application filed October 6, 1894.

This comprises a rotating disk, a sector gear, adjustably held on the disk, a gear to be meshed by the sector gear, and an electric switch in part carried by the gear.

540,456. Electric Motor. Frederick Pearce, New York, N. Y. Application filed December 3, 1890.

The claim is given: The combination with the electro-magnets, armatures and rotating shaft, of a circuit-breaking arm and contact points, a spring fastened to one end of the arm and to a rigid support, and a block on the armature shaft for vibrating the circuit-breaking arm.

540,463. Electric Gas Lighter. George W. Shepherd, Philadelphia, Pa. Application filed March 13, 1895.

This burner has a crown and a screen; an electric terminal is carried by the crown, also a terminal ring; one terminal is insulated from the other, with means for moving one terminal toward and from the other to make a spark.

540,477. Telegraphy. Cyprien R. J. Willot, Paris, France. Application filed April 24, 1894.

NO. 540,540.

In this system a transmitting key is connected to the cable, with two polarized relays connected to the key and cable and to the ground, whereby the cable may be grounded at the sending station, to limit the duration of the emissions of negative or positive currents.

540,486. Trolley for Electric Railways. Theophile Euphrat, Darien, Conn. Application filed March 5, 1895.

The fork is adapted for the ordinary trolley wheel, the wheel housing is pivoted in the jaws of the fork by the ordinary trolley wheel pivot, and the beak rests on the head of the fork, the trolley wheel having the grease chamber, and the detachable trolley pivot confined by the jaws of the fork when in the working position.

540,487. Ice Detaching Trolley for Electric Railways. Theophile Euphrat, Darien, Conn. Application filed March 22, 1895.

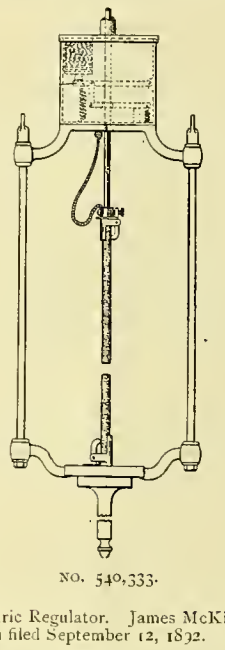
A trolley wheel has a grooved serrated ice-breaking face in combination with a housing in which it is mounted, having cheeks formed as flaring extensions of the groove coincident with the transverse outline of the groove, or substantially so. The wheel is made in two independently operative parts, and is divided transversely of the axis.

540,529. Electrically Controlled Speaking Tube. George S. Williamson, McKeesport, Pa. Application filed February 18, 1895.

A speaking tube is provided with a signal box having a connection with a main tube and a mouthpiece, a whistle is arranged in the box, a spring pressed valve controls the connection between the mouthpiece and whistle, and a lever normally engaging the whistle and closing the same is attracted by electro-magnets.

540,540. Underground Electrical Conductor and Method of Manufacturing Same. John H. Croskey and Joseph Locke, Pittsburg, Pa. Application filed January 17, 1895.

The method of insulating electric conductors consists in forcing molten glass into a metallic casing or cover, and around a conductor or conductors therein, solely in a lateral direction through substantially the entire length of the casing, as shown in the cut.



NO. 540,333.

540,557. Electric Regulator. James McKim, Weir, Kas. Application filed September 12, 1892.

Claim one reads as follows: An electric regulator, consisting of a hollow coil located in an alternating current circuit, electric lamps in said circuit, a core, a switch lever connected to said core in such manner that the movement of the one affects the position of the other, and a contact plate also located in the circuit and in the path of said switch lever, so that when the same is in contact with said plate the circuit is completed, and the movement of the lever in one direction or the other, and the consequent movement of the core farther in or out of the coil, either diminishes or increases the brilliancy of the electric lights.

540,569. Conduit Electric Railway System. Charles M. Allen, San Francisco, Cal. Application filed October 3, 1894.

An underground conduit for electrical railways is described, having a series of contact boxes fixed therein, and at one side of the slot an insulated main conductor extending along the line of the contact boxes, insulated boxes within the first named boxes, stationary contact plates within insulated boxes and connected with the main conductor, movable plates also within the interior insulated boxes, having shanks extending through the boxes and provided with rollers, a contact bar supported from the car and adapted to travel with it to form contact with the rollers and force the contact plates together as the car passes, and means for withdrawing the movable contact plate from the stationary one.

## REISSUE.

11,498. Electrical Signaling System. Bradley A. Fiske, U. S. Navy. Application filed February 16, 1895.

The first claim is given: The combination of a source of electricity, two similar bodies of conducting material located at distant stations, pivoted supports provided at their extremities with contact points moving upon said conductors and combined with one of said supports, so as to be moved therewith, an electrical indicating or measuring instrument, having a pivoted index or pointer, the pivot center of said index coinciding with the pivot center of said support, the said elements being connected in Wheatstone bridge circuit.

Western Electrician.

EVERY SATURDAY.

Vol. XVI. CHICAGO, JUNE 22, 1895. No. 25

## Steinway Hall, Chicago, and Its Electric Organ.

The new Steinway Hall, on Van Buren street, Chicago, was built with the idea of creating a recognized and permanent musical center in one building. It is well located in the district of musical studios and stores about Wabash avenue, and while in the down-town district it is in a measure remote from the noise of street traffic. It has a handsome, dignified exterior, as shown in the illustration on page 299, Fig. 2, and is almost entirely devoted to musical interests. The building contains two recital halls—Steinway Hall proper, a beautifully decorated assemb'y room, with a seating capacity of 800, and a smaller recital hall. Sound-proof studios are provided, and in every way the building is well fitted for the use for which it is planned.

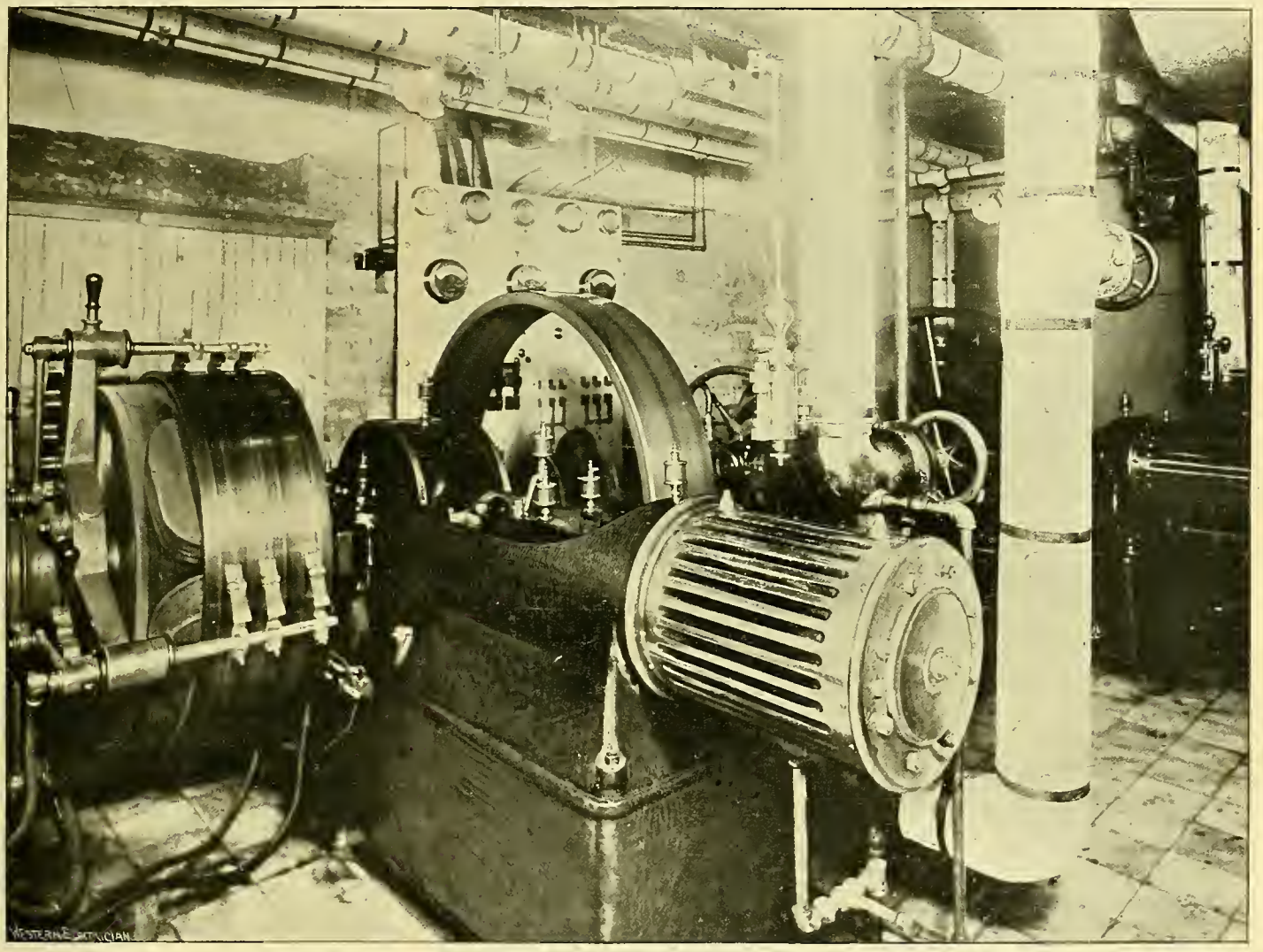


FIG. 1. STEINWAY HALL, CHICAGO, AND ITS ELECTRIC ORGAN.—GENERATING PLANT IN BASEMENT.

The electrical current for this fine building is obtained from an isolated plant on the premises. The generating machinery is in the basement, and the engines and dynamos are illustrated by the picture shown on this page, Fig. 1. The steam generating plant consists of three tubular boilers 54 inches in diameter and 16 feet long, supplied by John Moore's Sons. Coal is burned in Hawley down-draft furnaces, and steam is furnished to the engines at 90 pounds pressure. Two Ball & Wood simple engines drive the dynamos, each being directly connected to a Siemens & Halske 40 kilowatt machine. The engines are rated at 60 horse power each, and are operated at 300 revolutions per minute. As the illustration shows, the dynamos are of the type made familiar by Siemens & Halske in larger sizes, with the periphery of an exterior revolving armature serving as commutator. This is one of the first isolated plants in the West to make use of small machines of this character, and possesses a distinctive individuality on this account. It is also up-to-date in the use of directly connected units, but installations of this type are now becoming so numerous as to excite no comment. The dynamos are four-pole machines, compound wound for 110 volts.

A white marble switchboard, Fig. 1, provides accommodation for Weston instruments, rheostats and switches. The board serves a double purpose, as on the upper part are placed the steam and water gauges used in connection with the boilers and engines. The building is wired on the convertible three-wire system, and contains about 1,500 16 and 20 candle power lamps. The fixtures are tasteful, and in the larger auditorium are notably elegant. The lighting of this hall is a feature, as the illumination is so diffused that unless one looks for the lamps he is not conscious of the source of the light. The switchboard and wiring were installed by the Louis K. Comstock company.

The large pipe organ in Steinway Hall, Fig. 3 (page 299), is not only blown by electrical power, but it is equipped for electrical action throughout. Every touch on the key-board makes an electrical contact, by which an electro-magnet operates a pneumatic valve in the corresponding pipe and produces the effect which the organist desires. Both key action and stop action are thus effected, and the instrument is truly an electric organ. As can be seen by referring to Fig. 3, the organ is double, one-half being on each side of the stage opening. It is played from the movable key-desk shown well down toward the footlights in the picture. This keydesk is mounted on casters, and when it is pulled out the organist is enabled to hear the music as it sounds to the audience. When the organ is not in use, however, the key-desk can be pushed back into a niche in the rear of the stage, leaving the platform unobstructed. The interior wiring of the key-desk is shown by the rear view, with panel removed, in Fig. 4 (page 300). The system of contacts and wires appears very complicated, but is in reality simple and efficient. The flexible cable shown in Fig. 4 contains 325 conductors connecting the contact pieces in the key-desk with the electro-magnets at the base of the pipes. Current for the organ action is furnished by six storage battery cells shown on a shelf in Fig. 5 (page 298). These cells are charged from the house mains and are in series with the organ-blowing motor, also shown in Fig. 5. This is a Holtzer-Cabot two horse power motor belted to a countershaft, from which a crank-shaft is driven to fill the reservoir bellows. As this bellows rises a simple lever combination is operated to cut in the resistance of a wall rheostat, by which the action of the motor is automatically controlled to supply air as needed. From the bellows the compressed air is conveyed to a smaller receiver, called a "regulator," which insures absolute steadiness, and thence it is distributed to the different departments of the organ, each being supplied by a separate windtrunk. To avoid friction, and consequent loss of pressure when the utmost demands are being made on the wind supply, all the windtrunks have been made of large sectional area, and right angled bends are avoided. Each trunk is fitted with a "concussion bellows" or "lung" to prevent unsteadiness arising from the

recoil caused by the simultaneous closing of many pallets, and also with a telescope joint to avoid the weight of windchests and pipes being transferred from the frame to it. by possible shrinkage or the settling of the floor.

The adaptability of electricity to the work of operating an organ, and its reliability under all sorts of atmospheric conditions, have been fully proven by exacting tests. The simplicity of the electrical connections is a great advantage. The electric power is not employed to open the main pallets, but simply as a transmitting medium by whose agency extremely small valves are controlled, which, in their turn, through pneumatic manipulation, effect the opening of windchest pallets irrespective of their size or resistance. This operation is accomplished instantaneously, and it is impossible to detect any pause between the depression of the key and the production of its resultant sound, other than that caused by the inevitable acoustic delay in transmission of the vibrations from their distant source.

This interesting electric organ was installed by L. Heerwagen, western manager of the Farrand & Votey Organ company of Detroit.

## Milwaukee Telephone Rates.

[From the Milwaukee correspondent of the WESTERN ELECTRICIAN.]

In about two weeks the Wisconsin Telephone company will announce its new schedule of rates for Milwaukee. It reduced rates in the rest of the state a number of weeks ago and has promised to modify its rates in Milwaukee by July 1st. It is by no means certain that the company will make a general reduction in its rates here. What it is likely to do is to divide its patrons into classes and establish different rates for different classes, according to the number of calls. The idea of this plan, of course, would be to make the actual service rendered the basis of the rates.

Several mass meetings of persons interested in getting lower telephone rates have been held of late, and at one time it looked as though the company was going to have trouble. The most formidable movement originated on the South Side, where a meeting attended by a number of business men was held and resolutions calling for lower rates were adopted. The resolutions recited that the telephone rates in Milwaukee were higher than those in any other city of its size in the United States; that the rates have not been reduced notwithstanding the reduction in wages and in the prices of commodities; that an attempt to have the Legislature fix telephone rates had failed, and that the company had promised to reduce its rates in Milwaukee, but had not done so. The resolutions concluded with a protest against the present rates, which were pronounced exorbitant, and declared in favor of a mass meeting of all the telephone subscribers in the city at the Academy of Music at an early day, to the end that at least as favorable rates as other cities enjoyed might be obtained.

The agitation, however, received a setback at the hands of the Merchants and Manufacturers' association, which had previously demanded lower telephone rates. Manager Wilkins of the association announced that in March, when a committee of the association waited upon the telephone people in the interest of the movement to get lower rates; the officers of the company had assured the committee that the company would reduce rates as soon as possible, not later than July 1st. "The officers of the company are honorable men," said Manager Wilkins, "and no doubt will do as they say as soon as possible. The work of preparing a new schedule is difficult, involving the outlay of several thousand dollars, and it is only reasonable to give the company time to make the reduction that it has promised. The association cannot join in the proposed mass meeting until it knows just what reductions the company proposes to make; if the reductions are not generally satisfactory, then it will be time enough for the Merchants and Manufacturers' association to act."

At this time arrangements had been made to hold a mass meeting in the Academy of Music last Saturday evening, but a few days before the date of that meeting, it was announced that owing to the absence of one of the chief agitators, the meeting had been indefinitely postponed. The movement had not been abandoned, it was said, but would be revived as soon as necessary, the idea conveyed being that nothing would be done before the company announced its decision regarding rates.

At the last meeting of the county board of supervisors a resolution was adopted ordering the Wisconsin Telephone company to take out all telephones used by the county, except one in each of the county institutions, the intention being to put in private lines connecting the several offices.

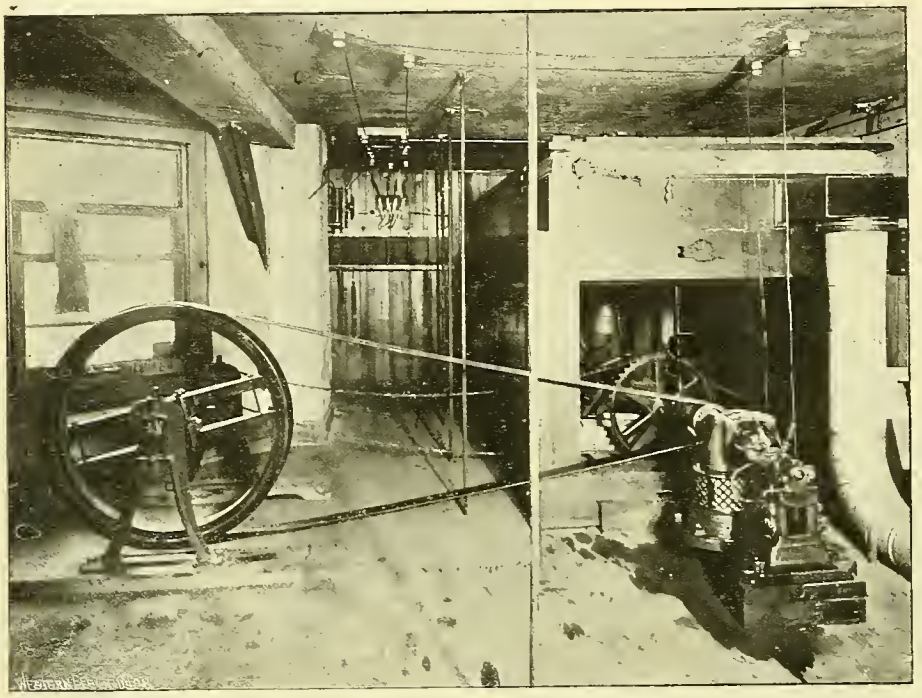


FIG. 5. STEINWAY HALL, CHICAGO, AND ITS ELECTRIC ORGAN.—BELLOWS MOTOR AND STORAGE BATTERY.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

Sioux City, Ia., is about to become a storm center of telephonic activity. Heretofore the Iowa Union Telephone company has rented 25 instruments to the city at one-half the regular rates. When the new Home Telephone company secured its franchise it was with the proviso that 21 telephones be furnished the city free. This company will have its exchange in operation very soon now, and the aldermen have drawn a notice of cancellation of the contract with the Iowa Union, taking effect at midnight, June 30th, at which time the new company's instruments will be in. The loss of connections with fire and police departments would be a severe blow to the Iowa Union, so they will offer free use of all telephones now in the public buildings. The fight will be carried into the council, but will not begin until the notice is formally served.

The Standard Telephone & Electric company of Madison, Wis., is crowded with orders. It has recently received orders for 500 instruments in Ishpeming, Mich., shipped samples to Eureka Springs, Ark., is negotiating with the Western Electric Telephone company of Sumner, Ia., for 10,000 instruments for several toll lines and exchanges in Iowa. The company has unfilled orders in Iowa alone for over 2,000 telephones. Inquiries are coming from all over the country, and bids for branches of the factory have been received from New York, Chicago and Philadelphia, and from San Francisco, Portland and other western cities.

The Blue Earth Valley Telephone company of Winnebago City, Minn., is considering putting in a line to Fairmount, Minn.

# BERLINER OPINION.

## Grounds Upon Which the Patent Was Declared Valid.

[Special Correspondence of the WESTERN ELECTRICIAN.]

BOSTON, June 15.—The opinion of the United States Circuit Court of Appeals in the case of the American Bell Telephone company et al., appellants, versus the United States, appellees, in which the validity of the Berliner patent is involved, was filed June 14th, at 4 P. M. Judge Putnam wrote the opinion, the result of the decision being that the degree of the Circuit Court, Judge Carpenter, is reversed and the case remanded to that court with direction to dismiss the bill. The opinion says:

This is a bill in equity, filed February 9, 1893, touching a patent issued November 17, 1891, to the American Bell Telephone company, as assignee of Berliner. The alternative prayer is that the patent be in all things recalled, repealed and decreed absolutely null, but that, if the patent is not deserving to be wholly repealed, but is repealable in part, a decree be made repealing only such part as the court shall deem to be repealable. As to the latter part of this alternative prayer for relief, the court has heard nothing, and there is no occasion to consider it.

The bill contains enough on its face and in its frame and in its signature by the attorney-general to bring it within the United States against the American Bell Telephone company, 128 U. S., 351; but in the development of the proofs all allegations of affirmative or positive fraud dropped out, so United States versus American Bell Telephone company fails to reach the merit of the cause at bar. Berliner's original application was filed June 4, 1877, and patent 463,569 was issued more than fourteen years thereafter. This patent is sufficiently described for the purposes of this case by saying in a general way that it covers the microphone. In addition to this the American Bell Telephone company, as assignee of Berliner, holds, or held, a patent issued to Berliner November 2, 1880, numbered 233,969. It is represented that the patent of November 2, 1880, was a divisional one growing out of the same original application which supports patent 463,569. It is also represented that this patent covers the invention described and claimed in patent 463,569, under such circumstances that the latter comes within Miller versus Eagle Manufacturing company, 151 U. S., 186.

The pith of the case, as stated briefly by the counsel for the United States, is: (1) That patent 463,569 is void for illegal delay in its issue; (2) that it is also void on the ground that the prior patent, 233,969, "was granted upon the same application to the same applicant for the same invention."

So far as the law is concerned the patent in suit is to be tested independently of the Bell patent. There can be but one law touching alleged delays in the progress of an application through the Patent Office, and touching the duty of applicants in reference thereto, whether the invention was from the outset seen to be valuable, or only afterward proves to be so, or always remains of little account. To deny this is to deny that the laws are equal, and would furnish a standard for the determination of the rights of patentees too fickle and imaginative to form a proper basis for the use of a court of law. Therefore we have not set out these allegations as proper portions of the bill, and dot not deem it necessary to make further explanations in reference to them.

The following extracts from the answer of the American Bell Telephone company sufficiently illustrate its defense on this point:

> The respondent and said Berliner, in the initiation and in the prosecution of the application which resulted in said patent, and in all the proceedings with relation thereto, in all respects conformed to and complied with the various requirements of law in such case made and provided, did nothing which in law, justice or good conscience they ought not to have done, and omitted nothing which in law, justice or good conscience they ought to have done. All their respective statements and representations were intended by them, and were believed by them respectively to express the truth; they disclosed and communicated to the Patent Office everything which it was their duty to disclose or communicate; they did not conceal or attempt to conceal from any official of the Patent Office anything which they were bound to communicate or which they believed it was material for him to know; they did not deceive or mislead any such official, nor did they attempt or intend so to do; they did not take advantage of the ignorance of any official nor attempt to do so, nor did they profit by any such ignorance or seek to. They did not commit any abuse of process, proceedings or forms of law, nor contrive, attempt nor intend to do so, and were not guilty of any fraud, concealment, imposition or false suggestion whatever. They did not practice nor attempt to practice any fraud, deceit, suppression or subterfuge, but in all respects conformed to law and to the highest good faith and honesty.
>
> Whether Berliner's application was pending for a longer time than was necessary or proper this respondent is not sufficiently informed to fully deny or admit, and therefore requires the plaintiff to produce proof thereof if material. But this respondent did not designedly, with intent to postpone the expiration of said patent and its rights thereunder, delay or prolong the pendency of the application, nor do any act tending to that end. Neither the pendency nor the progress of the application, nor the issue of the patent in suit, were delayed by any act, omission or slowness of either respondent. It never omitted to take promptly every action which it was incumbent on it to take, or the taking of which it believed would hasten that issue. It never failed to prosecute the same promptly, and it used every means known to the law to speed the application, including applications to the commissioner in person as often as they seemed likely to result in speeding the case. It avers that the slowness alleged in the bill was the act of the plaintiff itself; neither respondent in any way contributed thereto by act or omission: neither such delay, nor any action, inaction or slowness which caused it, or contributed to it was in any way aided, promoted, due to, desired, intended, designed, contrived countenanced, acquiesced in, or connived at, by either of the respondents; and neither of them is responsible therefor, nor for the consequences and results thereof.

To the answer application was duly filed and proofs taken. The cause was heard in the Circuit Court and there decided in favor of the United States on each of the points we have briefly stated as being issues in the cause, from which appeal was duly taken to this court.

The case has been so thoroughly argued here on either side that the court has found little difficulty in apprehending it. We deem it imprudent to refrain from determining ulti-

mately any questions of fact except so far as we find it necessary so to do in order to apply the rules of law to it. The bill alleges, in portions of it which we have cited, that Berliner's application was abandoned at one stage of the proceedings. In order to correctly estimate the issue under discussion it is necessary to note that this is not now relied on. The United States has somewhat variously stated its opposition, and our first duty is to understand precisely what it is. In the very lucid and careful opinion of the learned judge who heard this case in the Circuit Court it is given in the following langnage:

The proposition is that the Bell company intentionally delayed the prosecution of the Berliner application and the issue of the Berliner patent, for the purpose and with the result of prolonging their control of the art of telephony, which would cease with the expiration of the Bell patent in 1893; and that they did this by submitting to delays on the part of the officers of the Patent Office, which delays they, the Bell company, had it in their power to prevent and refrained from preventing for an unlawful purpose. This conduct is alleged to constitute a fraud practiced upon the public through the commissioner of patents and his assistants, and it is claimed that the patent so obtained by such fraud may be and should be annulled by the decree of the court on the authority of United States versus American Bell Telephone company, 128 U. S., 315, because there is no substantial difference between a fraud practiced upon the commissioner as an agent of the public, and a fraud practiced on the public with the commissioner's connivance or acquiescence.

This is far from precise. It uses the words "intentionally delayed," while it necessarily conceded that there is no evidence to support that expression in its natural sense, and that the case comes down to a claim that the American Bell Telephone company submitted to delays which it was in its power to prevent. The statement continues that it refrained from preventing for an unlawful purpose. The "unlawful purpose" is understood to mean that it expected that its monopoly would be extended through the delays on the part of the Patent Office. This in some respects it might well regard as advantageous; but to undertake to lay down a rule of law, or a fact that acquiescence in the delay of a public official who is bound to perform a certain act, involves an unlawful purpose because it may result to the advantage of the applicant, omits an important element. If the applicant is under no obligation touching the delay, there is no rule of law by which it can be said that because he may receive an incidental benefit therefrom, his purpose in relation thereto is unlawful. A man's motives will not make wrongful an act which, in itself, is not wrongful.

The proposition further states that there is no substantial difference between a fraud practiced upon a commissioner which is an injury to the public, and one practiced on the public with the commissioner's connivance and acquiescence. This is probably a true statement of the law, because either hypothesis involves positive and affirmative fraud of a public character. But of this there is no claim whatever in the case at bar as it now stands. We must therefore look somewhere else for an accurate statement of the position of the United States.

At the hearing at bar the propositions were that the American Bell Telephone company owed the public some duty in the matter under consideration; and that duty is to be sought in the principle of legal ethics that every man is bound to enjoy his own in such a manner as not to interfere with a like enjoyment of their own by others; that if the exercise of the rights of the American Bell Telephone company under the Berliner application was liable to work injury to the public in a way foreseeable by the company, it was bound to take note of that fact, and conduct its proceedings in such a manner as to avoid that injury if possible; that if this situation imposed any duty on the American Bell Telephone company toward the public, it was a duty commensurate with the interests involved, and that no doctrine of reasonable diligence will reach the case unless reasonable diligence is held to be the utmost diligence, and that it owed the public an extraordinary duty in the matter, which could be discharged only by the greatest possible diligence on the prosecution of its application. It was further claimed that the delays set up in the bill were unwarrantable and illegal; that the attitude of the American Bell Telephone company toward them was not one of consent, but of interested consent, of acquiescence, of guilty connivance; that the commissioner was betraying his trust in permitting these delays; that it knew this, and knew the practical effect of what he was doing; and that it was its duty to stir the commissioner to action instead of refraining him from so doing. It was further said that if the American Bell Telephone company had bribed the commissioner for holding Berliner's application from year to year for the purpose of prolonging its monopoly this would plainly be a fraud on the public through the commissioner; but that to reach the same result by an intentional reliance, incapacity and neglect of duty, instead of his cupidity, and by conduct in keeping with such reliance, the same injury results to the public, with only the degree less of moral heinousness of behavior on the part of the applicant. We ought to say that all these epithets charging the commissioner or any other officer of the Patent Office with any conscious violation or neglect of duty or incapacity, are unsupported by the proofs in the case, unless it can be claimed that they constitute the language which the law applies in consequence of delays which possibly might have been prevented by the public official.

The United States having thus stated its position, we do not find ourselves required to recite the details of the proofs. It is enough to say that the case shows that all the allegations in the answer which we have quoted, are sustained, except only that we do not deem it necessary for the purposes of this case to determine fully the condition of the proofs on the proposition that there rested on the American Bell Telephone company an extraordinary duty to speed its application by every means known to the law, as alleged in the bill, or to exercise the greatest possible diligence, as claimed at the bar. Unless the case required this extreme diligence, there can be no just claim of an unlawful omission to act; and therefore there could not be the "unlawful purpose," because, as we have said, this does not result from a mere omission to do what the law does not require.

During the progress of the arguments the court anxiously looked for practical illustrations of what was meant by the high degree of diligence referred to, what practically could be done to satisfy its demands, and wherein, if accepted as necessary to relieve the applicant from the charge of the course of conduct unlawful or by implication fraudulent, it differed in its practical requirements from what was in fact done. The court failed to receive light in this direction; and it regards it as an answer to the proposition of the United States on this part of the case that what it did obtain was a mass of theoretical propositions, which, if applied practically, might or might not have involved the case, in its progress through the Patent Office, in greater complications and difficulties than those which did in truth surround it. In other words, so far as the proofs go, the course of the application was in accordance with the usages of that office, and was such as the officials there, acting in good faith and according

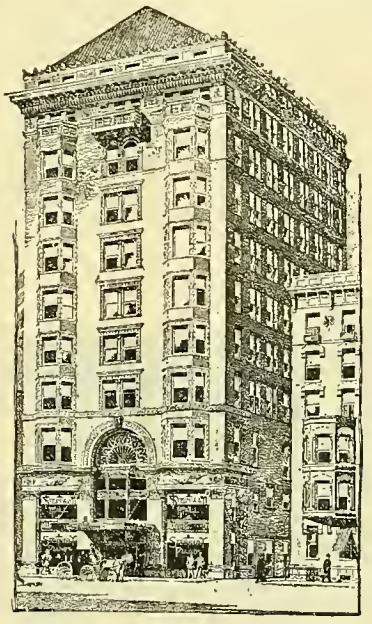


FIG. 2. STEINWAY HALL, CHICAGO, AND ITS ELECTRIC ORGAN.—EXTERIOR VIEW OF BUILDING.

to their practical experience, determined at the time to be on the whole the best. What would have been the practical result of the theoretical courses suggested, with an application around which centered so much powerful hostility as gathered about this one, it is impossible to ascertain by any methods of determination given to the courts. If, instead of suggesting theories as to what might have been done, the United States could have pointed out among the usages of the Patent Office an existing pathway other than that which was adopted, we would have some rule by which to estimate what could have been done in the exercise of extraordinary diligence other than was done.

One proposition of the United States illustrating generally what they say might have been done, we give in the exact terms stated to us at the bar:

The duty of the Bell company was to get its patent with the least possible delay by the exercise of all its legal rights. Whatever it had a right to do to expedite an application in its own interest, it was in this case bound to do in the public interest. If a situation arose in which the commissioner was not doing his duty, and in which it would have had a right to challenge his conduct in its own interest, it was its duty to challenge his conduct in the public interest. Its submission in silence to the delay directed by the commissioner in violation of his duty was a failure in the discharge of its duty.

In its own interest the American Bell Telephone company had a right to go to Congress for legislation touching the general course of proceedings in the Patent Office, as did the commissioner himself in 1889. It might have applied for the removal of subordinates for the purpose of substituting others who would attempt a more radical course of proceedings. It might have applied for the removal of the commissioner himself and the appointment of a successor who would have turned his energies more in the direction of forwarding the application under discussion. It might have applied to the commissioner for a general revision of the rules of practice of the Patent Office. The imagination can hardly put a limit to the things it had a right to do. To say, therefore, that it was bound to do in the public interest all that it had a right to do in its own, and that if it did not do this it should pay the penalty of a forfeiture of an invention said to be extremely valuable, is a proposition so unreasonable that the mere statement of it by the United States seems to confess the weakness of their case.

The court quotes from the bill a statement that the patent might have been put through had the Bell company made a fair, candid, and strong presentation of the facts, and adds:

This is a merely negative proposition, so far as it attempts to reach the defendant corporation, without specification and proofs. But the proposition is that there was on the part of these officials a gross dereliction of duty. Indeed, in the presentation of the case of the United States we have heard very much in censure of the public officials, clothed in the strongest epithets, of which we have already given some instances. We are compelled to say that if this record suggests any derelictions of official duty, it was in the form of a continued hostility to the American Bell Telephone company, and of an indisposition to grant the application for the Berliner microphone, with a concurrent disposition to nurse and favor the Drawbaugh application, either for its own direct advantage or for the purpose of defeating inventions controlled by the defendant corporation.

Notwithstanding, as we have already said, the proofs do not convict the officials, they show enough to have warranted the American Bell Telephone company in guarding itself against the possibility of such a disposition on their part during the period covered by the nine years between June 9, 1882, and the issuing of the patent now in dispute

* * *

Indeed, the whole tenor of the case of the United States, so far as it is supported by the proofs, has the appearance of requiring of the defendant corporation a degree of diligence and astuteness apparently greater than that which would be expected from other inventors.

Referring to the statement that the commissioner was not personally advised of the true relations of the application, and that the American Bell Telephone company was in fault for not bringing them to his attention, the court says:

The record shows beyond question that the Berliner and Edison application, which went hand in hand, had become so notorious that the knowledge of them permeated the Patent Office from the head to the foot, and that the contest against them by Drawbaugh was so vigorous that it was impossible that any person, from commissioner to examiner, should not have understood their importance.

* * * The practical summing up of all these various suggestions (of the United States) is that the American Bell Telephone company is in effect censured for not reforming both the practice and officials of the Patent Office. We think this demand is without parallel or precedent, that the case may justly be stated in this form, and that, when thus put, it shows itself so revolutionary as to require the legal mind to reject it on the mere statement.

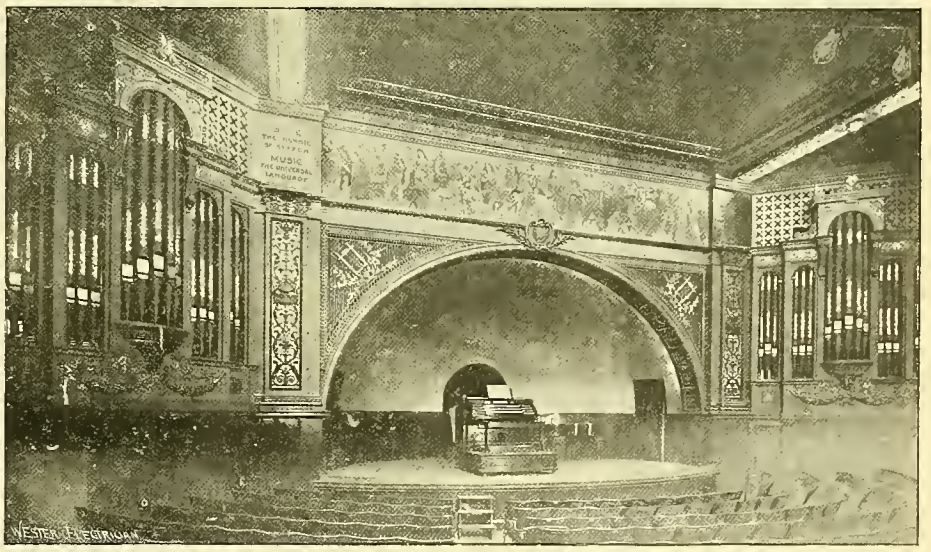


FIG. 3. STEINWAY HALL, CHICAGO, AND ITS ELECTRIC ORGAN.—MAIN AUDITORIUM.

The most that can be claimed by the United States is that the officials of the Patent Office, having all the law and facts before them, erred in the free exercise of their free judgment in the determination that the earlier patent did not cover the invention described and claimed in the later one. Even were this so, the result was not a mistake in the sense of the law in its application to the principles of cancellation of deeds and other instruments, but it was merely an erroneous judgment and determination of the ultimate fact deducted from the primary fact, all of which were known.

* * * The United States has filed a motion praying that if we find for the appellants we will reserve leave to the Circuit Court to permit an amendment at bar alleging that the American Bell Telephone company did directly agree with the representatives of the Drawbaugh application, that the determination by the Patent Office of the question of priority should abide the decision in the telephone cases, that these parties, acting in concert, did procure the

commissioner of patents to consent to such postponement, and thus that the American Bell Telephone company, by its own act, did procure the postponement of decision of priority, without necessity or right, in violation of its duty to speed the patent for the microphone.

We have already found that as the record now stands it contains no proof to sustain an allegation of this character. Therefore, an amendment of this nature would require the opening of the record below for further proofs. It is not at all a case where a complainant has proved his case, but his allegations are found by the appellate court to be inapt. To grant this motion would, under the circumstances, violate all the rules requiring diligence from parties complainant. The decree of the Circuit Court is reversed, and the case remanded to that court with directions to dismiss the bill.

## Madison's New Telephone Enterprise.

In view of the activity of the Standard Telephone & Electric company of Madison, Wis., it is evident that that concern contemplates taking an active part in the development of this new field of enterprise. The company finds much encouragement in the reception its system has thus far been accorded.

Mineral Point, Wis., Prairie du Chien, Wis., and Tomah, Wis., will soon have telephone exchanges and will use the Standard company's system. The Marquette County Telephone company of Michigan has also contracted with the Standard Telephone & Electric company for the first 500 telephones required for the exchanges at Ishpeming, Negaunee and Marquette.

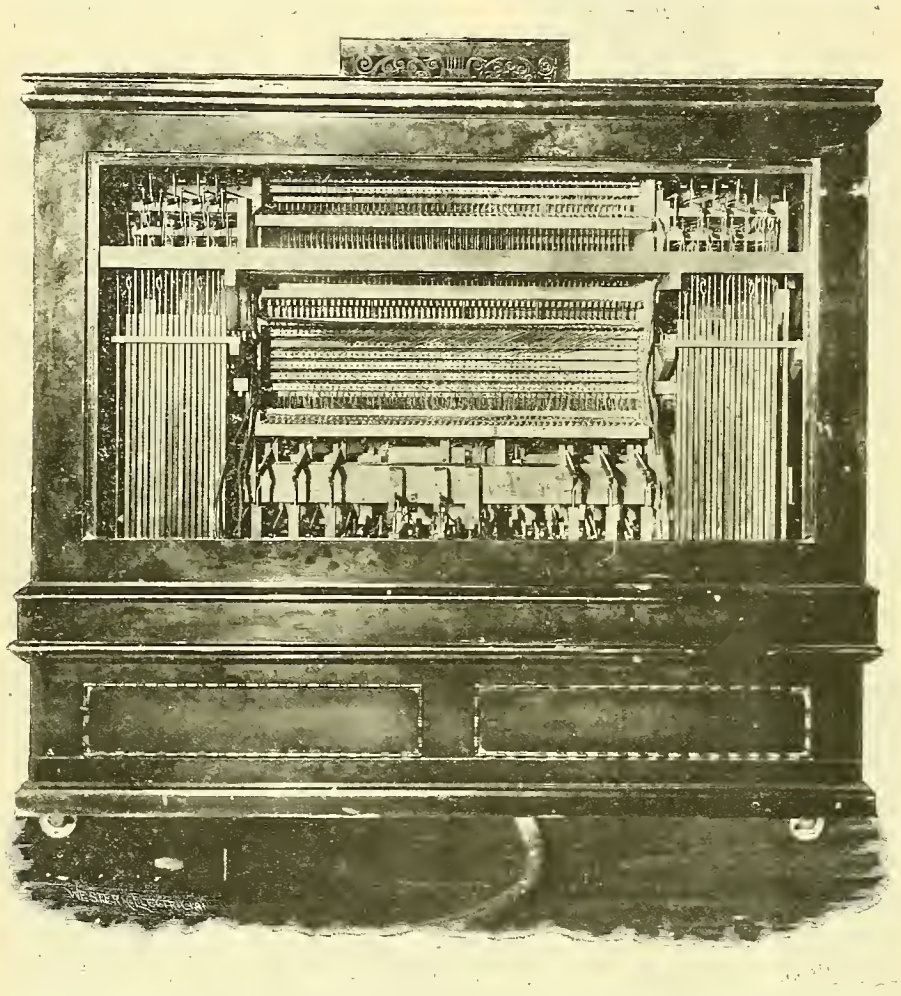


FIG. 4. STEINWAY HALL, CHICAGO, AND ITS ELECTRIC ORGAN.—KEY-DESK MECHANISM.

# COMMUNICATION.

## Complicated Telephone Litigation.

*To the Editor of the* WESTERN ELECTRICIAN:

One of the queer things in the telephone litigation is brought to mind by the odd litigation now in process in the Seventh Judicial District, U. S. Circuit Court.

A suit by the Thomson-Houston Electric company against the Western Electric company appears to be prosecuted by the representative law offices of the Bell company at Boston and defended by the representative law offices of the Bell company in Chicago. Another singular fact in connection with this case is also that the counsel for the government in the suits against the Bell company is prominently represented with the Bell company's Boston law offices in these same suits.

The writer's judgment is that an effort is being made, not so much to defend a Thomson-Houston patent, or sustain it, as between the parties to this legal controversy, as there is a disposition to obtain a rule by this Circuit Court upon questions which will later be more greatly involved in other cases.

A prophecy may not be out of place. In no other way could a certain adjudication by the Circuit Court of Appeals be had upon questions at issue in these first cases, unless, to begin with, an unfavorable decision occurred in the lower court, as in the Boston case A reversal by the Circuit Court of Appeals in this judicial district involving grave questions may be looked for and would not be surprising.

THE TELEPHONE PROTECTIVE ASSOCIATION OF AMERICA.
J. E. KEELYN, President.

*Chicago, June 11, 1895.*

## Electric Gold Mining in New Zealand.

An interesting account was given recently by Robert Hay of the applicatioo of water power in producing electricity for use in gold dredging in Shotover river, New Zealand. The water is obtained at a creek 1½ miles distant from the dredging ground, and brought by a race-cut in the side of the hill, or, in places where the ground is not suitable, in a timber flume to a pressure tank at a level of 524 feet above the pipes at the power house. From this tank to the Pelton wheel the water is carried in rolled steel pipes, constructed in lengths 19 feet six inches bolted together by wrought-iron flanges riveted to the pipes. The prime mover of the generating plant is a four-foot Pelton reaction waterwheel, upon the buckets of which the water, from a nozzle 1½ inches in diameter, impinges at a pressure of 228 pounds per square inch. This wheel drives two series-wound dynamos working at a normal speed of 700 revolutions per minute, each developing a current of 40 amperes, at an electromotive force of 650 volts, or nearly 70 horse power. The dynamos are coupled in series. The conductors, of a length of two miles, are of bare copper wire, and are supported upon insulators carried by cross-arms upon old 40 pound rails. The current is conducted to two motors in the dredge, one for driving a centrifugal pump and the other for operating the buckets, winches and revolving cylinder. These two machines are duplicates of the dynamos, and are coupled in series, so that when the bucket motor is switched off, the pump motor absorbs the surplus power by increasing the speed of the pump, and causing it to throw more water. The dredge is constructed for the most part of steel, and is capable, when operating at a depth of 20 feet, of an output of 90 cubic yards per hour. The dredgings are delivered through a revolving screen, for separating the stones and coarser material, upon baize tables set at an inclination of one in 12. Two ten-ampere arc lamps light the dredge at night, and are joined in multiple series with the motors, with suitable arrangements for their control. The cost of the installation and the weekly working expenses are $35,000 and $175 respectively.

## Electricity in Germany.

According to the *Elektrotechnische Zeitschrift*, the following tables show the electrical energy utilized and projected in Germany:

| SYSTEMS. | No. of Stations. | Horse Power of Machines. | Horse Power of Battery. | Total H. P. |
|---|---|---|---|---|
| Continuous current with accumulators | 80 | 14,388 | 4,459 | 18 847 |
| Continuous current without accumulators | 40 | 11,621 | ..... | 11,621 |
| Alternate current | 15 | 4,208 | ..... | 4,208 |
| Polyphase current | 8 | 2,858 | ..... | 2,858 |
| *Mixed Systems.* | | | | |
| Polyphase and continuous with accumulators. | 2 | 646 | 32 | 678 |
| Primary alternate, constant current with accumulators secondary | 1 | 99 | 68 | 197 |
| Continuous and alternating | 2 | 76 | . | 76 |
| | 148 | 33,896 | 4,589 | 8,485 |

These 148 stations are divided into 135 localities.

| MOTIVE FORCE. | No of Stations | Total H. P. of Machines |
|---|---|---|
| Steam | 80 | 27,290 |
| Hydraulic | 44 | 3,938 |
| Gas | 5 | 265 |
| Compressed air | 1 | 14 |
| Electric motors | 3 | 126 |
| *Mixed Systems.* | | |
| Steam and hydraulic | 11 | 893 |
| Gas and hydraulic | 1 | 30 |
| Steam and gas | 3 | 1,341 |
| | 148 | 33,897 |

| | |
|---|---|
| No. of incandescent lamps of 50 watts | 493,081 |
| No. of arc lamps of 10 amperes | 12,357 |
| Horse power in motors | 5,615 |
| No. of prospective stations decided upon | 34 |

## Institute Meeting at Niagara Falls.

Next week's general meeting of the American Institute of Electrical Engineers, at Niagara Falls, beginning on Tuesday, promises to be a decided success. Much interest is manifested and quite a large Chicago delegation will be in attendance. Since the preliminary programmes were distributed to the members, the convention rate of one and one-third fare on the certificate plan has been granted by the Central Traffic association and the Boston Passenger committee. This, together with the concession of the Trunk Line association, covers practically all the territory east of the Mississippi river and north of Richmond and St. Louis, conditional upon an attendance of 100 who have traveled by rail to the meeting. Those who expect to attend the meeting, whether members or not, are requested to send their names to R. W. Pope, secretary, 26 Cortlandt street, New York. The papers to be read were enumerated in the WESTERN ELECTRICIAN of last week.

## All Eyes on Chicago.

[From the New York *Sun.*]

It is not necessary that anybody should urge the managers of the Manhattan Elevated Railway company to adopt electricity as a motor in the place of steam. As soon as it is ascertained that electricity is more useful and otherwise more advantageous for the service than steam, and is less expensive as a motor for the trains, they will not need any further argument. They will be unable even to consult their own wishes in the case, if they have any wishes. Economic laws clear the way for their own application and provide for their own enforcement, irrespective of any man's will or any opposing interest.

We suppose that the result of the use of the electric motor upon the Metropolitan West Side Elevated railway in Chicago may influence the action of the managers of all the elevated lines in the country. The Chicago experiment is the first of the kind in the United States, and it has followed hard upon that of the Overhead railway in England. The reports from Chicago about the immediate success of the new experiment are in luxuriant language, and we trust that our Chicago contemporaries are as accurate as they are verbose in their descriptions of it. It is possible that they do not take sufficient account of questions in engineering and in finance which require time for their determination, and which are of interest to the New York and Boston capitalists who have furnished the means for the Chicago company. We shall know more before long.

If things continue to go favorably in Chicago, and economies are effected by the substitution of the electric for the steam motor, the example set by Chicago will surely be followed upon all the elevated railways in the United States just as soon as the necessary arrangements can be made, and wholly regardless of the first expense account.

The plant of the Baxter Electric Motor company of Baltimore has been sold to B. F. Deford, Jesse Hillis and Michael Jenkins, representing the bondholders of the corporation. The price paid was $25,000. The property includes a square of ground bounded by Chester street, Chase street, Collington avenue and Biddle street, and is improved by a two-story brick factory 320 feet long and 60 feet wide, and also a brick power house, brick drying house, a frame stable and all the patents of the corporation, together with the machinery, tools and finished product.

## Col. Payne's Income.

Ever since the United States Court placed the Milwaukee Street Railway company in the hands of receivers, there has been considerable speculation as to the salaries that the two receivers, George R. Sheldon of New York and Henry C. Payne of Milwaukee would receive. It was at first reported that they would serve as receivers without pay, on account of their own interests in the property and their desire to place it upon a business-like basis, but Mr. Payne denied

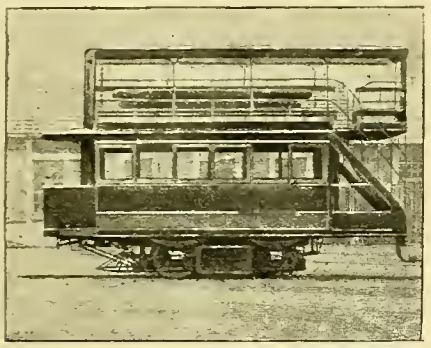


FIG. 2. ACCUMULATORS ON ELECTRIC RAILROADS.—BATTERIES IN PLACE.

the story in a most convincing manner. "Does anybody," he asked, "take me for a fool? Do you suppose that I am going to worry myself to death about this matter and all for nothing? It is the most ridiculous thing that I ever heard of." The most general estimate of the salaries that the two receivers will be paid is $10,000 each. The property in their charge is probably the largest and most valuable street railway property that ever went into bankruptcy and there will be plenty of work for the receivers in winding up its affairs and in conducting its current business. Mr. Payne, who, by the way, is president of the Wisconsin Telephone company, receives a salary of $18,000 a year as receiver of the Northern Pacific Railroad company. He is one of the busiest men in the United States, for in addition he is a director of one of Milwaukee's leading banks and he has many other interests.

## Mineral and Metal Production.

The table of mineral production of the United States for 1893 and 1894, compiled for *Mineral Industry*, which is a statistical supplement to the *Engineering and Mining Journal*, has been completed, and, as usual, it is full of valuable information and timely suggestions. The total value of the mineral products of the country, as shown in this table, was $615,887,108 in 1893, and $553,352,996 in 1894; showing a decrease in values last year of $62,534,112, or 10 per cent. The year 1894 will long be remembered as one of low prices and in almost every industry values were brought down to a point lower than had ever been before known. It was a repetition of the experience of former panic periods, only intensified by the general distrust provoked by the condition of the currency. It may be an unavoidable result of the concentration of capital and the continual improvement in processes which characterize the present age, that production increases in a greater ratio than consumption, and that at greater or less intervals there is a period when a halt must be called until the demand can again increase to the level of the supply; and 1894, being

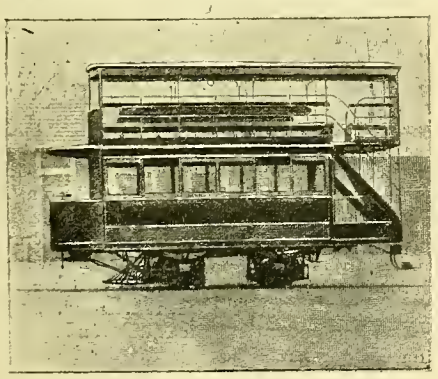


FIG. 3. ACCUMULATORS ON ELECTRIC RAILROADS.—BATTERIES REMOVED.

one of those periods, the producers suffered accordingly. In some important metals there was at actual increase, amounting in the case of copper to 26,250,000 pounds. In this metal the decline in home consumption was offset by a large increase in the exports. The table shows a moderate decrease in production, a much larger proportional decrease in the value or prices, but in both cases a decrease less than the general expectation of its amount. It shows also that in a year of extremely unfavorable conditions the mineral production of the United States by its extent and variety still gives the country the foremost place among the nations of the world—a place which is, above all, surprising, when the comparatively brief period in which the industry has been built up is considered.

## Accumulators on Electric Railroads.

There are arguments for and against the use of accumulators for electrical traction. The batteries are heavy, but they are readily handled and very convenient. They are expensive in the first instance, but not more so than the copper for an overhead line. There is no electrolysis, and no objection is raised by fire marshals and city electricians, and peace is preferable to war, even with electric railway promoters.

There is well grounded belief on the part of city authorities, based on experiment, that sooner or later even the best and most recent arrangements for the return circuit will prove unsatisfactory, although the system of to-day are far better than those in use a short time ago. There is still more or less tramp current escaping along the lines, or in the vicinity of these roads, and there always will be, while the laws governing branch circuits exists.

There are ways out of the difficulties belonging to and inseparable from the overhead system, one of which is the use of storage batteries placed on the car. It has the advantage over the present system of overhead wiring of being entirely safe from life or fire hazard, for each car is its own power house. It is ready to move at any time when called upon, and the changing of exhausted for fresh batteries where proper systems are utilized is of but little more consequence than the changing of locomotives on a steam road, and these changes may be made, for the most part, when the car is off duty.

A line of road has been recently opened at Paris from the Madeleine to St. Denis, a distance of, say, 5¾ miles, about one-half of which is within the city limits, though not

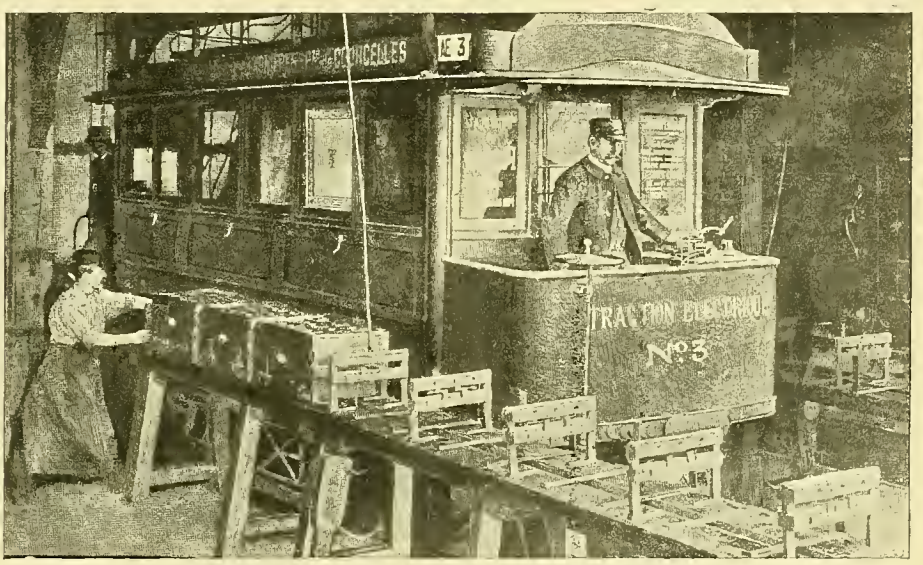



FIG. 1. ACCUMULATORS ON ELECTRIC RAILROADS.—CHANGING THE BATTERIES.

in the fashionable districts. The cars of the lines which radiate from the passenger station at St. Denis are of the form known in Europe as covered imperials—covered double-deckers—of 50 seats, 24 on deck, 20 inside, and six on the platform. The cars are lighted by four incandescent lamps fed by the accumulator battery. The curves of the road in some instances have a radius less than 20 meters, and it comprises grades as steep as 38 millimeters per meter. The trucks are connected by a spring union, which permits of the necessary lateral motion, and also the unequal movement in passing curves and restores them to parallelism on a straight line. Each driving axle is operated by a machine through a single gear connection. The motors are bipolar, with Gramme rings. They are excited in derivation. The brushes are of carbon. Each machine when driven at a speed of 600 revolutions per minute is equal to about 12 horse power.

The charging current is furnished by three Desroziers dynamos, each being run by a horizontal condensing Corliss engine of 125 horse power. Two of these have a speed of 75 and the third 160 revolutions per minute. The last is coupled direct, while the first two are independently connected. At a speed of 600 revolutions these dynamos generate 250 amperes of current at 260 to 280 volts. These are grouped in parallel, as are the batteries during the charging. The duration of the charge is five hours for a battery having exhausted itself by furnishing 230 ampere hours or 52 horse power hours. The efficiency of the batteries is shown to be 70 per cent. Two of the charging machines are run 23 hours per day, while the third is only active six hours daily.

The battery room comprises 24 stalls for recharging. Each of these is connected with a distribution board, and is charged by its individual circuit, in which are found an ammeter, a current direction indicator, a double-pole switch and cut-out fuse.

The batteries have the following dimensions: Height, 0.2 meter; width, 0.2 meter; thickness of positives, 0.007 meter; thickness of negatives, 0.005 meter.

When a car is run in, a traveling table is set in motion, which brings opposite to the car a series of little so-called "wagonets," Fig. 1, which, all save one, contain charged batteries. The first empty cell is drawn out into the empty wagonet, and its place on the car is taken by the first full cell. This process of exchange is continued until the car is loaded, and the empty cells are then shoved along to the charging department to be recharged. This traveling table may be lowered or raised to bring it to the exact level of the car. A few of the cars have been arranged with special reference to a still more rapid change. The use of lighter positive plates having more exposure permits of the batteries being handled in a single drawer, and all at once shoved between the axles of the car, as shown in Figs. 2 and 3. A switch permits of reversing the car, or of throwing one of the motors out of service for any cause and leaving the other to run the car alone. This switch, while it accomplishes much, is so simple that the former drivers are abundantly capable of manipulating it readily. Each lamp in the car is on an independent circuit and has its own switch. The service per day comprises 52 round trips between the Madeleine and St. Denis, and is run by seven cars, making 48 to 62 per cent. more kilometers than was formerly made by the horse cars.

A noteworthy fact in this connection is that before the introduction of electrical traction on one of the lines in Paris there had been a yearly diminution of from 150,000 to 200,000 passengers, while after the completion of the electrica equipment not only was this leak stopped but there was a sudden increase amounting to 1,000,000 passengers the first year.

A system of thorough inspection keeps the batteries in excellent condition.

The cost per car-kilometer of the electric system is thus divided: First, maintenance and repairs of accumulators, 10 centimes; second, station power, 13 centimes; third, repairs of trucks and motors, 3 centimes; fourth, motor man, 8 centimes; total, 34 centimes.

Thirty-four one-hundredths of a franc is a reduction of 30 per cent. on the cost of the former vehicles, and is less than any other system of mechanical traction known.

The advantages claimed for the accumulator system are: First, great elasticity of the service—any number of extra cars can be placed on the line at any time; second, absolute independence of each of the cars; third, non-liability to evil results from a breakdown at the power house; fourth, economy in the installation of the power house; fifth, economical production of current, only so much being generated as will be needed; sixth, small expense for repairs on the generators, which move regularly and are not subject to sudden strains; seventh, maximum utilization of the rolling stock—the empty seats are fewer where single cars are run. The illustrations are from *L'Energie Electrique*.

The Chicago City Railway company is endeavoring to secure the consents of property owners for a downtown overhead trolley line through South Clark street to Washington street. The idea is to parallel the State street cable line on the west with a rapid transit line for the benefit of Englewood and vicinity by way of Wentworth avenue,

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ELECTRIC light and gas men of Texas have found that they can dwell in harmony, and they have accordingly formed a state organization in which both interests are well represented. There is no reason why this plan should not be followed in other states with good results. There should be no conflict of interests between the two industries, for there are many ways in which they can assist each other. This is especially true where gas engines can be used for electric lighting plants. There are other instances, too, where the interests of the gas and electric companies are identical.

ONE of the measures sent to the governor for approval by the Illinois Legislature last week was the bill amending the libel law, in which every publisher is to some extent interested. The new law provides that no person can recover exemplary or punitive damages from a paper which has injured him if, as soon as informed of the incorrectness of its statements, it prints a proper retraction, nor can punitive damages be recovered unless the offended person before bringing suit notifies the publisher of his error and the latter fails to print a correction. The right to recover damages where an actual injury has been suffered is not taken away. The bill was supported by the newspapers of the state without exception, as it was considered a vast improvement over the old law, which was harsh and oppressive.

IT is sometimes instructive, in considering an improvement, to reverse the order of progression, looking at it, as it were, through the object glass instead of through the eye glass. Someone once invented a clothespin with a spring to hold it on the line. Of course it was patented and became more expensive than those split stick arrangements our grandmothers used. Reversing the conditions, let us suppose that the patent had been the original and the split stick the improvement, which then would have been th better clothespin? What brings this thought to mind is an anecdote of a remark made by Prof. Crookes to Sir David Salomons. "If," said the professor, "in these days of electric lighting, candles had been just now invented, what a wonderful furore there would be over their advantages? A single light at will, simple and portable, with no encumbering machinery, without the inconvenience of requiring the attachment of two wires to light it."

THE "Digest of Electrical Literature" published weekly in the *Electrical World* is conducted in such an evident spirit of detraction and jealousy, so far as contemporary American electrical journals are concerned, that its value as a record of current electrical literature is very greatly impaired. The "Digest" might be fair and broad and useful, but instead it is envious, petty and narrow. In the issue of June 15th, for instance, under the heading "Belfast," in the "Digest," it is stated that "Some of the illustrations of the article published in the *Electrical World*, May 18th, of this gas engine and accumulator station are reprinted in the WESTERN ELECTRICIAN June 1st." Now, the truth is that both articles were copied from the *Electrical Review* of London, with proper credit. The reprinted article for the WESTERN ELECTRICIAN was in type in time to be used the same week as the *World* article, but was held over to make room for matter considered more important. It is absurd to say that the WESTERN ELECTRICIAN reprinted the *World's* illustrations, and the reference makes perfect evidence of a petty spite. The *World* can hardly aspire to be generous, but it should strive to be just.

THE Supreme Court of Minnesota, in deciding the case of Capehart against Foster, held that "the electric annunciator in a hotel, attached to the wall and to all the wires of the electric call or electric bell system of the hotel is part of the realty," and not, therefore, liable to attachment or other levy, against the tenant who may have purchased it on credit.

By parity of reasoning, other apparatus, similarly connected, would also be a part of the realty, such as a dynamo, etc., being connected with the electric light wiring of the house. So also would electric fixtures, for the same reason; although the court held that gas fixtures, consisting of chandeliers and burners, screwed to the ends of the gaspipes projecting from the walls and ceilings of the building, were not a part of the realty.

While the distinction drawn seems to be an unjust discrimination, it will be well for all electric contractors, in view of this decision, to see that the owner of the realty either joined in the contract for placing such apparatus upon his property or executed a release by which they could be removed in case of non-payment. Special attention is drawn to the decision quoted because the same principles are involved, it is understood, in a number of suits yet pending in this state, growing out of contracts for apparatus put into some of the numerous World's Fair hotels.

IN the penitentiary at Kingston, Ont., there is confined an individual who appears to have successfully deluded his keepers and fellow-convicts into the belief that he is a person of much consequence in the electrical fraternity. Our unsuspecting contemporary, the *Canadian Engineer*, shares in this belief, for it announces that this person, who is heralded to fame as J. Hurd, is "one of the best electricians in America," having "superintended the working of the electrical machinery at the World's Fair in Chicago." The WESTERN ELECTRICIAN is familiar with the electrical features of the World's Fair, but it never heard of "J. Hurd," nor can it find anyone who has had the honor of the gentleman's acquaintance. It would not be difficult to trace the men who occupied responsible positions in the department of electrical operation and maintenance at the exposition, and we do not doubt that every man is at present so conducting himself as to be an ornament and an honor to the community which he favors with his presence. But if any of the "boys" were forced by stress of circumstances to accept the hospitality of a penal institution for a brief period, would he not seek an American prison as the scene of his retirement, rather than immure himself in the slow-going Dominion without prospect of escape? Of course he would. So we are forced to the conclusion, from every point of view, that someone is fooling our excellent Canadian friends.

AT last the opinion of the United States Circuit Court of Appeals in the Berliner case is made public, and, as might have been expected from the decision announced on May 18th, the result is a substantial victory for the Bell interests. The opinion is a remarkable document. It sustains every contention of the Bell company of any importance and places the stamp of judicial approval upon the course of that corporation in its Patent Office proceedings. There are many features of this remarkable document that will require more than passing notice, but at the present time it is only necessary to say that this utterance of the United States Circuit Court of Appeals is a disappointment to the great majority of those who have followed the case. It is a singular fact that so many able lawyers should have pronounced the government's case invincible, that Judge Carpenter should share this opinion, and that in spite of the attention and care bestowed by counsel it remained for Judge Putnam to discover that the case was scarcely worthy of any consideration. Regarding the petition of the government to be permitted to make an amendment alleging violation of duty by the Bell company, the court holds that "to grant this motion would, under the circumstances, violate all the rules requiring diligence from parties complainant." Evidently Judge Putnam considers this application a presumption on the part of the government deserving rebuke.

It is well to remember that this decision merely places the Bell company in the same position it occupied when the Berliner patent was issued. What the value of the patent is remains to be seen.

AN instructive paper, full of important and timely suggestions, is presented in another column on "Danger in Flexible Cord." Mr. Haskins sounds a note of warning against the employment of incompetent and irresponsible men to put in fan motors and other small devices, which may become instruments of destruction if improperly installed. His experience leads him to believe that a large proportion of electrical fires are due first to carelessness on the part of those who through ignorance play the role of experts and attempt work beyond their capacity; second, to willful transgressions of known electrical laws, such as substituting copper wire for fuse metal where the cut-out strip has melted from any cause; and third, to overloading circuits which are already as full as is safe. There are, as Mr. Haskins remarks, a good many things about electricity that the public does not know, but which a little investigation would bring out. For instance, it does not seem to be generally appreciated that an increase of light in a lamp means an increased amount of current consumed; that a wire of a certain capacity is incapable of safely carrying double that amount of current; that when a wire is overloaded the current is partially resolved into heat; and that all wires of a given size are not capable of carrying equal amounts of current without heat. A knowledge of elementary principles should be acquired by the users of electric light and motors. This would lead to an appreciation of the necessity for employing skilled workmen under the direction of experts to do work of this kind.

WHILE the good people of Milwaukee are so earnestly engaged in discussing the municipal lighting project now under consideration in the council, they should not allow an exchange of personalities to distract their attention from the main issue. Our conservative neighbors seem just now on the verge of getting excited. This unusual condition of mind is due to the turn which the discussion over the lighting project has taken. The city engineer, acting under instructions from the council, prepared an estimate of the cost of establishing and operating a plant for lighting the city streets, and the advocates of the plan have been so enthusiastic over the project that they seemed to forget that there might be any possible objection to the scheme. They have been conducting a brass band agitation for a city lighting plant and they are now very much surprised to find that there is opposition to such a measure. A minority report presented by Alderman Ramsey was the stumbling block that they encountered. Opposition from such a quarter does not seem to have been anticipated and at first it is probable that it was not considered seriously. But when the astonished aldermen read the masterly report that their colleague submitted for their consideration they were amazed. It was beyond their comprehension that such an able document could be intended for the proceedings of their body. The arguments against the city engaging in such an enterprise as that proposed were unanswerable. Be it said to the credit of the city fathers of Milwaukee that they wasted no time in vain attempts to make reply, for they realized their utter inability to make a creditably defense of their position. But the petty spite shown in their allusions to the identity of the author of the report does not comport with their character as public-spirited citizens. It was much more creditable for Alderman Ramsey to enlist the aid of a scholar and statesman in the preparation of a report on such an important subject than for these men to sneer at him for doing so. They might emulate his example with profit to themselves and the community. Their plan of indulging in personalities when their stock of arguments was exhausted is an old trick, and it has done much service for men of small mental calibre, but it won't work this time. They must come back to the point under discussion and present arguments supported by facts and figures, in order to convince the public of the wisdom of their course.

## Danger in Flexible Cord.

By C. C. Haskins.

The education of the public in matters of hazard from the standpoint of the property owner or the underwriter is by no means an easy task. Mankind is naturally suspicious, and when the attempt is made to instruct, the thought at once comes to the front, "There is something besides sympathy or kindly disinterestedness in all this flow of honeyed words, and I will not heed advice; I will not be compelled if I can help it, and in any event I like to have my own way best."

We are all just now in the transition stage in the use of electricity both as an illuminant and an element of power. The greater proportion of the community knows nothing of its use for either purpose, by experience, and the majority of those who are using it daily know hardly more of its capabilities for good or harm. It seems so easy; everything about it is so simple. All that is to be done is to take a wire and hitch it on here, and hitch on another somewhere else, fasten the two ends to a lamp, turn the key, and lo! you get just as much light as if the work had been done by a high priced man from a first-class electrical firm. The better way, too, as such persons reason, is not to attempt to do this with wire, but to get a flexible cord; "it will give you just as good a light, it can be manipulated so much easier, and it will show much better than an awkward, ill looking black wire."

Now there are several things about flexible cord that the general public knows nothing of.

Firstly, there are more kinds and qualities of flexible cord —none of them too good—than there are wire manufactories —for each makes several grades—so that when a non-expert, a janitor or a porter, is sent for flexible cord he thinks he does well when he buys the cheapest, and of course he gets the poorest.

Secondly, a flexible cord is made up of tinsel-like strands of copper, and after a short time the constant handling to which it is subjected is very apt to break these thin strands, with one of two results, if not both. The breaking of one of these will reduce the conductivity of the entire length of cord, and this may result mischievously, for in self-installed applications no care is taken, as a rule, to protect the installation by fuses. Again, the break may permit the broken end to stick through the thin covering of the cord and thus invite trouble. That point is just so much naked wire on the line, and is abundantly capable of doing mischief under favorable circumstances.

Thirdly, the fact that the two strands of the flexible cord are from the two sides of the dynamo, and if brought together they will make a direct connection from one pole of the dynamo to the other, is either not known or is ignored by self-created electrical constructors. The only barrier between these two poles, which when brought together are competent for all the mischief which dynamo current is capable of, is the very thin and otherwise miserable insulation which envelops all the cheap varieties of flexible cord.

The season when the electrical fan is to come to the front is upon us. These little one-eighth horse power motors will soon be heard and seen on every hand. With the heated term some of these come forth from their hibernation, and the electrician who formerly mended washing machines or wringers peddles some in new places. With 30 feet or more of cheap cord, he shows the uninitiated that a lamp can be removed and an attachment made, and the fan will run, and can be carried all over the room, while consuming only the same amount of current as the lamp for which it is substituted, "because it fits in the same place. See?" The fan motor may or may not absorb more current, may or may not be safe, may or may not eventually create trouble. The wringer electrician doesn't care and the purchaser doesn't know. The former gets his money cheap, and the latter gets a cheap installation.

A large proportion of the fires from electrical current are due and chargeable to: First, carelessness on the part of those who through ignorance play the role of experts and do those things which I have hinted at above; second, willful transgressions of known electrical laws, such as substituting copper wire for fuse metal where the cut-out strip has melted from any cause; third, overloading circuits which are already as full as is safe. This is often done by exchanging lamps of a lower for a higher candle power. The general public does not know that an increase of light in a lamp means an increased amount of current consumed, that a wire of a certain capacity is incapable of safely carrying double that amount of current, that when a wire is overloaded the current is partially resolved into heat, that all wires of a given size are not capable of carrying equal amounts of current without heat—iron, for instance, requiring over five times as much cross-section as copper. And there are a good many more things about electricity pertaining to safety to person and property that the public has yet to learn.

Anyone can thread a needle and sew on a button, and if a finger gets pricked no one but the owner of the finger suffers, yet all that doesn't make such an one a tailor. If a tailor undertakes the installation of a motor or an additional lamp, it is not alone his finger that is in danger, for death or a conflagration may result from his ignorance, while he may escape injury.

The use of cord in show windows has proven a very fruitful source of loss to the underwriters, and is not now permitted in any similar locality. Motors in windows, too, have been ruled out in all the larger cities. It is sometimes very difficult to convince a man against his will, but when he is shown by argument and facts that assent is money in his pocket, conviction is comparatively easy and sudden; and there is no argument like that which experience uses. A burned child dreads the fire.

## Siemens & Halske Company Purchases the Grant Locomotive Works.

The Siemens & Halske Electric company of America has purchased the Grant Locomotive Works. It will be recalled that the Siemens & Halske company made a lease of the plant less than a year ago, and some time ago negotiations were begun with a view to its purchase prior to the expiration of the lease, that the extensive business already established might be much enlarged and continue on a greater scope of magnitude than had been contemplated. In order to purchase the property it was necessary for the Siemens & Halske company to increase its capital, and this, with other details of a complicated nature, required time as well as skillful negotiation. The capital stock has been increased from $1,000,000 to $2,000,000, of which $700,000 is preferred and $1,300,000 is in common stock. It is interesting to note that the new issue was oversubscribed by $500,000. In payment for the property the Grant Locomotive Works receive $500,000 in the common stock of the company and $200,000 in the preferred. There is at the present time a mortgage of $217,000 against the property, which, according to the agreement entered into, is to be paid off, the property going to the purchasing corporation clear and free of all indebtedness. The Siemens & Halske company of America is composed of the interests of the parent company of Berlin, with branches at St. Petersburg, Vienna and London, and President O. W. Meysenburg and Secretary A. W. Wright of the American corporation, who are responsible for the high standing and the magnitude of the operations of the company on this side of the water. The Grant Locomotive Works are in the hands of W. K. Ackerman and James H. Wilson, receivers, the title to the land being in President David B. Lyman of the Chicago Title & Trust company, who has carefully conducted the present negotiations, and President E. G. Keith of the Metropolitan National Bank, as trustees.

## Springfield's Electric Light Plant.

[From the *Chicago Record.*]

Nearly all American cities find themselves face to face and forced to grapple with lighting and other difficult municipal problems. Because of simpler conditions many of the smaller cities are foremost in successful attempts at solving these problems. Many have done so by establishing municipal lighting plants. Among these is Springfield, the capital of this state, whose plant has been put in recently.

For several years the city has been supplied with light by a private company, but its charges were considered too high, being $138 per arc lamp a year. The effort to start a municipal plant was blocked at first by the fact that the city had reached its limit of bonded indebtedness. At length, however, sixty public-spirited citizens came to the assistance of the council. They loaned the city their credit to enable it to enter into an agreement whereby it eventually would become the possessor of a plant without the expenditure of any more money than its light had cost before.

On the strength of the credit loaned by the sixty gentlemen referred to, the city borrowed money and put up an electric light plant. Two skilled electricians were given a lease, who agreed to furnish light to the city for $60 per arc lamp. The council pays for the lamps used at the rate of $113 a year, instead of $138, the price paid to the private company. The difference between $60 and $113 is turned into a sinking fund, which in less than five years will completely pay for the plant, which will then be the absolute property of the city. After that the city can supply itself with light at cost, which must be less than $60 an arc lamp, or private individuals could not furnish it at that price. By adopting the plan of municipal ownership, therefore, the city of Springfield, for the next five years, will get its light at $113 per arc lamp, as against $138 under private management. After that the city will own its plant and can supply itself with light, it is fair to presume, at $60 a lamp or less.

One difficulty in connection with the establishment of municipal lighting plants in Illinois is that the general charter act does not authorize cities to sell light to private consumers. In many of the smaller cities, where the lighting paid for by the council is not sufficient to warrant the establishment of a municipal plant, one could be started to advantage if the city could do commercial lighting. This at the same time would be a great accommodation to the people. A bill authorizing cities to sell light to their citizens was introduced in the Legislature early this session, but, like other bills displeasing to existing corporations, especially in Chicago, it was effectually buried.

It will not be very long, however, before the people will force the Legislature to pass a bill of this kind.

## Assumption of Risks by Electric Light Linemen.

In deciding the case of Smart against the Louisiana Electric Light company (17 Southern Reporter, 346), the Supreme Court of Louisiana said:

There are general rules applying especially to the relation of employer and employe. Under these rules, it is presumed that every person of average intelligence has knowledge of the destructive forces of nature. If the work he performs exposes him to danger from these forces, he assumes the risk of the injury. Every man of experience, in handling wires when heavily charged with electricity, will be taken to understand that he must use great prudence. The authorities generally announce that if the employe has full and equal knowledge with the employer that the appliances are defective, and each is equally indifferent to the danger, they will stand on a footing of equality as to damages. In the first place, however, it is the employer's duty to be careful that his workman be not induced to work under the notion that the appliances are safe when he knows or has reasonable ground to believe that they are dangerous. On the other hand, it is the duty of every workman to execute the work with required care, and not expose himself to injury. These being the governing principles of the law of personal injuries, we take up, first, the charge that the wires on which the deceased was working should (in electrical parlance) have been made "dead."

The deceased and another lineman had been directed to take down two alternating live wires from their position on one arm of a pole, and place them below other wires on another arm. The service is not necessarily dangerous. The evidence explains that for the purpose of lowering a pair of live wires on a pole, the lineman handles one wire at a time, and that he should not handle more than one. These two wires were near each other; not more than six inches apart. It is in proof that there is no danger whatever in handling a single wire, one side of a circuit, while upon a wooden pole insulated from the ground, and a careful lineman will never handle more than one wire at a time. This is generally understood by all linemen. But there is great danger in touching both live wires, and completing a circuit. While at work, lowering the lines from one arm of the pole to another just below, the deceased was not observed at the instant of the accident by those present. A moment after he had received the fatal shock, his body was taken down by his fellow workmen. When he received the shock he had on rubber gloves. He was a competent lineman. A few moments prior to the shock, the foreman of the party working at the pole directed the two men engaged in lowering the wires to wear gloves. At the same time he sent up the gloves to the top of the pole where the men were at work. The deceased complied with the direction of the foreman. The other did not, trusting to his naked hand, but received no injury, although he was handling the wire corresponding to the one which was being handled by deceased. The evidence shows that the linemen were to take care of their gloves and keep them in good condition, and carry them in their belts for use when needed. It was also shown that it was left with them to determine when to exchange an old for a new pair.

The officer in charge of the operation of the plant testified that any lineman could order the opening of a circuit at the plant in case of necessity. The record does not disclose that any such necessity was suggested by the lineman. The principle announced on this point is that the employe who has the opportunity to avoid danger will have no recourse for the injury. We are led to infer from the testimony that it is not usual to open the circuit and deaden the wires while linemen are lowering them, as in this case.

As to any defect in the insulation of the wire, and that it was not in proper condition, it is a matter that would have great force if brought by one not in the employ of the company; but the testimony here informs us that where a lineman goes on a pole, and finds a defectively insulated wire, it is his duty to remedy the defect. The fact that such is the duty is not seriously questioned. The risk is one of those assumed by the employe.

It is evident that this experienced lineman knew the danger, and that, under ordinary circumstances, he would not have touched the two wires at the same time. We feel justified in the inference that the gloves were unsafe. They were furnished by the company without charge, had been in use a number of years, and were such as are generally used at the present time. Under the rules the workmen were required to examine daily the appliances furnished them, and in case of defect return them to the storekeeper. It is insisted that these rules were not generally known to the linemen. It is shown that these were defective, and should have been returned. It is insisted that he acted with ordinary care in putting on the gloves given him by the foreman. But it is not shown that the latter represented the employer; he had no power to employ or discharge the men under him, and was a fellow workman. The gloves were not in his charge; he only picked them out of the wagon and sent them up; the other lineman did not put those sent him on. The lineman injured assumed all the risks referred to, and the company is not liable for resulting damage.

## New Use for Old Insulators.

On the wall of the office of the general administration of postoffices, telephones and telegraphs at Brussells, there recently appeared a poster which announced a coming auction sale of second-hand insulators. The last paragraph reads as follows:

These articles will be sold in one or more lots to suit purchasers, and may be utilized for borders to parks and gardens.

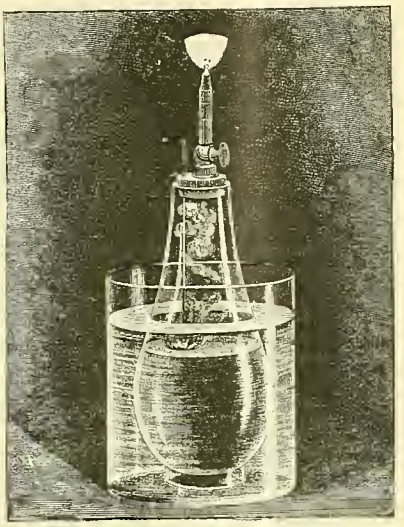
## Gas Engines for English Electric Lighting Plant.

In the accompanying illustration is shown the dynamo and engine room of the new electric lighting plant driven by gas engines which has been installed by the Midland Railway company at Leicester and which is said to be the largest of the kind in England. There are four large gas engines and two smaller ones specially fitted for driving dynamos with the necessary steadiness. Each of the four large engines is of 25 nominal horse power, capable of giving off 40 brake horse power as a safe working load with Dowson gas; and instead of the two overhung flywheels usually employed, one heavy flywheel, seven feet six inches in diameter by 19 inches wide, and weighing 4,500 pounds is fitted on each engine, with a massive out-end bearing and pedestal for supporting the end of the shaft. The engines run at 200 revolutions per minute and with the means adopted very great steadiness is obtained. The face of the flywheels is slightly rounded, and the dynamos are driven directly from it. The crankshafts are cut out of solid steel forgings and are machined and polished all over. The cylinders are fitted with loose liners, made like the pistons of specially hard metal, so that when they are worn beyond the stage at which reboring is possible, they can be renewed at the smallest possible cost. Owing to the high speed at which the engines run, special attention has been paid to the bearings and to all the parts of the engines, with a view to easy maintenance and facility of renewals at the least cost. Automatic lubricators have been fitted to all the vital parts. A novel feature in connection with these engines is the new igniting arrangement. Instead of the metal tubes, which are short lived, a short porcelain tube is used. It is about three inches long and if not destroyed by careless handling, it is imperishable. It is quickly heated, thus reducing the time required for starting after the burner is lighted to about a minute and a half, besides being low in the first cost. The engines are started by Crossley's self-starting apparatus, which enables an engine to be set in motion with nearly half load on. Thus fast and loose pulleys on the dynamo, or on other machinery the engine has to drive, are rendered in many cases unnecessary.

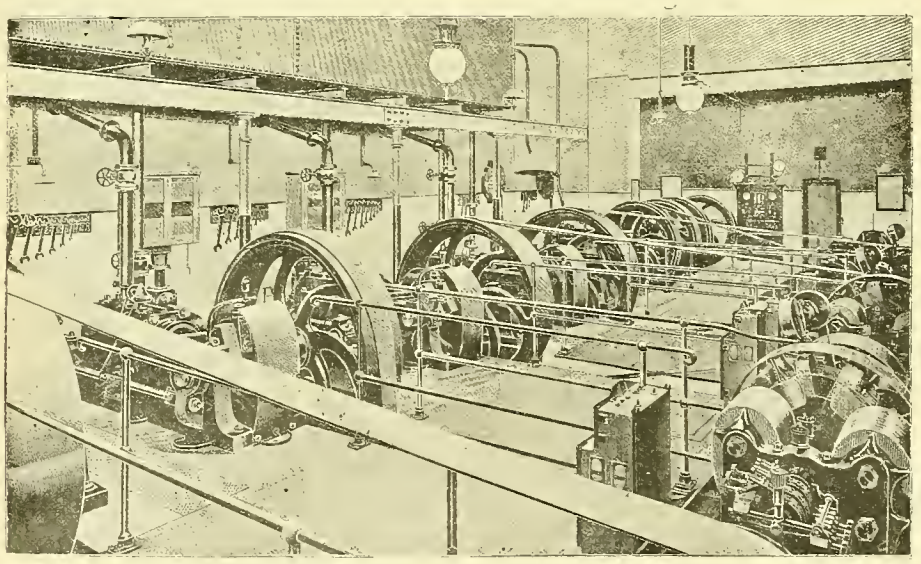
The two smaller engines at Leicester are each of 14 nominal horse power, capable of working up to 25 brake horse power with coal gas, and are each fitted with two overhung flywheels running at 200 revolutions per minute. Each engine is fitted with governors used for electric lighting work and is generally on the lines of the larger engines. Although the heavy flywheels militate against the efficiency of the engines, it costs less to store up the necessary energy to insure steady running by increasing the flywheel power of the engine than it would do to achieve the same result on the dynamo.

For the jacket water for these engines one large tank is fixed on columns and girders and contains sufficient water for cooling the cylinders of the engines even if all were working at once. Under ordinary circumstances the engines are worked with Dowson gas, but arrangements are made whereby, in the event of anything being out of order with the gas plant, the engines can be immediately turned on to coal gas from the town's mains. Three of the four larger engines are connected to Brush series arc lighting machines capable of driving 50 2,000 candle power lamps each; the fourth large engine driving an incandescent machine of 300 amperes. Each of the smaller engines drives a small machine for incandescent lighting, giving an output of 125 amperes at 115 volts. The arc lighting is required for the goods yards and sheds belonging to the Midland and London and Northwestern Railway companies, and for the platforms, etc., of the new passenger station. The incandescent lighting is employed for the refreshment rooms, dining rooms and offices.

The gas plant is placed in a separate building adjoining the engine house. There are two gas generators and each has a gas cooler, hydraulic box, coke scrubber and sawdust scrubber. Space has been left for a third set, which has not yet been supplied. The gasholder is 16 feet diameter by 10 feet deep. There are two small vertical boilers, but only one is used, the other being in reserve. The generators are fired with anthracite coal and the boiler with common boiler slack. The engines were manufactured by Crossley Brothers of Manchester. The cut is reproduced from the London *Engineer*.



SLOANE'S NOVEL ACETYLENE GAS BURNER.



GAS ENGINES FOR ENGLISH ELECTRIC LIGHTING PLANT.

## New Telephone Enterprises.

The Rogue River Telephone company contemplates building a line into Medford, Wash. It has begun work on an extension to Central Point.

The Badger State Telephone company of Hartford, Wis., has been incorporated. It will build a line northward from Iron Ridge.

The Home Telephone company has begun work on a line connecting Montgomery, Lexington and Le Sueur Center, Minn.

The Rocky Mountain Bell Telephone company will soon extend its line from Butte to Whitehall, Mont., the new location of the Parrott smelters. The line between Helena and Great Falls will be completed July 1st. It is 105 miles long and will be double circuited.

Maurice Auerbach of St. Paul, representing the Standard Telephone company, says that they will soon begin operations there.

The Marquette County Telephone company of Ishpeming, Mich., proposes to rush work on its line and will have it in operation in less than three months. This company will also build a line to Palmer, Mich. The cost of it will be borne by Clarke Kirkpatrick, and it will be his personal property.

The Phœnix Construction company of Indianapolis, Ind., will be an applicant for a telephone franchise at Mankato, Minn., C. M. Waterbury, general manager, being there to make the application. This company uses a complete metallic circuit and offers a guarantee that it does not infringe on the Bell patents.

## Sloane's Novel Acetylene Gas Burner.

The ready development of acetylene gas from calcic carbide is shown in the simplest possible manner by dropping a fragment of the carbide, the size of a small pea, in a glass of water. The gas will escape rapidly and if a lighted match be held above the bursting bubbles, a rapid series of miniature blazes will result.

If a steady flame is desired, the simple apparatus illustrated herewith will prove an inexpensive but very complete method of accomplishing that result. It consists of a tumbler sufficiently large to receive a lamp chimney, the upper end of this being closed with a cork, into which a gas burner is fixed with a quite minute opening. A rod descends through the cork also with a pan at its lower end, upon which to place the calcic carbide. This rod should fit very tightly, otherwise the gas will escape through the space around it. When all is ready the rod may be drawn up near the cork, its little pan being thus kept out of the water until the proper moment. The stop cock is then opened and the inner vessel forced down into the glass. The outer pressure will force the water into the lamp chimney until it rises to the surrounding level. If the rod is pushed down so as to immerse the carbide, the gas will escape and force its way out at the burner, where it may be lighted as shown. Care must be exercised that the mixture of gas and atmospheric air is not lighted, for an explosion might follow, and it is for this reason that the opening in the burner should be extremely small—so small that flame cannot pass through it. Whenever the gas is generated faster than it is consumed, the pressure will force the water down until it passes below the mass, when the formation of gas will cease, because the mass is out of the water, this latter being held down by the gas pressure. The illustration is from *La Nature*.

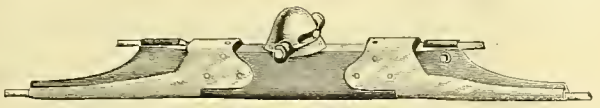
## Wisconsin Railway Enterprise.

Articles incorporating the Milwaukee & Waukesha Railway company have been filed in the office of the secretary of state. The capital stock is $1,000,000, divided into 10,000 shares of $100 each. The incorporators are Max Rosenthal, James Hetley, A. B. Myers, Stutley I. Henderson, Jacob Wellauer, Charles Pittlekow and Joel W. Bingham of Milwaukee and John J. Constantine and Andrew Snyder of Waukesha. The company is simply an enlargement of the Milwaukee & Wauwatosa Railway company, which has operated a dummy line for several years, but now proposes to extend its line to Waukesha and to run electric cars over its entire system. Mr. Bingham is president of the company, and it is stated that more than $300,000 of the capital stock has already been subscribed. The present tracks to North Greenfield will be used and from that point the line will parallel the Chicago & Northwestern Railway company all the way to Waukesha, where cars will stop at or near the Wisconsin Central depot. It is announced that the building of the line will be begun almost immediately and that it is intended to have the line in operation for the state fair; but it is very doubtful whether the work will actually be begun at once and whether it will be completed by the end of the year. The present lines, however, will undoubtedly be equipped with electricity without delay. Two power houses will be built for the new line, one at Milwaukee and the other at Waukesha.

A press dispatch from Tacoma, Wash., announces that the Armours will resist the attempt of the New York Guaranty & Indemnity company to foreclose the $1,350,000 mortgage against the Tacoma Railway & Motor company. The dispatch says: "The Armours became interested in the local street railway company several years ago when it had $750,000 in capital stock. On this Schulz issued $1,500,000 in bonds and disposed of $1,350,000 through the New York Guaranty & Indemnity company. The Armours are innocent stockholders, and not being represented in the issue of bonds, claim the bond issue was excessive and unwarranted. In placing these bonds it is alleged Schulz made use of a dummy syndicate. Another feature of the deal was the purchasing of a suburban railway for $350,000 when it was valued at but $60,000, beside turning over to the seller a bonus of $141,000. All this the Armour stockholders claim was done in collusion and with a view to permitting the General Electric company to wreck the local street railways."

## Compact Ship Lighting Set.

For the last few years efforts have been made to secure greater compactness in electric ship lighting plants, and the latest type which is now being built by the General Electric company is an instance of success in this direction. The combination shown in the illustration consists of a double cylinder vertical engine, 4¼ by four inches, directly coupled to a General Electric multipolar generator. It is known as an eight kilowatt set, the voltage of the dynamo being 110 volts. In the generator, which is of the latest type, all the material of the frame is available for magnetic purposes, so that the magnetic leakage is reduced to a minimum—a point of vit



MEDBERY SECTION INSULATOR.

tal importance on board ship. The frame is of cast soft-steel of very high magnetic permeability, and the armature is iron-clad; the windings are sunk in slots in the outer surface of the armature core, are interchangeable and can be easily replaced. Provision is made to ventilate the armature thoroughly, and the insulation throughout is practically indestructible. The commutator and brushes work perfectly under all conditions of load, and the regulation has been brought to a high degree of excellence. This generating set occupies a minimum of floor space, and this consideration alone will serve to recommend it to ship-builders and owners. It is remarkable for its smooth running and for the capacity obtained from the size and weight of material used.

## Medbery Section Insulator.

The Medbery section insulator illustrated was originally designed for the Chicago City Railway company, and the entire line is equipped with this very simple yet unusually strong and effective device. During the last year several of the other leading traction companies, particularly in the East, have adopted this insulator with good results to their systems.

The methods of insulating the sections of the line, as well as the ease of adjustment, are all in favor of its use, and are at once appreciated by practical men.

The metal parts are of standard high grade material.

The Mason Electric Equipment company, 307 Dearborn street, Chicago, carries a full line in stock and is prepared to make prompt shipments.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, June 15.—At this week's meeting of the Rapid Transit Commission the chief engineer was instructed to prepare detailed plans and specifications, and submit them to the board for consideration not later than the second Tuesday in September. The proposed Whitehall street extension of the down-town tunnel was approved.

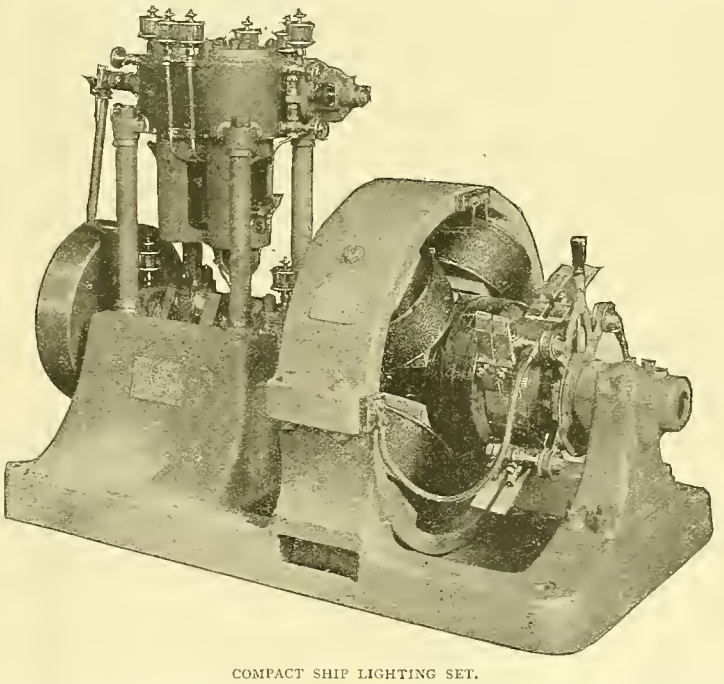
The success of the electrically operated Metropolitan elevated road in Chicago continues to make the traveling public of this city wonder when the Manhattan system will undergo a corresponding improvement. The daily papers have had considerable to say on the subject, and it has even been asserted that the Westinghouse company had secured the contract for the equipment. On this subject, Russell Sage, in talking to a reporter yesterday, said: "I had a note from Col. Hain this morning saying that he had examined the Pittsburg apparatus, and he speaks well of it. He will return to the city to-morrow in order to be here during the ceremonies incident to the opening of the Harlem ship canal on Monday, and next week he will go to Chicago to examine the electrical equipment used on the West Side Elevated in that city. When he shall have completed his inspection of the various methods of applying electricity as a motive power, he will make his report to our committee, and we may ask for estimates from electrical companies. We have not considered yet the probable cost of the changing from steam to electricity, nor can I give you any estimate of the cost per mile. If we should decide to adopt electricity, the change would be made gradually, and a trial would be made first, probably on the Second avenue line. The whole subject is, however, a problem of the future." Col. Hain is the general manager of the Manhattan company. At Pittsburg he made this statement: "We have not contracted with the Westinghouse company for an equipment of the elevated railway. We are here, however, to satisfy ourselves that the Westinghouse company has every facility necessary to do the work. We have not, as intimated, formed any alliance with the Westinghouse Electric company, 'forever shutting out the General Electric company from our patronage.' The statement that the Westingbouse company had accepted the contract at a price which the General Electric would not take is also untrue. We have not even definitely decided on abandoning steam for electric motive power. We have thought electricity might be cheaper and more convenient. On this trip I will make it a point to convince myself of the adaptability of electricity to run trains on our elevated system. If I am satisfied on that point the probabilities are that we will finally give up and substitute electricity as a driving power. We have not as yet asked for bids from either the General Electric or the Westinghouse people. That will be done on our return to New York. Until then I will not be in a position to speak definitely on the matter."

President Lewis of the Brooklyn Heights trolley road, President Partridge of the De Kalb avenue road, and Vice-President Illersley of the Atlantic avenue road had a conference with Mayor Schieren of Brooklyn yesterday in reference to the speed of the trolley cars. They spoke in favor of increasing the present rate of speed, and complained of the reduction in receipts since the six-miles-an-hour ordinance went into effect. Mayor Schieren intimated that some change in the ordinance would meet with his approval.

W. F. O.

## Milwaukee, Wis.

MILWAUKEE, June 15.—The old case of Newton S. Murphey against Benj. M. Weil, which has twice been before the Supreme Court of the state, grew out of a deal in stock in an electric company. On April 7, 1887, Mr. Murphey and Henry E. Jacobs sold to Weil 250 shares of stock in the Jacobs Electric company. They represented $25,000 at par value and were sold to Weil for $12,500. There were also included 250 shares of stock in the Electric Temperature company. Jacobs died and Murphey came into possession of his interests. Then Weil refused to pay for his stock. He alleged that the stock had never been paid up, that the patents which paid for the stock were useless, having been declared invalid by the court and that Murphey induced him to purchase stock by fraudulent representations. The suit was brought to compel the payment of the balance of the purchase price of $12,000. The first trial resulted in favor of the plaintiff. After it came back from the Supreme Court for the last time, it looked as though Murphey might lose his case, but everybody was surprised when the jury gave a verdict for Mr. Weil for the money that he had paid upon his stock and interest thereon. He will recover more than $4,000 under this verdict.



COMPACT SHIP LIGHTING SET.

There are before the Common Council two reports on the question of establishing a municipal electric lighting plant. The majority report of the special committee on electric lighting is strongly in favor of the project, and the report is signed by four of the five members of the committee. At the meeting of the special committee City Engineer Benzenberg explained that in estimating the cost of operating the plant he had purposely figured the expense high, so as to be on the right side. He thought that the plant could be in running order in eight months, possibly in six months if the work were pushed. He suggested that arrangements might be made with the Badger Illuminating company to do as much of the street lighting as necessary until the city plant was in full operation, and that the company could shut off circuits by degrees as the work of constructing the city conduits progressed. This plan, according to the city engineer, had worked very successfully in Detroit. City Comptroller Fiebrantz told the committee that this month there would be a leeway on the bond limit of $1,949,743.04. New bonds to the amount of $720,000 had been authorized, and street improvement bonds amounting to $100,000 were to be issued, making a total of $820,000, and leaving a leeway of $229,743.04. The city engineer said that he thought that $150,000 as a preliminary appropriation for the work would suffice.

The question of the city's purchasing the Badger plant came up at the meeting of the committee, but no recommendation was made, the committee being content to recommend city ownership of an electric light plant in some form. It is thought by some that now that the Milwaukee Street Railway company, which is the owner of the Badger plant, is in the hands of receivers, the Badger plant may be bought at a very reasonable figure, especially in view of the fact that the establishment of a city lighting plant would reduce the business done at the Badger plant more than one-half. The Badger plant cost the Milwaukee Street Railway company $380,000, but that was some years ago, and although it has been greatly improved and enlarged since that time, still electrical machinery and equipment are considerably cheaper now than they were when the Badger plant was started, and besides the depreciation of machinery must be taken into consideration.

The minority report on the municipal lighting question was submitted by Alderman Thomas Ramsey. It advances the opinion that the financial condition of the city of Milwaukee is not such as to permit it to engage in any electric enterprise. It urges that other public improvements are more pressing and it particularly mentions school houses, bridges, public parks, the completion of the intake tunnel and the extension of the water works system. It declares that a municipal lighting plant would necessitate the placing of wires underground in a very large portion of the city, especially in the business district, as the stringing of wires overhead would be dangerous, and it points out that the tearing up of the business streets would result in great inconvenience to the public, the business interests of the city demanding that the pavements be disturbed as little as possible. The minority report also urges that the city should not put in its own plant until it has given the company that is lighting the streets at present an opportunity to bid upon the lighting upon a basis which will enable it to make as low figures as possible to the city. It does not need any argument, the minority report continues, to show that a contract for two or three years cannot be made as cheaply as it can be made for a term of years, which will allow some return upon the capital invested. It is claimed in the report that the figures of the city engineer do not make a sufficient allowance for repairs and maintenance of the plant. For instance, the city engineer estimates that $4.44 a lamp a year will be sufficient, but the report asserts that the amount actually required is in excess of $17 a lamp a year. The report goes on to say that the difference, if any, between

the cost of electric lighting under the contract system and the cost under the municipal system is so slight as not to justify the city in engaging in the enterprise. It points to the experience of other cities, as developed by facts shown in the city clerk's correspondence with them, and adds that "our neighboring city of Chicago is a most striking example" of the fact that municipal lighting is not profitable. The city was at liberty to do its own lighting before any company entered the field, the report says, and could have done so at that time without injuring any private enterprise. But now more than $500,000 is invested in a commercial electric lighting plant and the investments were made at a time when there were practical difficulties to overcome and when the financial returns were uncertain. These investments were in effect encouraged by the city, the report says, and Alderman Ramsey adds that he believes that the city cannot afford to do an injustice to men of enterprise by failing to pay due respect to vested interests. So long as the people now engaged in electric lighting in the city furnish lights to the city at fair and reasonable figures, the city should confine itself to those fields which is its more legitimate duty to develop.

City Engineer Benzenberg denies that his estimate on repairing lamps is too low and asserts that the report submitted by Alderman Ramsey was really drawn up by General Manager Wyman of the Milwaukee Street Railway company, whence, according to the city engineer, all the opposition to the municipal lighting project comes.

## Washington News.

WASHINGTON, D. C., June 15.—Various solutions of the street lighting problem, it is said, have suggested themselves to the commissioners of the District of Columbia. One is the hope, still fondly cherished, that the present electric light company may put in a bid. This, however, is probably a delusive hope, for if that company had intended to bid it would have done so long ago. The other alternative contemplated by the commissioners is a shadowy expectation that a new electric light company may be formed and use the telephone poles for its wires, and the officials are said to hold the opinion that they have the right, if necessary, to erect poles and run overhead wires. This is even less tangible than the expectation that the Electric Light company may do something, for it comes in direct conflict with the statute. The law expressly forbids the stringing of any more overhead wires in the city, and by that law the commissioners are bound as firmly as any corporation.

Arrangements have at last been completed for building the Washington and Baltimore electric road between the two cities. A director of the company says that the Widener-Elkins syndicate of Philadelphia, which is a heavy stockholder in Philadelphia, Baltimore and Washington street railroads, has become interested in the new line and will take a portion of the bond issue. E. D. Smith & Co. of Philadelphia, who have built a number of street railroads for the Widener-Elkins syndicate, will propably do most of the work on the new one.

A case was filed in the United States Supreme Court this week, the decision of which will determine the power of state railroad commissioners in the fixing of telegraph tolls under certain circumstances. The case is that of the railroad commissioner of North Carolina against the Western Union Telegraph company, and it grows out of the complaint of overcharge made by one Robert E. Lovell, who on August 17th last delivered a ten word message to the Western Union operator at the town of Wilson, N. C., for transmission to Edenton in the same state. The operator made a charge of 50 cents for sending the message, notwithstanding the rate fixed for messages inside the state by the commissioners was only 25 cents. Lovell paid the full charge under protest, and brought the matter to the attention of the commissioners, making a complaint. At the hearing the telegraph company set up as a defense that in transmitting the telegram to Edenton it was necessary to send it through Norfolk, Va., and therefore outside the state of North Carolina, and also that as the Western Union had no commercial office at Edenton, it became necessary to transfer the message to another telegraph company at Norfolk, and justified the double charge on the ground that the rate from Wilson to Norfolk was 25 cents, and from Norfolk to Edenton the same price, making necessary a total charge of 50 cents, as collected by the operator. The railroad commission in its ruling held the charge to be excessive and issued an order requiring the company to refund the 25 cents extra and forbidding a continuance of the practice under similar circumstances. The Western Union took the case to the State Supreme Court, where the decision was also adverse to it. It comes to the Federal court on a motion for a writ of error.

Arguments have recently been made before Justice Cole in Criminal Court No. 2 on the petition of Philip A. Deffer and Harry Smith, linemen employed by the Postal Telegraph company. They were arrested several weeks ago for stringing wires on Ninth street, in violation of the ordinance of 1862, and convicted in the police court. They petitioned for a writ of prohibition to prevent their sentence by Judge Kimball. The petitioners claimed that the streets and avenues of the city were owned by the United States and that the telegraph company's employes were responsible to the United States, not the District, for the alleged violation. The law of 1866 was claimed to be sufficient warrant for stringing the wires, because, the attorneys maintained, that the streets of the city were post roads or military roads. They said further that telegraph poles were not obstructions to the streets. Counsel for the opposition answered that Congress had given the District power in the premises and the police court could not, therefore, be prohibited from enforcing its judgment. Justice Cole has taken the matter under advisement.

In the District of Columbia there are 188,567 people old enough to work, that is, from the census standpoint of over ten years of age. Of this large working force there are 203 telegraph and telephone operators and 48 telegraph and telephone linemen and electric light employes, 45 of the telegraph and telephone operators being women.

James Leitch, United States consul at Belize, reports to the State Department that under the new tariff law of British Honduras materials or plants for railways, tramways, electric lighting, telegraphs or telephones are now admitted into that country free of duty.

In the matter of the protest of Dr. Walter Lobach against the decision of the collector of customs at Chicago as to the rate and amount of duties chargeable on philosophical instruments for colleges, the United States general appraisers have rendered the following decision: "The merchandise covered by the protest consists of electric storage batteries, imported for the use of the Armour Institute, an incorporated educational institution. The articles are made of metal, and were assessed for duty at the rate of 45 per cent. ad valorem, as manufacturers of metal not specially enumerated or provided for in the tariff act. They are claimed to be exempt from duty as philosophical or scientific apparatus of the kind described under paragraph 677. It is a matter of common knowledge that electric storage batteries are more especially used for practical purposes in the arts and professions rather than in making observations, experiments and discoveries in the furtherance of science. For a similar reason the board denied free entry to an electric dynamo machine imported for an educational institution. The board finds that the articles in question are not philosophical or scientific apparatus and overrule the protest and affirm the collector's decision."

It is interesting to note the number of arrivals in the United States from other countries of electricians and wire workers. During the year ended June 30, 1894, which is the latest period for which the statistics have been made up, there arrived from Hungary, one wireworker; from Austria, one electrician; from France, one electrician; from Germany, two electricians; from Norway, two electricians; from Sweden, two electricians; from Switzerland, two electricians; from England, 24 electricians; from Scotland, two electricians; from Ireland, four electricians; from Australia, two electricians. This makes a total of 42 electricians; one over 40, the rest under 40 years of age, and one wireworker under 40.

The District Supreme Court has issued an order fixing the amount of capital stock of the Washington & Georgetown & Great Falls Electric Railway company to be $650,000, and confirming the vote of increase to that sum by the majority of stockholders.

The appeal from the decision of Judge Cox in the suit of the Metropolitan club against the United States Electric Light company, to enjoin the latter from cutting off the club light, is to be argued in the Court of Appeals. Judge Cox has granted the injunction asked for, and the appeal is by the company. W.

## Buffalo and Niagara Falls.

BUFFALO, June 14.—The Common Council of Niagara Falls came very near holding another all-night session, the subject under discussion being the franchise asked for the Niagara and Lewiston railroad. This franchise has been before the board for some time and would have been acted upon at the last meeting had not the council adjourned at midnight. Mr. Bissell of Buffalo and Messrs. Ely and Gaskill of Niagara Falls represented the interests of the road, while the property owners were in opposition. It was two o'clock in the morning when a vote was reached and the franchise granted. The franchise is for 50 years and the road must be in operation within six months. In consideration of the franchise, the company agrees to pave Third street from Main to Cedar avenue with first class brick. The Niagara Falls & Lewiston Electric Railroad company formally accepted the franchise on June 10th.

The Builders' Association Exchange is thoroughly in harmony with the project of the Mutual Automatic Telephone company to establish a telephone system in competition with the present system of the Bell company. At a meeting held on June 7th resolutions were passed expressing entire sympathy with the plans of the new concern, and authorizing the secretary of the exchange to make a contract for one of the new instruments. The resolution also urged upon the members that they do all in their power to aid the new company in securing the necessary number of subscribers, so that the exchange may be installed at the earliest possible date. It is said that over 1,500 subscribers have already been secured.

No action will be taken in the matter of a franchise for the Niagara Falls Power company for a week at least. Both of the companies, the Niagara Falls Power company and the Niagara Falls Hydraulic Power & Manufacturing company, are represented by counsel. Attorney Franklin D. Locke represented the interests of the former and Attorney Romer the latter at a recent conference. J. F. Schoelkopf of the latter company was also present. Mr. Locke stated that the company had not received notice of the meeting until Thursday and that it would like a copy of the proposed franchise, that it might study it and be prepared to make an intelligent statement before the committee. He asked that the matter be put over a few days until the official representatives of the company could be present. The city clerk was directed to send a copy of the proposed franchise to each of the companies.

The indications are that there will soon be an electric road connecting Buffalo and Olcott on Lake Ontario, via Williamsville, Swansville and Lockport. Chas. A. Johnson, president of the Lock City Electric Railroad company, and Fred. H. Reed, the contractor, both of New York, and William Treis, a capitalist of Philadelphia, were in Lockport. At the directors' meeting a contract was closed with the Lockport Gas & Electric Light company to furnish power for the street railway in the city of Lockport now about completed.

Trolley affairs continue to be interesting and are engrossing the attention of the public. The extension of the village system at Tonawanda has been postponed for a few days pending the setting aside of the injunction. The Buffalo & Niagara Falls company is now doing considerable work, and Payne avenue is a scene of more than usual activity. The New York Central still has watchmen on the lookout for any undertaking on the part of the Buffalo and Niagara Falls men to lay tracks and to prevent it if possible.

Leonard Henkle, the veteran projector of Rochester, the gentleman who has formulated a scheme for utilizing the power of the Niagara river that eclipses all others in estimates and figures, was in the city and had his plans on exhibition at the office of Superintendent Welch in Prospect Park. In an interview Mr. Henkle said that matters with reference to his project had recently taken a new turn. He had commenced selling stock in the concern at $100 per share, but about a week ago a party of Rochester and Boston capitalists waited upon him and asked him if he would stop selling stock if they would put up the money to carry his plans forward. They said they were going to Chicago and would return on Sunday night with $500,000, one-half of which they would immediately make subject to his draft. They were as good as their word, and Mr. Henkle says that he now has $250,000 to draw upon. He says that the company will be capitalized at $40,000,000, and $7,000,000 will be expected from all of the countries of the world as gratuities in the way of columns, etc., to be placed in the building. The plan also contemplates the construction of two railroads at a cost of $77,000,000, one to run from California to Maine and one from Manitoba to the St. Lawrence river. The *Buffalo Courier*, in giving the above, says that Mr. Henkle returned to Rochester for a few days.

Another company has appeared in the field for a franchise to conduct electric power throughout the city of Buffalo. "If the Niagara Falls Power company will not come to us we propose to go to them," say Jacob Musch and Thomas Murphy in a petition submitted to the street committee. The petitioners ask for a franchise to enable them to handle power subject to such reasonable restrictions as the Common Council may see fit to impose. They have undertaken to form a company with a subscription list of $1,000,000. Of this they say $100,000 has been subscribed within a few days, and, if the franchise is granted, they have assurances "that if necessary $5,000,000 will be subscribed for the purpose of this enterprise." The petitioners ask "the right, privilege and franchise to erect poles, lay conduits, and string wires in any and all of the streets, alleys and squares of the city of Buffalo for the purpose of supplying heat, light and power." They want the privilege of obtaining power "from any company, firm, person or persons engaged in transmitting electricity in Buffalo, Niagara Falls or elsewhere and to be allowed to connect wires for the purposes of such electrical transmission." The petition sets forth the purpose of the

new company to go to Niagara Falls if necessary and bring power to Buffalo. Alderman Bradish inclined to the belief that J. F. Schoelkopf of the Niagara Falls Hydraulic & Manufactnring company, the rival of the Cataract company, was behind the application for the new franchise. Mr. Murphy said he would be satisfied to have the corporation counsel requested to draw up the terms of the franchise.

Capitalists have swooped down upon the lively village of Depew, a suburb of Buffalo, and have bought nearly all of it. They are John Jacob Astor, H. Walter Webb, W. Seward Webb and H. McK. Twombly. There is much significance in this deal. It seems reasonable to suppose that the gentlemen named have obtained controlling interest in this company because there is a definite purpose to expend a very large amount of money in improvements. At Niagara Falls they control the production of what will be practically unlimited electrical energy. That this energy can be transmitted economically to Depew and there used in the various manufacturing concerns, there is no doubt. It is thought certain that there is some definite plan in view that will be developed soon for the construction of other great shops in addition to those already in operation at Depew.

A hearing has just been held before the mayor of Buffalo in reference to the Assembly bill which gives to Alonzo C. Mather the privilege to build a power bridge across the Niagara river at Buffalo for the purpose of developing electric power. A delegation of about fifty citizens was present at the hearing and not one word was uttered in opposition to the approval of the bill. After several had spoken in favor of approving it, Mayor Jewett took a vote and all who voted at all were in favor of giving to Mr. Mather the privilege he asks. Mr. Mather, the originator of the scheme, spoke for some time. In an affidavit Mr. Mather said that he had devoted much time and thought and quite an amount of property on both sides of the river with that end in view, and had expended nearly $7,000 in constructing working models, in drawing specifications and in American and Canadian patents, and in consultation with not only American engineers, but prominent engineers from Paris; that as a result of these investigations he believed that he was far nearer the solution of converting the power of Niagara river right at Buffalo into electrical energy than we are of transmitting it from Niagara Falls to Buffalo in commercial quantities. After the hearing Judge Daniels was interviewed and he said that the objection of the War Department could undoubtedly be overcome if proper assurances could be given that the bridge would not obstruct navigation. Mr. Mather said he had as yet made no bargain with the Canadian government, but he believed that it could easily be done. It would be a great advantage to Canada, and he thought the Canadian government would be quick to see it. It has been rumored that the Lehigh Valley railroad was interested in the scheme, but that rumor was emphatically denied. Assemblyman Braun went to Albany with the bill bearing the approval of the mayor of Buffalo and the citizens of this city.

F. C. P.

## Northwestern Notations.

MINNEAPOLIS, June 14.—The work of surveying for the electric line from La Crosse, Wis., to Neillsville, about 90 ninety miles, has been begun under direction of Fred H. Pickles, engineer of Winona Minn. The company will secure power from Black River Falls.

Shell Rock, Iowa, citizens want electric lights.

Mayor Born, of Sheboygan, Wis., has vetoed the resolution accepting the bid of the Sheboygan Electric Lighting company for ten years at $95 per lamp. Several months ago the company wanted to contract at the rate of $90 per lamp. The mayor, who was then alderman, opposed it and finally succeeded in having bids asked for, but only one was received, that of the company, at an advance of $5 per lamp. His veto is based on a clause in a former franchise in which the company contracts to furnish the city with light at as low a rate as is furnished in any other city where water power cannot be obtained.

The Anaconda, Mont., Electric Light & Power company is purchasing new machinery and will enlarge the plant to double its present capacity.

The trials of the Central Wisconsin Interurban Electric company are not over with the withdrawal of the competing companies from the field. The new company has been rushing work in Oshkosh, Wis., but the local street railway people executed a strategetic move by laying low until they had all materials on hand, when they suddenly began laying rails on North Jackson street, from New York avenue to the fair ground gate, a section for which the Central Wisconsin people claimed an exclusive franchise. They began work at 10 P. M., by the light of the moon, lanterns and headlights. When the opposition learned of this they sought the Board of Public Works and found the company had not secured permission to tear up the street, and was in violation of the ordinance. The chief of police then issued an order to the officers not to permit the Oshkosh Street Railway company to tear up the street in question, and ordered work to stop, but those in authority declined to obey and there was nothing further done to stop work that night. The Oshkosh Street Railway people had a franchise to that street some years ago, but had not built and operated it in the last five years, as provided by the ordinance. Their opponents claim that the franchise is void, but the City Council has never declared it void. The outlook for injunctions and legal battles generally is promising.

G. D. Barnett, an employe of T. P. Benton & Son's electrical machine shop in La Crosse, Wis., was instantly killed by the bursting of a wheel.

Madrid, Iowa, has voted a franchise for electric lights and telephones to J. P. Anderson.

An electric line between Waterloo and Cedar Falls, Iowa, is projected.

W. J. Diehl of La Crosse, Wis , secured a contract with Lanesboro, Minn., for an electric light plant.

The Consolidated Street Car company of Sheboygan, Wis., has contracted with C. E. Loss & Co. of Chicago for eleven miles of electric street railroad construction, to be done in sixty days.

Wheeler & Co. of Beloit, Wis., have applied for an electric light franchise at Rock Valley, Ia.

There is talk of an electric plant at Hallock, Minn.

The Sandstone Supply company has been formed to supply Sandstone and Hinckley, Minn., with light, heat and water.

W. J. Bell, an electrician of Winona, Minn., while stringing wires near Durand, Wis., had a narrow escape from death. He was at the top of a pole and a companion was guiding the wire through the top of a tree, when lightning struck the wire, and Bell saw his assistant come out of the tree like a flying squirrel. He had no time to assist him, for the next second he went down too. The bolt demolished the coil of wire which lay on the ground, but neither of the two was severely hurt.

Walter Lilly, a lineman in Dubuque, Ia., while working on a pole, got a shock and fell among the wires. A short-circuit formed through his body and blue flames played all over him. The current was shut off and after 20 minutes he was taken down. He will probably recover, though he is said to have received a current of 2,000 volts.

La Crosse, Wis., will have John A. Cole make an estimate of the cost of a municipal electric plant.

Electric cars are being considered in Ft. Madison, Ia.

The Butte Electric company is enlarging its plant.

The Consumers' Light & Power company has been incorporated at Spokane, Wash., with $250,000 capital.

W. N. Stewart of Minneapolis, representing the Siemens & Halske Electric company, is in Mankato, Minn., to negotiate for putting in a plant to operate the street railway and furnish light and heat. He proposes to absorb the present street car and electric company, if possible, and improve the plant, practically rebuilding it, or put in an entirely new plant. J. H. Finney of Minneapolis, representing the Fort Wayne Electric corporation, is also in Mankato, with a similar proposition.

Mayor A. C. Probert of Washburn, Wis., is in a very critical condition from receiving a current of 1,756 volts by falling on the dynamo in the electric light plant. He was unconscious for several hours, but hopes are entertained for his recovery.

An electric line from Fort Dodge, Ia., to "Wild Cat Cave" is proposed.

M.

## PERSONAL.

W. H. McKinlock, president of the Metropolitan Electric company, Chicago, has been enjoying a fishing expedition during the last week. On his return he brought with him ample evidence of his success.

B. J. Launiere, formerly secretary of the Grand Rapids Machinery & Electric company, has accepted a position as traveling salesman for the Metropolitan Electric company, Chicago. Mr. Launiere possesses remarkable ability and he is well liked by the trade.

Secretary A. D. Newton, of the Eddy Electric Manufacturing company of Windsor, Conn., was married to Miss Gertrude Hyde of Hartford, Conn., on June 12th. Mr. Newton, who is very popular among electrical men, is to be congratulated on his good fortune. Mr. and Mrs. Newton will be at home after October 1st, at 362 Laurel street, Hartford, Conn.

Henry C. Parmly, senior member of the real estate firm of Parmly Brothers, Chicago, and a member of the board of directors of the Standard Electric company from its inception, died recently. Mr. Parmly was born in Painesville, Ohio, in 1836, and educated in Ohio colleges. In 1860 he went to Paris and there formed a partnership with his cousin, George W. Parmly, a physician widely known in Europe, and the young firm gradually built up a large practice in medicine and dentistry among the nobility of France. Returning to this country in 1873, he was married to Miss Hattie Sumner, and shortly thereafter located in Chicago. Engaging in the real estate business, success attended his efforts, and at the time of his death he owned valuable properties in the heart of Chicago. Though of a quiet, retiring disposition, yet he was a charming companion, a loyal friend, an upright, wholesome and progressive citizen.

## TRADE NEWS.

L. M. Moyes, the manufacturer of the Combine safety water-tube boiler, announces that he has entered suit through his attorneys, Biddle & Ward of Philadelphia, against the Stirling Boiler company of Barberton, Ohio.

The reputation of the Meston standard type fan motor, manufactured by the Emerson Electric Manufacturing company, St. Louis, can well be judged from its output, which last week reached the 10,000 mark. The company has started on the manufacture of the second 10,000.

General Sales Agent P. C. Ackerman, of the American Electrical Works, has left his New York office for an extended trip through the central and western states. It is rumored that he took a trunk this time in order to have sufficient room for orders for the well-known products which he advocates.

The Louisville Electrical Works of Louisville, Ky., have established an eastern office at 203 Broadway, New York, in charge of J. A. Machado, who in the future will represent the company in New York and vicinity in the sale of the Phœnix transformer, which is rapidly making an enviable reputation.

The West End Railway company of Boston has recently placed an order with the General Electric company, covering two 800 kilowatt generators, two 1,300 kilowatt and one 1,500 kilowatt, all to be directly connected to the engines. This is one of the largest orders for railway generators ever placed at one time.

H. F. Kellogg, of W. B. Southgate & Co. of Boston, Mass., paid the New York office of the WESTERN ELECTRICIAN a call last week, on his return from a trip from the South. He reported an active condition of business through the South and stated that there was a prospect of a very bright trade in the future. This concern is now handling the entire product of two slate quarries, which they finish to meet all the requirements necessary in fine switchboards and other electrical furnishings.

Warren Webster & Co., Camden, N. J., specialists in examining steam plants where increased economy in fuel is desired by utilizing waste exhaust steam, report considerable activity in their business, by reason of a recognized appreciation of their manufactures in comparison with other apparatus for a similar purpose. Among the recent orders for the Webster "Vacuum" feed water heater and purifier, and in addition to numerous contracts for the vacuum system of steam heating, without back pressure upon the engine—Webster steam and oil separators—the firm reports contracts aggregating 10,000 horse power from the leading concerns in the country.

Chicago's electrical district is undoubtedly enlarging its territory on the south. A year or so ago the majority of Chicago's supply houses were in the district north of Adams street. Now a large number of concerns are to be found with their headquarters south of the postoffice, although there are still quite a number north of Adams street. Among the last to move into the southerly district is the New York Insulated Wire company. It will be remembered that this concern had its quarters at 80 Franklin street, but Western Agent J. Wolff felt that a more advantageous location would be in the southern district and moved to 320 Dearborn street. Mr. Wolff without doubt has made a good selection of offices. The headquarters at 320 Dearborn street are between Van Buren and Harrison streets, and the offices occupy the entire ground floor through to Custom House place. The suite consists of Mr. Wolff's private office, the general office, and a commodious store room at the back; a large dry cellar, too, admits of the storage of a full stock of wire. With such conveniently located quarters, and so genial and energetic a representative, it is easily understood how the New York Insulated Wire company feels so much encouraged over the prospects for business. The fact that Mr. Wolff carries a full stock of wire in Chicago goes a long way toward enabling him to add to that growing business so largely due to his popularity.

## BUSINESS.

The Hemingray Glass company of Covington, Ky., is still supplying the electrical trade with a large proportion of its glass insulators. Various sizes and styles are made, and all give satisfaction.

H. H. Harrison has acquired an interest in the business of R. B. Corey, Havemeyer building, New York, and will be associated in the active management. Mr. Harrison was for several years prominently connected with the White-Crosby company, contracting engineers of New York.

The Wagner Electric Manufacturing company, St. Louis, is endeavoring to keep pace with the demand for its well-known transformers and fan motors, but although its force is working overtime the company is considerably behind in its orders. The prospects for a large fall trade are very bright.

E. Kuhlman, of the Kuhlman Electric company of Elkhart, Ind., was in Chicago on Monday. He is exploiting the Elkhart transformer, which, with its high efficiency, low leakage, good regulation, simple construction, durability and removable coil, seems to be meeting the success it deserves.

General Manager Hugo Bendix, of the Boudreaux Dynamo Brush company of New York, reports that the orders for June are far ahead of May, and from nearly every customer duplicate orders are being received. Testimonials of the perfection of this dynamo brush are being compiled for publication. These letters are numerous and from prominent

central station managers. J. W. Brooks & Co. of San Francisco, Cal., have been appointed sole agents for the Pacific coast.

The Julius Andrae & Sons company of 225 West Water street, Milwaukee, is doing a booming business in telephones and telephone supplies. The celebrated Milde microphone is used in all the Andrae telephones. Milwaukee papers report that Mr. Andrae has purchased the buildings at 162 to 168 West Water street for $125,000 in cash.

The Electric Appliance company, Chicago, has succeeded in securing the general western agency for another very desirable specialty, a staple article for which there is a big demand. Its control and sale in the West by the Electric Appliance company is considered a very desirable arrangement. A large Chicago stock will be carried, placing the company in a position with facilities possessed by very few supply houses in the country. The company promises a big surprise when it announces the particulars of this deal through the advertising pages of the WESTERN ELECTRICIAN.

The annual catalogue of the Law Battery company of New York is always expected to contain full data regarding primary batteries and their attendant appliances. The catalogue of this concern for 1895 is one of the most complete publications of its kind ever issued, containing an exhaustive treatise upon batteries and profusely illustrated throughout, making a very desirable book of reference upon this subject. The Law Battery company has recently erected a factory at Cranford, N. J., where it manufactures all parts pertaining to their battery cells and various lines of medical apparatus. This company will continue to push to the front its "old reliable" battery.

Nations may be ungrateful, but the chief officials in our western cities are not so constituted, judging from a letter received by the Standard Electric company, Chicago, from which the following extract is taken: "The (Standard arc) dynamo we bought of you has been in constant use in all-night service, since November, 1893, and has not cost one cent for repairs. I find it much more economical to operate—in the amount of power required—than any other dynamo we use." The Standard company during the last few months has installed nearly a dozen municipal lighting plants, including one for the city of Springfield, Illinois, having a capacity of 700 arc lamps; one for the town of Newton; one for the city of Logansport, Ind., and one each for Paducah, Ky., Fulton, Mo., Jamestown, N. Y., Harrisonville, Mo., Independence, Iowa, Willoughby, Ohio, Kearney, N. J., and Chesaning, Mich.

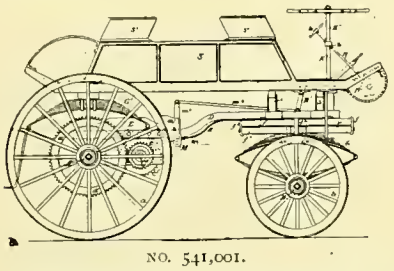
# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued June 11, 1895.*

540,620. Electric Circuit. William W. Alexander, Kansas City, Mo. Application filed March 24, 1890.

The combination consists of a relay provided with front and back contacts, its armature, a battery, a sounder, and a switch in the sounder circuit, a signal controlling device having a toothed wheel and pawls on a division of the battery circuit, and operated by the back contact of the relay. The sounder and signal controlling device are operated by the same battery without interfering with each other, and a different or contrary action is produced by the line pulsations upon the sounder from that upon the signal controlling device.

540,642. Automatic Electric Railway Signal. William Daves, Jersey City, N. J. Application filed February 14, 1895.



NO. 541,001.

This apparatus comprises a rotative signal staff and a commutator, a track circuit, a signal controlling magnet in the track circuit adapted to be cut out of circuit by the presence of a train on the track section, a relay interposed in the track circuit and adapted to stand open and be cut out when the track circuit is employed to charge the signal magnet, and to be closed when the train has passed from the track section, and a signal operating battery circuit, having a signal magnet interposed therein and completed by having one of its lines through the contact piece of the relay to the signal magnets, so that when the train has passed from the track section the track battery will energize the relay, and the signal battery will energize the signal magnet to operate the signal mechanism, after which the relay and signal and signal-battery circuits are broken and the signal held at safety by the track circuit.

540,653. Supply System for Electric Railways. Oscar A. Enholm, New York, N. Y. Application filed November 3, 1891.

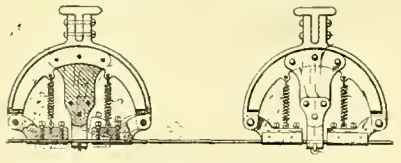
This arrangement is composed of a group of electro-magnetic circuit controllers outside of the roadbed, and arranged to be easily accessible, each controller being electrically connected with one exposed terminal head in the roadbed.

540,664. Electric Railway. Sebastian Hoeninger, Milwaukee, Wis. Application filed August 15, 1894.

In the cut is shown the combination of a suspended yoke, an insulated hanger central of the same, insulators pivoted to the ends of the yoke, and trolley wire sections secured to these pivotal insulators to normally lap each other in the insulated hanger.

540,668. Regulation of Alternating Generators. Rudolph M. Hunter, Philadelphia, Pa. Application filed June 21, 1894.

The cut shows an arrangement including an alternating current generator, line circuits leading therefrom for supplying energy to translating devices at distant places, a separate continuous current generator or exciter, an exciting circuit leading from the continuous current generator for supplying current to the field magnets of the alternating current generator, a regulating armature for generating counter-electromotive force arranged in the exciting circuit, field magnets for producing a magnetic field in the vicinity of the regulating armature, and adjustable devices for shifting the poles of the regulating armature relatively to the poles of the field magnets for the purpose of varying the speed of the regulating armature, and thereby controlling the counter-electromotive force.



NO. 540,664

540,685. Electric Brake. William B. Potter, Schenectady, N. Y. Application filed March 9, 1895.

A controlling switch, a brake switch, a reversing switch, an interlocking mechanism between the switches, and means arranged to vary the effect of the interlock in accordance with variations of position of one of the switches are features of this invention.

540,781. Telephone Transmitter. Daniel Drawbaugh, Eberly's Mill, Pa. Application filed February 16, 1895.

One claim is given: In a telephonic transmitter, the combination with the body having the central opening, the diaphragm and rear plate of the electrodes, a felt pad held in the central opening in the body and surrounding the electrodes to form a chamber between them, and comminuted resistance conductor located in the chamber.

540,800. Electric Arc Lamp. Samuel P. Parmly, Chicago, Ill. Application filed October 26, 1891.

A pair of carbon pencils for an arc lamp is adapted to be presented end to end, and to be adjusted toward one another as they are consumed by an arc passing between them, formed each as a flattened bar or prism thickest at the middle and becoming thinner toward the edges.

540,859. Electric Railroad Signal. Burton H. Gedge, Anderson, Ind. Application filed May 20, 1892.

In a system of electric signals, the combination of the lines of rails, each line separated at desired intervals by forming divisions, and there connected to an electro-magnet, in connection with the source of electrical energy, and other intervals between the first named insulation, also electrically insulated, and the lines of electric conductors separated near the electro-magnets, and capable of being put into circuit by the circuit closers, adapted to be closed by the electro-magnets, the mechanism being a part of a system of which locomotives provided with electric signal devices are the complementary part.

540,883. Trolley. William E. Steinbach, Philadelphia, Pa. Application filed April 6, 1895.

A trolley formed with auxiliary rollers which are adapted to engage with the trolley wire, and a crank arm for separating the rollers to permit the same to be disconnected from the wire, is shown in the accompanying illustration.

540,899. Telegraphic Apparatus. Louis Bondet and Pierre Lacombe, Lumel, France. Application filed October 20, 1894.

In the transmitter described there is the combination with a suitable dial, of a plurality of hands carried by shafts concentric one with another, a toothed wheel secured to each of the shafts, a plurality of electrically conducting circuits similar in number to the wheels, shafts and hands, and a vibrating contact making and breaking strip located adjacent to each of the toothed wheels, so as to be vibrated by the rotation thereof and forming part of one of such conducting circuits.

540,900. Condnit Electric Railway. David Brooks, Jr., Philadelphia, Pa. Application filed June 9, 1892.

The principal parts in this device are a condnit with slot, an insulating support on hangers in the conduit, a continuous conductor on the support, insulating strips on the continuous conductor, a sectional conductor with separated ends on the strips, pieces connecting the ends of the sections and the continuous conductors, a receiver movable in the slot, a frame protecting the receiver, and a chain secured to the receiver and in contact with the sectional conductor.

540,901. Conduit Railway Conductor. David Brooks, Jr., Philadelphia, Pa. Application filed February 27, 1892.

This is a continuous conductor, sectional conductors and insulating material between the continuous and the sectional conductors, and pieces of fusible material electrically connecting each of the sections with the continuous conductor.

540,959. Telephone Transmitter. Daniel Drawbaugh, Eberly's Mill, Pa. Application filed February 23, 1895.

This transmitter has a fixed and a removable electrode, a body of granular carbon interposed between the electrodes, an elastic carbon holder having an opening of a size to fit the electrodes, thereby to keep the granular carbon in operative position with relation thereto, and means for adjusting the removable electrode to and from the fixed electrode and locking it in its adjusted position.

540,960. Carbon Holder for Telephones. Daniel Drawbaugh, Eberly's Mill, Pa. Application filed February 21, 1895.

A carbon holder for telephone transmitters, comprising an annulus wholly of sponge.

540,961. Telephone Electrode. Daniel Drawbaugh, Eberly's Mill, Pa. Application filed February 21, 1895.

A closed casing, a disk-like annulus filling the space between sides of the casing, carbon buttons within the casing of a size to fit the opening in the annulus, and a body of granular carbon interposed between the buttons.

540,969. Telephone. Stephen D. Field, Stockbridge, Mass. Application filed December 5, 1894.

A magneto telephone is described, having two independent circuit windings in inductive relation to each other, one of the windings being in mechanical connection with the diaphragm and forming a closed circuit complete in itself, and the other being adapted for connection in a main line circuit.

540,974. Multiplex Telegraphy. Daniel B. Grandy, St. Louis, Mo. Application filed December 17, 1894.

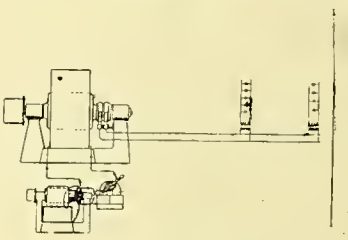
In a quadruplex or multiplex telegraph system, the combination with the main line circuits, the means for producing signals simultaneously in each direction by changing the polarity of the line currents, and the means for producing other and independent signals simultaneously in each direction by varying the strength of said line currents, of an additional resistance in the form of coils differentially wound on iron cores, condensers shunted around said resistance, and electro-magnets connected in said shunt circuits with said condensers around said resistance, so that said resistance offers but little impedance to outgoing currents beyond its ohmic resistance, while incoming currents encounter a high impedance from the self-induction therein, and a stronger charge is thereby caused to enter the condenser in one of said shunt circuits.

540,999. Electrically Driven Fan. Henry G. Morris, Philadelphia, Pa. Application filed February 9, 1894.

The invention as described combines a base, an electric motor thereon, a vertical driving shaft, a disk on the shaft, a series of blades extending above and below the disk at its periphery, a ring inclosing a portion of each of the lower blades, and another ring inclosing a portion of each of the upper blades, the rings forming an annular space between them, and the driven disk forming a deflector.

541,001. Electric Carriage. Henry G. Morris and Pedro G. Salom, Philadelphia, Pa. Application filed January 19, 1895.

The details of construction are shown in the illustration. The first claim is reproduced: The combination in an electric carriage, of the rear axle, the driving wheels thereon, the front



NO. 540,668.

axle and wheels, a frame attached to the rear axle, a ring section on the front of the frame, springs on the front axle, a ring section carried by said springs, a body attached to the frame at the forward end springs mounted between the frame and body at the rear, an electric motor carried by the frame, an intermediate shaft mounted in bearings on the frame, pinions on the shaft, and gear wheels on the driving wheel meshing with the pinions, and equalizing gearing between the motor shaft and the intermediate shaft.

541,019. Electric Wire Lock and Support. Daniel W. Smith, St. Louis, Mo. Application filed September 10, 1894.

A suitable trolley wire hanger is employed in combination with the guy wire clamp, having a transverse recess in its upper side, a lateral enlargement of the recess, downwardly curved side-grooves intersecting the recess at their inner ends, and together extending continuously from end to end of the clamp, and a suitable pivot passing through the lateral enlargement of the recess and engaging the trolley wire hanger, so that the head of the pivot will be located below, but out of contact with the overlying guy wire.

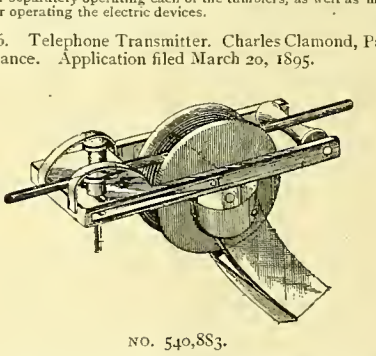
541,020. Conduit Electric Railway. Daniel W. Smith, St. Louis, Mo. Application filed September 10, 1894.

A loop is formed integral with and in the length of the conductor at the crossings of the conduit, the loop comprising the vertically bent portions, horizontally bent portions and the circular loop all bent from the length of the conductor.

541,024. Electro-magnetic Combination Lock. Emory Stockwell and Herbert C. Stockwell, Stamford, Conn. Application filed August 6, 1894.

A series of independently operated tumblers are adapted to control the fence, while an independent electric device is provided for separately operating each of the tumblers, as well as means for operating the electric devices.

541,036. Telephone Transmitter. Charles Clamond, Paris, France. Application filed March 20, 1895.



NO. 540,883.

Included in this device are a movable electrode and sound receiving diaphragm in a telephone circuit, an adjacent receptacle, a bridge within the receptacle, a plastic, viscid, conducting paste contained within the receptacle, and a loosely supported ball encompassed by the paste and maintained in the described relation to the movable electrode.

541,037. Telephone Transmitter. Charles Clamond, Paris, France. Application filed March 20, 1895.

A pendulous electrode is suspended within plastic, viscid microphonic conducting paste, in combination with a vibratory diaphragm electrode between which and the suspended electrode the paste intervenes.

# Western Electrician.

EVERY SATURDAY.

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## James E. Keelyn.

In the struggle for supremacy in the pending telephone litigation and consequent control of the situation, one of the most active leaders of the anti-Bell forces is the subject of this sketch. James E. Keelyn was born at Albany, N. Y., 38 years ago, and came to Chicago when a mere boy. For 30 years he has lived in the West, and much of that time in Chicago. He may, therefore, be justly considered a typical western business man, enterprising, energetic, resourceful, and keenly alive to the advantages offered in the opening up of the telephone field to the public. He has become thoroughly familiar with the Bell policy and methods through long service with that company, and his knowledge of that concern's great resources, and his willingness to enter the field against that corporation, shows his confidence in the ultimate success of the anti-Bell crusade.

Mr. Keelyn became interested in telephony at an early day in the history of its commercial life. He entered the Wisconsin Telephone company when it was formed, and was manager of the Racine exchange from 1880 to 1885. In May of the latter year he engaged in business independently, but continued to keep in touch with the telephone situation. His experience in general electrical construction business gave him a wider acquaintance, and was valuable in other ways. Anticipating the expiration of valuable patents held by the Bell people, he began his preparations to re-enter the telephone business, and in 1890 formed the Western Telephone Construction company of Chicago, of which he is president. He has devoted much time and study to the Bell company's policy, methods, and the system of that corporation, and is probably as well equipped as any man in the country to lead the opposition to the old concern. He has succeeded in gaining the confidence of many representative telephone men, engaged like himself independently of the Bell company in developing the telephone field, and with their assistance he formed the anti-Bell organization known as the Telephone Protective Association of America, which has been in consultation at Pittsburg this week.

It is a noteworthy fact that Mr. Keelyn is conservative in his business methods, and that this movement which he is now leading is intended for the protection of the members against attacks by the Bell company rather than an effort to stir up prejudice against the old corporation. It is his belief that the telephone field is too extensive for one company to control if the full possibilities that are offered are to be developed, and in support of this position he cites the fact that while the Bell company has made phenomenal progress in introducing and extending this business, it has not begun to exhaust the possibilities presented. It is not to be inferred, however, that this conservatism of Mr. Keelyn will prevent him from stubbornly opposing every effort of the Bell company to once more monopolize the field and retaliate every attack that is made upon him or his associates. His record already establishes the fact that he is ready to defend his interests, and that he is full of expedients and measures with which to meet his powerful opponent.

Socially, Mr. Keelyn is a very pleasant and agreeable companion, and enjoys popularity and confidence in the community. He has a pleasant home at Evanston, Chicago's favorite suburban town. In 1885, Mr. Keelyn married a daughter of David Lawton of Racine, Wis. He is very much attached to his family, which comprises his wife and one son.

## Telephone Competition in Wisconsin.

After trying without success to get a franchise in the city of Berlin, Wis., the Badger Telephone company finally entered that place without a franchise. After reaching the city limits, the workmen set poles on private land as far as they could, and then set them on the river bank, on government land. From the river the wires were strung from building to building, wherever permission could be obtained, and the company put in some telephones. Two other telephone companies had been granted franchises in Berlin, and the city officials did not care to grant any more franchises because the city was in danger of being made unsightly by too many poles. The Badger company operates a line through Waushara county and so does another company which has quite a large exchange in Berlin.

The Oshkosh Northwestern Telephone company has accepted the franchise which was granted to it at Oshkosh, and there is some indication of rival lines in that city before a great while.

## Telephone Protective Association.

A dispatch from Pittsburg, June 24th, says: "An adjourned meeting of the executive committee of the Telephone Protective Association of America, recently formed in Chicago, held an executive session for the purpose of completing its organization and plans. The association embraces about 40 telephone manufacturing concerns and plants. It is not a corporation; it is not a trust. It owns neither stock nor patents. It is an association designed to protect and further the interests of its members, and it proposes to prove that the earth and the fullness thereof doesn't belong solely to the American Bell Telephone company, and to that end will stand between it and other companies, users and exchanges.

"The officers so far elected are: President, J. E. Keelyn

JAMES E. KEELYN.

of the Western Telephone Construction company of Chicago; first vice-president, J. R. Johnson of the Viaduct Manufacturing company, Baltimore; second vice-president, S. J. Tunbridge of the Utica, N. Y., Fire Alarm & Telephone company; secretary, Paul W. Bossart, Minneapolis, Minn.

"On the executive committee, so far as consummated, are: P. C. Burns of the American Electric Telephone company of Kokomo, Ind.; J. G. Ihmsen of Pittsburg; H. C. Dodge of the Standard Telephone & Electric company of Madison, Wis.; L. Levick of the Anthony Telephone company of Cincinnati, O.; Judge E. S. Wallace of the Columbia Telephone company of New York. The association adopted its constitution and by-laws in part, and it expects to conclude the organization and plans at this meeting. The association looks upon the long-distance telephone in the light of a common carrier and proposes by legal measures to compel the company to accommodate local exchanges with connections. The association thinks the Bell patents much weaker than claimed. President Keelyn stated that an association of independent telephone companies of Pennsylvania is about to be formed. The committee was entertained by the Country club."

## Telephone Rates in Chicago.

For many years there has been much dissatisfaction with the telephone rates in Chicago, and the Druggists' association has made several ineffectual efforts to secure relief. At the present time an organized movement is on foot to compel the Chicago Telephone company to reduce the present charges to a reasonable basis. The local agitation is being conducted through the *Chicago Chronicle*, and, judging from the expressions of approval and encouragement found in the interviews with business men in all lines of trade, the movement is welcomed with universal favor. Commenting editorially upon the subject the *Chronicle* says:

The officials of the local telephone company lay stress upon the fact that it costs more to serve 15,000 subscribers than 200. This is doubtless true.

But it is also true that the 15,000 subscribers pay more—proportionally and disproportionally—for their 'phones. In a 200 'phone exchange $50 a year is a high rental, making an income for the company of $10,000 a year. In Chicago, with 15,000, it is moderate to put the average rental at $100, or $1,500,000 a year gross income. It is the only business in the world which demands bigger profits with larger sales. There is neither logic nor justice in the position of the telephone company.

No sane business man—and the *Chronicle* is representative of the sane business sense of the community—will deny to the telephone company the right to make a reasonable profit on its business, or, if it were subject to free competition, the right to make even an unreasonable profit. But, as there can be no competition, as the council has shut the streets of Chicago against competitors—as the very nature of the telephone business makes effective competition impossible—some public supervision of charges is essential.

Only united action will crush the telephone monopoly. Competition won't do it in a great city. The law offers no remedy. Nothing but enforcement of the public right to control and, if need be, to take and manage the telephone system will be effective. This in the present fiscal condition of the municipality is a simple impossibility. But the city can regulate charges, and if it is true to public interests will do so.

## Bell Instruments Replaced at the National Capital.

[From the Washington correspondent of the WESTERN ELECTRICIAN.]

The District government proposes to operate a telephone system of its own, and thereby cease paying the Chesapeake & Potomac Telephone company for such service. The proposal of Kennedy & Du Peraw to furnish 200 sets of telephone transmitters and receivers at $3.75 per set was accepted. The usual indemnity bond to guarantee against infringements will be given by the Manhattan Supply company, the maker of the telephone sets. The new system will be put into working order shortly after the beginning of the next fiscal year. The District already owns the wires necessary for the police and fire alarm service, which for the most part is that for which the government rents telephones, to the number of 200, at a rate of $2,000 yearly. The exchange telephones, sixteen in number, and the exchange service, now paid for at a total of $350 per annum, will be kept.

A company to be known as the Columbian Standard Telephone company has been organized in this city, with L. G. Hines as president, Felix Agnus vice-president, and George W. Cross as general manager. The company is to operate in Maryland, District of Columbia, Virginia and West Virginia.

Another dispatch under date of June 24th says of the movement against the Bell company:

The commissioners are so well pleased with the success of their experiment that an effort will at once be made to extend the system, and, if possible, enter into direct competition with the Bell company, which until now has practically owned Washington.

For a town of its size Washington has been paying higher telephone rates than any other city in the East. It is the claim of the Bell company that in small towns it is able to charge quite reasonable rates, because of the limited number of subscribers. Washington's population in round figures is 200,000, while Chicago's is 2,000,000, yet the telephone charges in this town closely approach, and in some cases exceed, the rates charged in Chicago. The lowest price for which a telephone can be obtained for business purposes in this town is $100, although the total number of subscribers is not within one-eighth of the number in Chicago. The Washington telephone directory is a limp booklet of less than ninety-five pages of actual names, printed in staring big type. It contains probably the names of 2,000 subscribers, many of them duplicates. Many of the subscribers realize that the rates they have been paying are altogether too high, but nothing has been done to bring the company to terms.

In most cities the telephone companies are required to furnish service to the city free in part payment for its franchise. This is not done in Washington, although a heavy percentage of the telephones are in use by the government and the commissioners. The District was obliged to put in its own wires, batteries and bells, but was forced to hire the transmitters and receivers from the Bell Telephone company. For the privilege of using these instruments the District had to pay $10 a year for every set it used. The government has to pay full rates of $100. The rate charged the District would, it is understood, have been continued, had not the Bell company feared competition. Since April the rent has been reduced to $5, a practical concession that the former

rate was exorbitant. Superintendent Miles, in charge of the telegraphic and telephone service, had repeatedly recommended to the commissioners that they should purchase the instruments and so obtain control of the entire system. Lack of money has prevented this in the past and would have prevented it again had it not been discovered that instruments could be purchased outright for less money than the Bell company charged for the hire of them.

The first batch of the new instruments arrived two days ago. Workmen are now engaged putting telephones into every department in the district. The telephones will be made to connect with an exchange and the system will be enlarged to whatever extent the appropriation permits.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

Superintendent Wainman of the Minneapolis office of the Northwestern Telephone Exchange says business has picked up considerably in the past few months, particularly for May, and that June is expected to run ahead of the record.

The Mankato Telephone & Telegraph company of Mankato, Minn., has been absorbed by the Phœnix Construction company of Indianapolis, Ind., and the latter company will apply for the franchise asked by the former.

A 13 mile telephone line connecting Sparta and Cataract, Wis., will be built by D. W. Cody.

The Standard Telephone company has applied for a franchise at Madison, Wis. The company has a list of 200 subscribers and 100 additional contingents and says it does not fear the old company.

The Wisconsin Telephone company has begun the work of rebuilding the system of Oshkosh, Wis., and will put in heavier wires and the return circuit system. It will cost $16,000.

The Forman Telephone company of Forman, N. D., has incorporated, with W. W. Bradley as president; Jas. Anderson, vice-president; and A. N. Carlblom, secretary, and A. M. Grover, treasurer. The company has over 75 miles of wire in operation and has just completed the line to Lisbon.

The Northwest Engineering company of St. Paul is building the telephone line between Ortonville, Minn., and Big Stone City, S. D.

A telephone company has been formed at Cherokee, Ia., and will put in the Bell system.

W. J. Bell of Winona, Minn., is building a telephone line to Fountain City and the Waumandee Valley.

The Northwest Engineering company of St. Paul is canvassing Fairmount, Minn., to put in a telephone exchange.

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A dispatch from Washington says that strenuous efforts will be made in the next Congress to induce the government to appropriate enough money to establish an electric plant at the Great Falls of the Potomac on lines similar to but less extensive than those at Niagara Falls.

The Seattle Consolidated Electric Street Railway company's power plant was destroyed by fire on the morning of June 20th, causing a loss of $75,000 to the company, insured for $40,000; and a further loss to the Third street electric line of $25,000, fully covered by insurance.

## A Central Station With Three-phased Current Generators.

By Dr. G. H. Zahn.

Electric light and power plants increase so rapidly that there is no keeping pace in describing them. All that we can hope to do is to mark the principal points and record the chief novelties of central station work. The plant here described is the central station owned and controlled by the city of Chemnitz, Germany, and comprises a system of high tension three-phased alternating currents with the necessary transforming apparatus.

The buildings, situated out of the town, are divided into boiler house and dynamo house, with generating room, workshop, etc.

Three Steinmueller water-tube boilers built for a working pressure of 180 pounds and provided with Leach's automatic coal feeding and stoking device furnish the steam required for driving the steam engines.

In the generating room are three vertical triple-expansion (three cylinders) condensing engines each yielding 150 horse power at 150 revolutions per minute and 165 pounds boiler pressure, the maximum output of each engine being 220 horse power. They were built by Kuhn of Stuttgart.

Directly connected with the shaft of each engine is the field magnet system of a Siemens & Halske three-phased alternating current generator built for an output of 180 kilowatts at 2,000 volts, and keyed to the same shaft is the armature of the small direct current dynamo furnishing the exciting current, at 120 volts, for the large generator.

The stationary armature as well as the revolving field magnets are built up of insulated sheet-iron stampings. The armature ring is firmly held together by steel bolts in a cast-iron frame. The windings are placed in grooves or channels at the inside of the ring, and generally there are three grooves per magnet pole. For insulation mica and fiber are used exclusively.

The field magnet system coupled to the shaft of the engine consists of a great many poles, the number of which varies according to the size and speed of the generator. There are 40 poles in the 180 kilowatt generators; thus, at 150 revolutions per minute of the machine, giving 3,000 cycles per minute.

The method of the armature winding is shown in Fig. 2 for a generator with 12 poles. Beginning at the back of the armature the wire is placed into channel *1* to the front, then going to *4* and through channel *4* to *1*, thus forming one turn. This process of winding is repeated as often as turns are required in one coil. In the same way coils are wound through *2* and *35*, *3* and *6*, *5* and *8*, etc. If a high tension is to be produced the coils $A_1$ to $A_6$ are connected in series; also the coils $B_1$ to $B_6$ and finally $C_1$ to $C_6$. The ends of these three groups of windings are connected in the neutral point, while the beginnings connect to the three terminals of the machine. Fig. 3 shows the way of connecting described and known as star winding; another method of making the connections, which might have been used just as well, the mesh winding, is illustrated in Fig. 4.

Very interesting are the curves of the voltage taken from the 180 kilowatt machines under varying loads. The diagram in Fig. 5 represents the voltage of the exciter, showing regular fluctuations or periods caused by the reactions of the armature and being six times the number of the periods of the exciter.

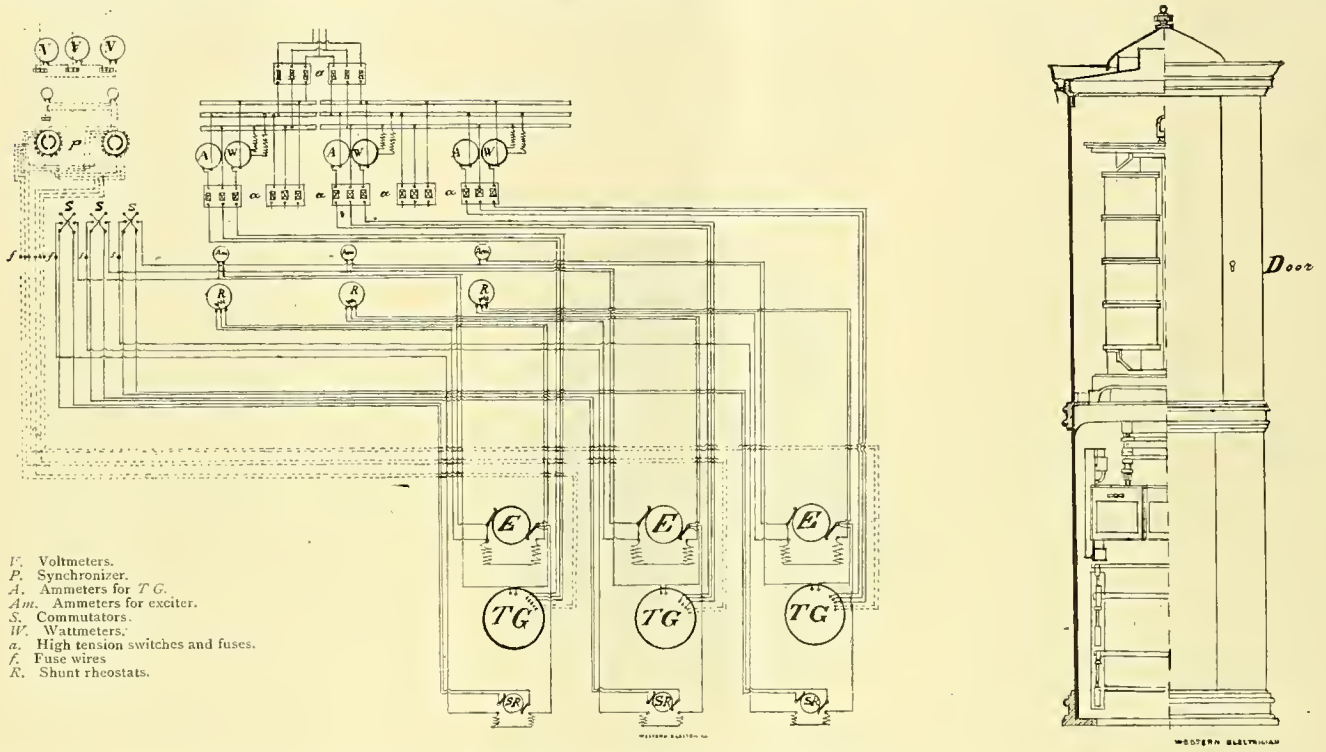
The curves of the three-phased current machines when running without load and with full load are represented by Fig. 6 and Fig. 7 respectively. It will be seen that for the generator when running without load the maximum pressure is a little lower than the maximum of a sinusoidal curve of the same effect. For 2,000 effective volts the maximum pressure as represented by a sine curve is 2,828 volts, while the diagrams taken from the machine show 2,788 volts for the unloaded and 2,930 volts for the loaded generator.

These diagrams are taken with an apparatus designed especially for this purpose, the main parts of which are a small three-phased current motor, a condenser and a reflecting galvanometer. The magnet system of the motor is supplied with current of the generator the curve of which shall be determined, while the armature is supplied from a direct current machine (exciter), thus securing synchronism of the motor. The motor shaft is provided with contacts and contact rings connecting the generator to be examined at every revolution at first with the condenser and then with the galvanometer. At every revolution the condenser is charged with a pressure corresponding to the variable positions of the contacts and then discharged through the galvanometer. If the motor be running with a high speed, the galvanometer will give a constant deflection of the mirror or the needle.

The dropping of the voltage of the generator is 7 per cent. if the load be changed from zero to the full output and if the exciting current be kept constant at 120 volts. The regulation of the large machines is effected by a small rheostat in the shunt magnet winding of the exciter. The power consumed in the field magnets of the generator and furnished by the exciter is about 3 per cent. of the power developed by each generator, the economical efficiency of which is 92 per cent.

In a corner of the generating room the switching arrangement is placed on a platform. A sketch showing the connection with the machines is given in Fig. 1. It will be seen that for each of the three sets of machines, the following controlling apparatus is used: For the exciter, one shunt rheostat, one ammeter; for the three-phased current generator, one three-pole switch, one ammeter and one wattmeter. The additional instruments for the entire plant are three voltmeters for the low tension mains and one synchronizer for putting the alternators in parallel.

It is an interesting feature of the arrangement that the small (pilot) transformers generally used as synchronizing apparatus and for the measurement of the secondary voltage are done away with. The armatures of the three-phased generators are provided with a few turns of an additional




FIGS. 1 AND 8. A CONTRACT STATION WITH THREE-PHASED CURRENT GENERATORS.

winding, yielding about 25 volts, and the terminals of this winding are directly connected with the synchronizer as shown by the dotted lines, while pilot wires connect the low tension mains with the controlling voltmeters.

In Fig. 1 $S$ $R$ represent small direct current motors used for the regulation of the steam engines and supplied with current from the exciter; $T$ $G$ are the three-phased current generators and $E$ the exciters.

From the central station, which is about one mile from the center of the district of the chief supply, two triple con-

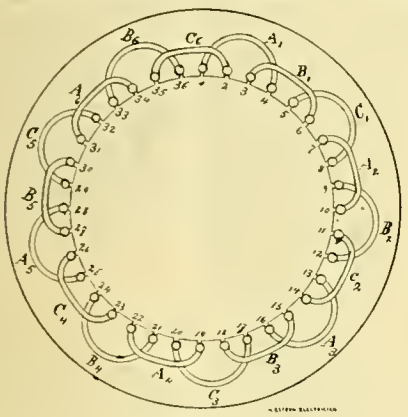


FIG. 2. A CENTRAL STATION WITH THREE-PHASED CURRENT GENERATORS.

centric lead-covered cables supply the transformers in the inner city branched cables connecting to the transformers situated in the outer parts of the town. The cables and the network of mains radiating from the sub-stations are constructed to supply 10,000 16 candle power lamps in actual operation.

There are at present 24 transformer sub-stations of 600 kilowatt capacity, reducing the voltage from 2,000 to 120 volts. The transformers and the high and low tension switching and safety arrangements are placed in iron columns about 12 feet high and 3.6 feet in diameter. All columns are of the same size—although the transformers are of different sizes, according to the output required—and are roomy enough for a 50 kilowatt transformer. In Fig. 8 one of these transformer cases is illustrated. It will be seen that the interior is divided into two parts, the upper one containing the transformer, the lower one the switches and fuses.

The transformers consists of three vertical columns (magnet cores) made of insulated sheet-iron strips, which are placed in a position corresponding to the corners of a triangle. They are wound on fiber spools around the cores, and the magnetic circuits are closed by sheet-iron strips magnetically connecting the cores on the top and the bottom, respectively.

A fairly good idea of a sub-station switchboard, the safety devices and connections of a transformer, may be gathered from the diagrammatic sketch, Fig. 9.

Light as well as power is supplied from the station, and the rates charged are of very great interest.

The price of 1,000 watts per hour is about 17 cents for lighting and 4.3 cents for power purposes. If time meters be used in connection with motors, the rate is about 3.3 cents per horse power per hour.

The motors operated in connection with the central station are of different types and makes. The stationary magnet ring of Siemens & Halske three-phased current motors is constructed and wound the same as the stationary armature of the generators described. In the inside of the magnet ring the revolving ring armature, made of laminated iron disks, is placed. The clearance between the magnet and armature iron is very small, to reduce as well the current required when the motor is running without load as the phase difference between current and voltage. The method of the armature winding is the same as in the magnet ring, the coils being placed in grooves on the outside diameter of the armature core. The ends of the three groups of armature windings are connected together; the beginnings are also put together in all small motors, and in large motors if current for power purposes only be supplied from the generator. If the central station furnishes power from the light mains it is better to connect the beginnings of the armature windings with three contact rings, brushes making connections with a suitable starting rheostat. All the resistance is in the armature circuit when the motor is started, thus reducing the current induced in the armature windings and the dropping of the voltage in the secondary transformer (light) circuits. With the increasing load the resistance is gradually diminished, and when the motor is running with full load the whole resistance is switched out and the armature practically short-circuited.

The difference in the speed of the motors running without load and with full load is from 2 per cent. to 3 per cent., the commercial efficiency is just as high as in good direct current motors of the same size, as may be seen from the following table:

Normal output of the motor four horse power:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Output in horse power. . . | 0.5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Efficiency in per cent. . . | 50 | 68 | 83 | 87 | 87 | 87 | 87 | 86 |

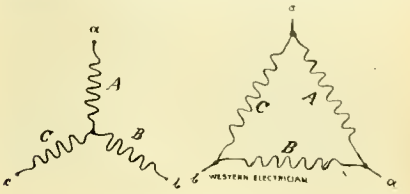
## Electric Railway Lines of the Chicago City Railway Company.[1]

If time is money, the saving in time for the passengers on the old horse car lines of the City railway, after that company has completed the conversion of those lines into electric roads, will represent a vast fortune. Thirty million passengers ride each year on the lines of the City railway, which have until within a few months been operated with horses. The conversion of those roads into trolley lines makes a saving in some cases of more than one hour in the time schedule from one end of the road to the other. It would be a fair estimate, perhaps, to say that passengers on the old horse car lines will be saved on the average 20 minutes each when the company has completed its electric work. That means a total saving of 10,000,000 hours in a year, or 1,250,000 eight-hour days. It means the time of 4,166 men working through a 300-day year. The story of the electric road development on the South Side is an important chapter in a history of this era of electric road building which is bringing such rapid changes in the city's development.

When the City Railway company has completed the electric railway construction that it is now engaged in, trolley cars will be running on 125 miles of its lines. Not a single horse car line will be left. The time that passengers have consumed in getting from one point to another will be decreased to a surprising amount. A passenger at Sixty-ninth and Leavitt streets will reach the business center one hour and 18 minutes sooner than he could have done under the old horse car schedule. An Auburn Park passenger, starting from the end of the Seventy-ninth street line at Halsted street, will be whirled down town at a speed that will save him one hour and 12 minutes, compared with the easy jogging of the street car horses. Passengers from the Union Stock Yards will spend 34 minutes less time jolting over street car rails than they have been forced to while the horses pulled them a portion of the way.

It requires an average of eight to 10 horses to operate every car on a line where the horse is the motive power. The substitution of electricity on all the horse car lines of the City Railway company will throw out of service 3,000 horses.

The work of converting the horse cars into trolley lines was begun last fall. On July 16, 1894, the City Council passed a handful of ordinances granting the right to convert horse car lines into trolley lines and to build new trolley lines on a number of streets where there were no transportation facilities. The City Railway's first experience with electricity was on Sixty-first and Sixty-third streets during the World's Fair, and the experience was so remarkably satisfactory that it was immediately decided that the cable and the electric motor should in the future be the only



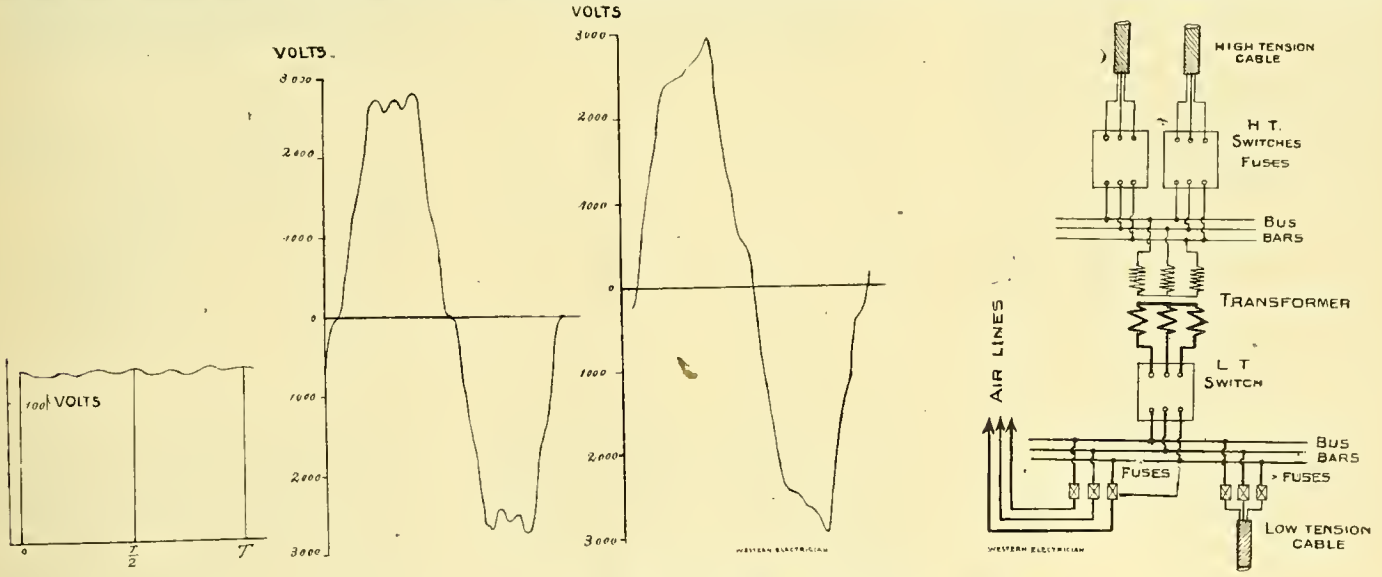
FIGS. 3 AND 4. A CENTRAL STATION WITH THREE-PHASED CURRENT GENERATORS.

power used. The work of converting the horse car lines was started in earnest last fall and has been going on all this year as rapidly as it could be pushed. The company is today operating 80.6 miles of electric road. Within the next few weeks over 20 miles more of electric lines will be started, and when the present plans for the system are fully carried out, 125 miles will be operated by electricity.

It makes an interesting study of electric lines to follow in detail the traffic on those lines which the City Railway has already equipped with electricity. Such a statement shows, for instance, an astonishing increase on the 11.6 miles of the Auburn Park line, running from Thirty-ninth and State streets by the way of Wentworth and Vincennes avenues to Seventy-ninth and Halsted streets. That road was operated by horse cars until a few months ago. When the trolley cars were put on the running time from the Seventy-ninth street terminal to Thirty-ninth street was shortened 44 minutes. The record for last month shows that the traffic of that line increased 118.37 per cent., as compared with the traffic in May, 1894.

The appended table gives in detail all the lines of the Chicago City railway now equipped with electricity and shows the mileage, the saving of time per trip as compared with the horse car time schedule, and a comparative record of earnings for the month of May, showing the increase as compared with May, 1894:

While some lines, like the Auburn Park and the Sixty-ninth street lines, show a great increase as compared with the traffic a year ago, it will be noted the average increase for all lines equipped with electricity has not been nearly so remarkable as is generally imagined. The average increase in the traffic of the 80 miles upon which the trolley cars are now running has been 20.23 per cent. The Stock Exchange speculators who have been building rosy estimates of the traffic of the street railway companies after the trolley cars have entirely superseded the horses should note these figures with a good deal of care. The bulls on street railway stocks have dropped into an easy habit of figuring that the replacing of horses with electric motors means a doubling of traffic and a cutting in two of operatiog expenses. Statistics have been shown of certain North Side lines where the increase was quite as pheoomenal as on the Auburn Park line of the City Railway. When the fact is kept in mind, however, that in spite of an increase of 118 per cent. on the longest line the City Railway has equipped with electricity the average increase for the whole electric system is a little over 20 per cent., it will be easy to see that one is pretty apt to fall into an error in estimating street car earnings after this easy




FIGS. 5, 6, 7 AND 9. A CENTRAL STATION WITH THREE-PHASED CURRENT GENERATORS.

1. Abstract from the *Sunday Tribune*, Chicago, June 23, 1895.

rule of a doubling in traffic and a cutting in two of expenses.

| | Miles of single track. | Percentage of change in earnings. | Saving in minutes per trip. |
|---|---|---|---|
| Sixty-first street, from Cottage Grove avenue to South Park court (electric in 1894) | 1.74 | 23.77[1] | 8 |
| Sixty-first and Sixty-third streets, from Ashland avenue to Stony Island avenue (electric in 1894) | 9.30 | 8 53 | 32 |
| Thirty-ninth street and Union Stock Yards from Cottage Grove avenue, via Thirty ninth, Wallace and Root streets (horse in 1894) | 4 81 | 16 00 | 18 |
| Forty-third street and Union Stock Yards, from I. C. R. R tracks via Forty-third, State and Root streets (horse in 1894) | 5.50 | 31 26 | 20 |
| orty-seventh street, from Cottage Grove avenue to Western avenue (electric in 1894) | 8.00 | 7.05 | 24 |
| Auburn Park line, from Thirty-ninth and State streets via Thirty-ninth street, Wentworth and Vincennes avenues, and Seventy-ninth street to Halsted street (horse in 1894) | 11.60 | 118 37 | 44 |
| Sixty-ninth street, from Sixty-fourth and State streets, via State street, Vincennes avenue and Sixty-ninth street to Leavitt street (horse in 1894) | 6.92 | 57.87 | 28 |
| Halsted and Sixty-ninth streets, from Sixty-ninth street, via Halsted street to Union Stock Yards (horse in 1894) | 7 12 | 36.83 | 24 |
| Halsted and Fortieth streets, from river via Halsted to Union Stock Yards (horse in 1894) | 3.31 | 15 00 | 10 |
| Thirty-first street, from Lake Park avenue via Thirty-first street and Pitney court to Archer avenue (horse in 1894) | 5.45 | 15 72 | 24 |
| Twenty-sixth street, from Cottage Grove avenue to Halsted street (horse in 1894), blocked 1895 by elevation L. S. and R. I. tracks | 3.01 | 18 67[1] | 10 |
| Thirty-fifth street, from State street to California avenue (electric in 1894) | 7.00 | 1 00[1] | 26 |
| Wallace street from Thirty-ninth street, via Wallace, Twenty-sixth, Twenty-ninth and Hanover and Butler streets to Archer avenue (horse in 1894), ran to Lake street via cable in 1894 | 6.85 | 28.50[1] | 16 |
| Total | 80 61 | 20.23[2] | |

1. Decrease.
2. Average increase.

The table which has already been given shows the electric system of the City Railway as it is in operation to-day. In addition to that there are now in process of construction four lines aggregating a little over 20 miles upon which the trolley cars will be running in a short time. There has been some delay in receiving rails, but that delay will not much longer hold back the improvement. Those lines upon which construction is now partially completed are as follows:

| | Miles of single track. |
|---|---|
| Ashland avenue, from Archer avenue (river) at Thirty-first street south on Ashland avenue to Sixty-ninth street | 0.50 |
| Archer avenue, from (Chicago river) Pitney court west on Archer avenue to Thirty-eighth street, thence west on Thirty-eighth street to Kedzie avenue | 5 00 |
| Wentworth avenue, from Archer avenue south on Wentworth avenue to Eighty-ninth street | 4.19 |
| South Chicago avenue, from Seventy-first street and Cottage Grove avenue, via South Chicago avenue, south-easterly to Seventy-fifth street, Grand Crossing | 1 50 |
| Total | 20.19 |

The following lines were covered in the blanket ordinance granted by the council July 16, 1894, and will soon be built, but construction on them has not yet commenced:

| | Miles of single track. |
|---|---|
| Halsted street and Seventy-ninth street, from southern terminus of present track, Sixty-ninth and Halsted streets, south on Halsted street to Seventy-ninth street | 2 50 |
| Center avenue, from Forty-seventh street, south on Center avenue to Sixty third street | 4.00 |
| Sixty-third street, from Cottage Grove avenue west to west side C. R. I. & P. R. R. tracks, joining present Sixty-third street tracks, to be commenced when elevation of L. S. & M. S. Ry. and C., R. I. & P. Ry. Co. tracks are completed to this point | 2.50 |

The plans for electric construction which the City railway has matured are not entirely comprehended in the ordinance already obtained. The company has plans covering about 24 miles of line, for which ordinances will probably be asked for. Work has been actively going on for some weeks securing the consent of property-owners and there have been a good many difficulties to overcome. But in most cases the consent of a sufficient number of property-owners has been obtained. On Indiana avenue there has been a hard task to convince the residents that trolley cars were better than horse cars. Some amusing instances of objections that have been met with are recounted by the people who have been canvassing for property-owners' consents. In one house the head of the family refused to sign on the ground that he was absolutely opposed to having the quiet of Indiana avenue invaded by thundering electric cars. His next-door neighbor refused to sign because he would not have any noiseless trolley cars sweeping down on him before he knew what was coming.

The following table shows the lines for which ordinances will now be asked:

| | Miles |
|---|---|
| Kedzie avenue, from Thirty-eighth to Sixty-third street | 6 5 |
| Archer avenue, from Thirty-eighth street to Fifty-first street | 5 2 |
| Western avenue, from Archer avenue to Seventy-first street | 4 2 |
| Fifty-ninth street, from State street to Ashland avenue | 4 |
| Indiana avenue line, from Wabash avenue at Eighteenth street, east on Eighteenth street to Indiana avenue, thence south to Thirty-ninth street | 5 06 |
| South Park line, from Thirty-ninth street south on Indiana avenue to Fifty-first street, thence east and west on Fifty-first street, thence to Grand boulevard and State street | 4 |
| | 23.76 |

The first four lines are to be built on streets that have no transportation facilities at present. On Indiana avenue and on the South Park line horse cars are to be replaced with the trolley.

The City Railway is also at work obtaining the consent of property-owners on Clark street for bringing the trolley as far north as Washington street. In the event it is successful in that plan all the electric cars west of State street will be brought directly down-town over Wentworth avenue and Clark street without necessitating transfers to the cable.

The map which accompanies this article shows the system of the City railway as it stands to-day, together with the contemplated extensions. A passenger boarding a car of the company at Sixty-ninth and Leavitt streets and riding down-town gets a ride of about 11½ miles for 5 cents. That point is the most distant from the down-town terminal, but there are a number of rides that can be taken on the lines of the company in the neighborhood of 10 miles in length. South of the City Railway lines is a perfect network of electric roads, covering not alone the southern part of Cook county away south as far as One Hundred and Thirty-eighth street, but running clear over into Indiana. These are owned by four distinct companies and all form important feeders to the City railway system, although there is no direct or indirect corporate connection between them and no special transfer arrangements.

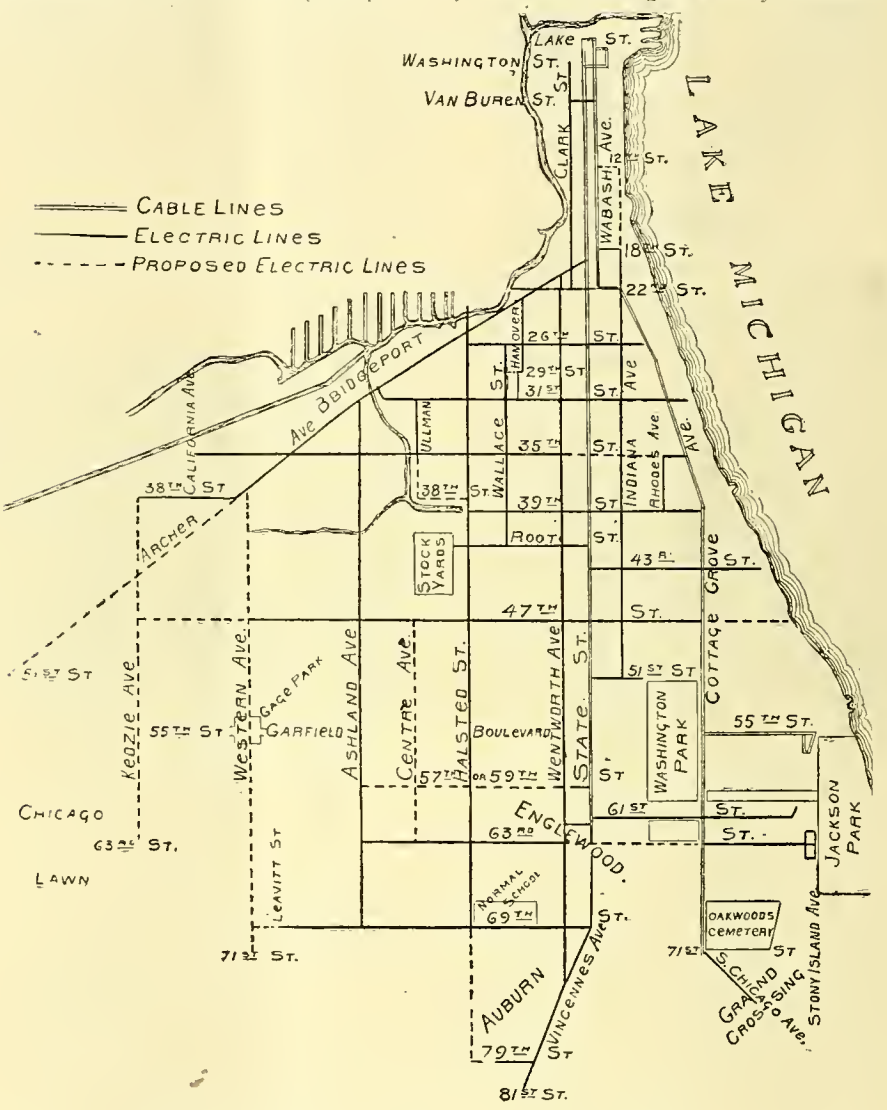
"The distance in time between the business center and the residence district is one of the important elements in fixing the value of property," says M. K. Bowen, superintendent of the City Railway company. "The value of such property is influenced but little by the number of miles it lies from the business center. Its value depends upon its availability, and time is the important element. The building of electric lines will in a large measure revolutionize values in many districts, I should think. Rapid growth and development is certain to follow the lines of rapid transit to the business center. The rapid multiplication of these lines in the last few months has added a vast amount to the value of residence property through the district which the lines of this company cover.

"Electricity is a complete success as a motive power for surface roads under certain conditions. There is no probability that the cable will ever be replaced with electric cars, at least so long as the electric system is anything like it is at present. When there is sufficient traffic to justify twelve cars to the mile of double track the cable becomes the cheapest form of traction per car mile run, and electricity cannot compete with it. On the other hand, when the traffic is not sufficient to justify more than four cars to the mile of double track, horses become the cheapest form of motive power. With traffic anywhere between these two extremes electricity is the most desirable. The space in a barn taken up by a street car is 300 square feet. The space occupied by horses to run that car is 800 square feet. The change to electricity gives the railroads two-thirds more barn room. The limit of the capacity of cable lines is reached when a rear train is compelled to stop for a train in front of it, when the first train stops to take on or let off passengers. We came just about up to that limit in 1893, when we ran trains with fifty seconds headway. With Clark street equipped electrically, taking care of the traffic of the cross-town lines, the congestion on the cable roads will be greatly relieved and there will be no danger of reaching the limit of their capacity for some years to come.

"We shall have about 240 motor cars in operation within forty days. We hope to run the cars from Seventy-ninth and Halsted streets down Seventy-ninth, Vincennes, Wentworth and Clark streets to Washington street. We also expect to run a through line to the down-town business center by the way of Root, Wallace, Twenty-ninth, Hanover, Archer and Clark streets to Washington street. This will be the first through line to the business center that the Union Stock Yards have ever had."

The electric system of the City Railway company, as illustrated at its power house on Wabash avenue, between Fifty-second and Fifty-third streets, shows many points of variance with the system being installed by the North and West Chicago Street Railway companies. There will be but a single power house, and it is declared it is large enough not only to answer all the present needs of the company, but to take care of all the development for at least the next 10 years. The construction of this power house is less elaborate and undoubtedly much less expensive than some of the power houses built by the Yerkes syndicate. But Chief Engineer Robert J. Hill declares he is ready to stake his reputation on the ability of the plant to turn out electricity cheaper than any other power house in the country. The idea of directly connected dynamos has not yet been adopted. The dynamos that are being put in by the North Chicago and West Chicago companies have an armature on the same shaft as the fly-wheel of the engine and there are no belts. The City Railway engineers have decided against that form and used dynamos driven by rope belts. The ropes are made of cotton, 1¼ inches in diameter and 3,800 feet long, manufactured with a single splice. They are driven at a rate that makes the rope travel 6,000 feet a minute.

The company is burning coal screenings that cost $1.40 a ton, and by means of automatic stokers is able to get as much efficiency from that coal, it claims, as other people get from coal at $2.25 a ton, and it does that without anything but a fleecy cloud of white vapor coming from the tall chimney. Smoke prevention, rather than smoke consumption, is what the men who have built this plant believe in, and by perfect combustion they prevent any smoke being made. In this power house are 10 single expansion engines with 18 foot fly-wheels, weighing 30 tons each, and running 100 revolutions a minute. Each pair is connected to a single crank shaft and develops 1,500 horse power. The dynamos are capable of operating 50 motor cars. The plant has a capacity, therefore, of 500 cars, although at present only about 160 are in operation. The almost perfect automatic character of the plant is remarkable. There were but two men in the big engine-room, and it is as




ELECTRIC RAILWAY LINES OF THE CHICAGO CITY RAILWAY COMPANY.

clean and well kept as if it were put up for exhibition only. Practically everything about the plant is automatic, from the automatic coal stokers down.

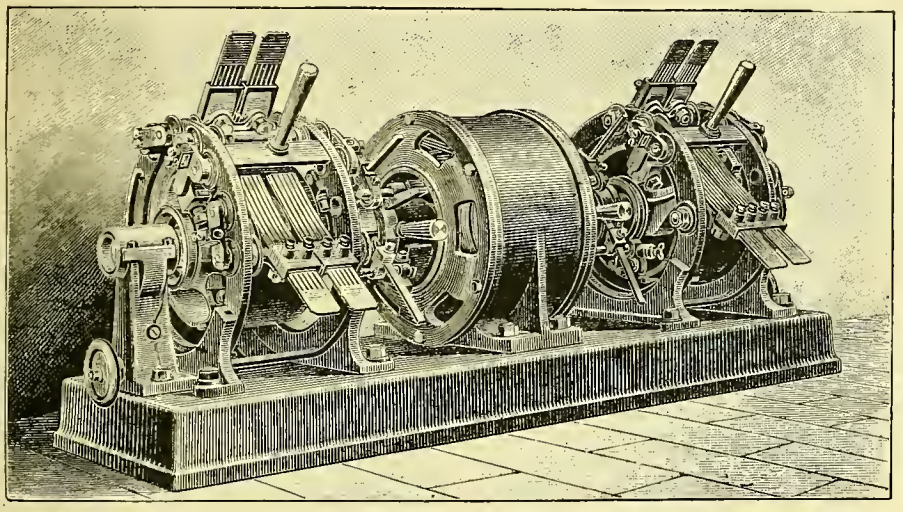
In one direction the City Railway has developed a system which is a little in advance of anything other companies have done. It is in the direction of preventing accidents in case of fire. The whole system is divided into 20 sections. Whenever there is a fire alarm it is sounded at the barns and power station at the same instant it is in the fire department stations. When the alarm sounds the man at the power house switchboard instantly turns off the current along the particular section of the road where the fire is located. A wrecking wagon, to which a team stands always harnessed, starts for the scene of the fire and usually before the fire department arrives, if the blaze is at all serious, the crew has taken down the trolley wire and given free rein for the fire department's operations.

This wrecking wagon is a remarkably complete institution. It has a telescope platform which can be quickly wound up so the men working on it are on a level with the trolley and they can take out a section of the trolley wire in a very few minutes after the fire alarm has sounded.

For the first four months of this year the traffic of the City Railway company was 25,428,421, against 25,056,683 for the first four months of 1894. That traffic in each of the two years was divided between cable, electric, and horse car lines as follows:

| | 1895. Per cent. | 1894. Per cent. |
|---|---|---|
| Cable | 61.62 | 64 36 |
| Horse | 10.68 | 26.84 |
| Electric | 27.70 | 8.80 |

The City Railway claims to be the most liberal in its systems of transfers as now in operation of any street railway company in the country. Fully 4,000,000 transfers are issued every month. On all north and south lines, including Archer avenue, transfers are issued to all connecting lines on the payment of cash or for a transfer from another line.



ALTERNATE-CONTINUOUS CURRENT MUNICIPAL PLANT.

On all east and west lines transfers are issued to any connecting lines on the payment of a cash fare.

## Electric Alarm Lock.

An electric alarm lock which has many excellent features is shown in the accompanying cut. The system of which it is a part comprises the lock *F*, the catch *G* and a plate *U*, which carries the electrical contacts. The lock has three bolts, *D*, *B* and *A*, this last called the half-turn, which only serves as a latch when the door is closed. The catch *G* which faces the lock has two blocks *V*, *V*. All the contacts are made through the plate *U*, which is fixed by four screws upon the door frame so that the catch is insulated perfectly from it. An insulated block *P* has fastened to it a long spring, the extremities of this spring being finished with ebonite buttons, resting on the plates *V*, *V*. In this, the normal condition, the two buttons insulate the spring from touching the plate *U*, yet if any metallic tool is inserted to pry open the lock, contact is formed and the alarm bell will ring. The bolts *A* and *B* are electrically separated from the rest of the lock by the pieces *C* and *Z*. When the key is turned in the lock the bolts entering the catch make contact with two springs, *S* and *R*, fixed on the plate *U*. Two pieces, *I* and *L*, are also insulated from the lock frame, but are connected with the bolts by the spring *M*, while the lock frame is connected to one pole of the line, the springs *S* and *R* being in contact with the other pole. When a skeleton key, a hook, or wire is placed in the keyhole, contact with *I* or *L* closes the circuit, and warns the inmates, but the proper key, fitted to pass these contact points, will throw the bolts without sounding the alarm.

Another peculiarity of this lock, which makes it especially valuable for stores or offices, enables the proprietor to notify the porter when he leaves the premises, and also when he returns. This is a function of the bolt *D*. When the door is being locked this bolt makes an instantaneous contact with two small springs *K*, permanent contact being prevented by the insulation *E* on the bolt. Connected with these two terminals is a battery which moves a disk carrying alternately upon its face the words "out" and "in." This bolt *D* can only be operated from the exterior, but the rest of the combination may be manipulated from within, without sending an alarm.

## Alternate-continuous Current Municipal Plant.

There is nothing which is more annoying in the way of artificial illumination than the quality of vacillation. If the light is too brilliant it may be subdued; if it is dim we may still accommodate the eye to its use, but the constant changes of a flickering lamp require such intense alternate action of the optic nerve that great fatigue results, and if too long continued trouble follows, which may become serious.

Helmholtz experimented along this line and established the fact that a source of light kindled and extinguished about 25 times per second was fatiguing to the eye; and Prof. Forbes has made investigations with an incandescent lamp of 16 candle power and 50 volts which show that when the alternations were less than 25 per second it proved tiresome to the eye and this fatigue continued to be felt up to 28 periods. Arc lamps are unstable with similar alternations, but when the periods reached 50 per second the annoyance is no longer appreciable. For this reason the transformation of alternate into direct currents must attract much attention, and its successful accomplishment be a matter of interest to all.

M. Pellissier, in *La Nature*, furnishes some information which is noteworthy, relative to the Cardiff, Wales, municipal plant.

The authorities, having decided upon the installation of a plant for both public and private service, were obliged on account of high prices and poor facilities to select a site at some distance from the center of the place. A spot was found at Canton, a suburban village, which lay along a coal railroad, and was of very little value for any other purpose. But the distance was such as to preclude the use of any other than an alternating system, with a pressure of 2,500 volts.

The dynamos are consequently simple alternate current machines of the Siemens type, remarkable for their dimensions, furnishing 75 amperes of current at 2,500 volts, with 40 periods per second. The armatures, of the disk form, are movable, and of about five meters diameter. The exciters—continuous current—are coupled directly upon an extension of the alternator shafts, these latter being coupled directly to the engine in a manner which makes each a complete and independent system. There are also two small alternators which have each a capacity of 16 amperes at 2,500 volts.

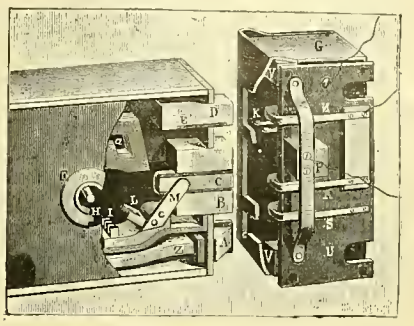
Subterranean cables convey the current to the center of the city, where the tension is reduced to 105 volts.

The incandescent lighting is done by the alternating current, but through fear that the low frequency of the periods would produce a flickering light, the city engineer, Mr. Massey, decided to change the alternating into a direct current before using it for street illumination.

The illustration shows a type of the Ferranti transformer which changes the current. It consists of a small synchronous motor, the movements of which are dependent upon the periods of the current, and carries two commutators. The machines are placed in the basement of the city building, about two kilometers from the central station. Two of these are in service, the third being held as a reserve. Each of them has a capacity of 24 lamps of 12 amperes in two circuits of 12 lamps in series.

The small synchronous monophase motor has a commutator for changing the current necessary for feeding the inductors. A high tension commutator is placed at each extremity of the shaft, and each of these supplies current to one circuit.

A reversing switch and a cut-out are placed in each circuit,



ELECTRIC ALARM LOCK.

and a water regulator is let into the primary circuit, which serves to break the sudden vacillation, in case of cutting out a group of 12 arcs at the same instant on the circuit of a small machine.

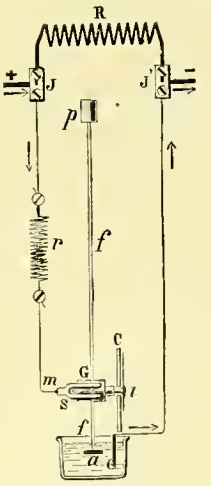
The arc lamps are of the Siemens type, and are placed at 6.75 meters above the street. The lamp-posts are cast-iron; a design at the base, on a door which can be opened to give access to the wires and cut-outs, represents the arms of the city. These posts are placed at the pavement line in the narrow streets and upon the "refuges"—miniature parks in the center of the wider streets—where the width permits.

## Continuous Current Meter.

Among the meters now finding favor in Europe, that illustrated in the accompanying cut is conspicuous. It is composed of a silver wire *f*, resting at its lower extremity upon a glass plate *a*, and carrying at its upper extremity a weight *p* bearing down perpendicularly. The vessel surrounding *a* contains a solution of azotate of silver.

The current to be measured enters at *J* and leaves at *J'*. Two resistances *R* of very coarse wire and *r* of fine wire are placed in parallel upon the route through the instrument. The small proportionate amount passing through the latter coil at *m* reaches a spring *s* which rests against the wire *f*, and passes thence into the solution at *a*, and out in the direction of the arrows, by way of the electrode *c*.

As the electrolytic action cuts away the wire *f* the weight *p* forces it downward, communicating a rotary motion at *G* to a shaft to which the needle *i* is attached before the face of




CONTINUOUS CURRENT METER.

the graduated scale, and from which the ampere hours are read direct.

## Temptation Would Be Too Great.

[From the *Chicago Evening Post.*]

Professor Barrett's remarks about the use of the city's electric lighting plant to furnish light to private consumers are worth considering. * * * * * * The objection would be that the conditions of American politics would preclude the possibility of honest and profitable management. Look at the men who collect the taxes (or don't collect them), who directed the water supply system, and who controlled the streets. How long would it be before these gentry, by means of bogus contracts and stuffed pay rolls, would wipe out the difference between the cost of production and the revenue from sales, which corresponds to the interest on bonds and dividends on stock paid by the electric light and gas companies?

Western Electrician

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THE Bell telephone company has taken the necessary legal steps to secure possession of the remainder of the earth.—*Chicago Tribune.*

If Justice Putnam writes the opinion in this case, he will endeavor to establish the fact that an apology is due the Bell company for having kept it out of possession for so many years.

IF, instead of accepting without reserve all of the glowing statements sent out in the form of interviews with the city electrician, the Chicago daily papers would investigate the subject under discussion, they would find that Superintendent Barrett may be mistaken, if indeed he does not intentionally impose on the credulity of the public. For instance, while municipal lighting is under consideration it would be well for the city papers to secure the opinions of competent electrical engineers or managers of central stations on this subject, and compare them with those in the published interview of last week. It is not necessary to go to representatives of interested companies, although as much weight should be given the statements of these concerns as that of Superintendant Barrett—both being interested in the outcome—and surely their experience and knowledge of the business would make their opinions of greater value than his. But let all these considerations be put aside and the matter left for determination to consulting and constructing engineers and central station managers of experience and ability. This, certainly, is a fair proposition.

THE plan advocated by Governor Altgeld for the enactment of legislation providing for the establishment of boards of arbitration in this state has been tried elsewhere, but has never been favorably received any more than has the expensive and inefficient system now in vogue in New York state. This latter is a costly experiment and should serve as a warning to other states. It has cost the state from $14,000 to $22,000 a year to maintain it, and it is neither feared nor respected—in fact the commissioners have about as much power as a trio of meddlesome old women, and their "recommendations" receive just about as much attention as if they were the result of the deliberations of an old ladies' sewing circle. The people of this state desire no such ornament. There are plenty of boards and commissions at present, and until a new and far more effective plan is advanced than those already proposed, neither the capitalists nor workmen of Illinois favor the establishment of boards of arbitration, mediation or conciliation.

IT is only during the hot weather that all the features of the Welsbach burners are fully appreciated. Those who are using them now realize that the claims that are made in their behalf for economy and efficiency in illumination are of only secondary importance. It is in heating capacity that these miniature furnaces are preëminent. It will be remembered that we have repeatedly called attention to this characteristic and insisted that the popularity of the new burner would be short lived. The following paragraph from an article on "Gas as an Illuminant," by Foree Bain, in the WESTERN ELECTRICIAN, December 15, 1894, is timely:

> And now we have another winter scheme in the revival of the Welsbach burner. It is a matter of note that the attempt to introduce this lamp again has been made in the fall of the year, at a time when heat is very desirable and when the great amount of heat given out by these burners may be turned to some useful account; but in the summer-time, when the scorching days have come and when the nights are no improvement on the days, and when the gentle breeze is conspicuous by its absence, how many Welsbachs will we see? 'Tis then the ash barrels will groan with their burden of discarded Welsbachs.

Those who tried the Welsbach burner during the winter months know that Mr. Bain was thoroughly familiar with the qualities and faults of this device. If economy were, the only requisite, this "incandescent gas lamp," as its advocates call it, might compete with the electric light, but those who have used the latter will never be satisfied with the Welsbach.

COLLEGE publications issued by students are always interesting, but at no other period are they so attractive as at this time of the year. In their pages are reflected the thoughts, the plans and hopes of aspirants for honors in the busy commercial world which they are about to enter. Their ideals are high, and if they but follow them they will undoubtedly gain honor and distinction, if, indeed, they fail to achieve fame and fortune. They have sufficient incentive furnished in the excellent example of those whose successes are frequently chronicled in the periodicals which are published by their alma mater. These pages contain ample evidence to prove that the days passed in the class room and in the laboratory give the possessors of this experience great advantage over those who have been less fortunate. In a journal published by the students of a leading college of engineering there is an excellent department in which brief mention is made of the present location, occupation and standing of former pupils. In glancing over this list from month to month the most casual perusal cannot fail to impress upon the reader the importance of college training to young men who intend to enter commercial as well as professional life. One cannot look through these columns without meeting many names already familiar through some achievement in science or art, prominence in the professions or success in commercial life. Of course, there are comparatively few who gain world-wide fame or national renown, but of those who attain a competence college men comprise a large proportion. The lesson which this experience should illustrate is the advantage of entering the struggle of life thoroughly equipped, and in these days of competition the advantages of college training cannot be too highly valued.

"OUR neighboring city of Chicago is a most striking example" of the fact that municipal lighting is not profitable. This is the conclusion a Milwaukee official reached after carefully examining the reports made by cities which have had experience in this line, and it confirms the opinion freely expressed by competent electrical men who have given the matter careful consideration, but it may be news to the people of Chicago. Depending upon the published statements of interested or irresponsible persons, taxpayers have come to believe that the city was pursuing an economical policy in establishing a plant for electric street lighting. It is not at all difficult to understand how this impression was gained, although it is quite remarkable that the public should so long remain in ignorance of the true condition of affairs. It can only be explained by the fact that there was implicit confidence in the ability of Supt. Barrett to fulfill the promises he made which induced the city to adopt the policy of lighting its streets, and that he has thus far evaded making a complete statement of the result of this experiment. Such a statement would show that instead of fulfilling the promises made for it and thereby effecting an actual saving for the taxpayers, the present municipal lighting system of Chicago has been a very expensive and unsatisfactory experiment. Supt. Barrett has been given ample opportunity to carry out his agreement to provide an economical lighting system for the city streets, but he has failed to show any advantage gained for the taxpayers. He has been urged repeatedly to present data in support of his claims that he was furnishing light at a price named by himself as the actual cost of production, but he has never been able to prove his case. In fact the whole subject of the cost of this project to the city has been shrouded in mystery, and thus far it has been utterly impossible to secure from the city electrical department any detailed statement that would be at all reliable. But while it is true that Supt. Barrett has positively refused to enlighten the electrical fraternity upon the cost to the taxpayers of his favorite scheme, and has encouraged the belief that the project was a profitable one for the city, electrical experts of established reputation have made it their business to investigate the subject thoroughly and they have proved conclusively that Supt. Barrett's statements are based upon figures that are not complete and that they are therefore neither fair nor honest, but misleading and injurious to the electrical business. Supt. Barrett cannot plead ignorance of these facts, for he has been confronted with them and he has been urged to disprove the charges of bad faith made against him or to admit the error of his statements. He has done neither, but he has repeatedly promised, or rather threatened, to publish figures that would convince the world of the truthfulness and the justice of his claims and cover his critics with confusion. For six years the fraternity has waited, occasionally reminding him of these promises, but he has ignored all demands.

Now, however, a new scheme is presented to the city by which it is proposed to keep up the present delusion. The city is urged to engage in commercial lighting, and in published interviews the city electrician tells the people of Chicago the great advantages to be derived from giving him additional power. The "arguments" used six years ago in advocating the establishment of street lighting plants are again presented in support of an extension of the system so as to enable the city to compete with established companies and drive them out of the field. Irrespective of the rights of these corporations, there is a question of accounting to the people of Chicago which Supt. Barrett should be required to meet before further power be given him. He must show he has not abused the confidence already reposed in him; that he has not deluded the taxpayers by promises which he had not the ability to keep; that the proposed scheme has some merit, and that it is not intended solely to cover up the failure of the last project engineered by him. The statements made in the interview given out last week to the newspapers of Chicago indicate that the same methods will be adopted in booming this scheme that were used so effectively six years ago. The people are told that there will be no dividends and no interest to pay, as in the case of a private concern. Of course Supt. Barrett knows that the city would have to pay interest upon the money it would have to borrow to establish this plant, but this is only one of the reckless statements and is in keeping with many others that have been made in connection with this enterprise and the one that preceded it. Yet this assertion is a fair illustration of the "arguments" advanced in support of this project. Concerning the cost of labor, it may be said that recent experience has led the people to consider every scheme of this character in the light of a political measure and that the pay rolls of the city are already large enough.

In considering the question it should be remembered, too, that the private interests involved are of great magnitude. To jeopard them would be a great mistake and bad public policy. Supt. Barrett need not be surprised if, in resenting his unwarranted interference, the interested electrical companies should call him sharply to account. It cannot be said that they have not heretofore treated him considerately. The electrical fraternity of Chicago and of the country is under no obligation to John P. Barrett. Even his most ardent admirers will not question the statement that he has been honored and rewarded to the full extent of his ability and services.

## Popular Errors About Electricity.

By C. C. Haskins.

There is a large amount of brilliant ignorance abroad in the land as to the capabilities for good and evil of electricity, which leads people into serious, if not harmful, conclusions.

The trouble arises largely through a lack of distinction between "current" and "tension," terms which, to the public ears, are more readily comprehended if, in their stead, one should say mass or quantity and pressure or strain.

Where a larger amount of electric current passes in a given time this flow is said to be one of more amperes, as one would say a larger pipe would discharge a greater number of gallons of water per minute, while a smaller sized pipe, as at the nozzle of a fire engine hose, might throw a stream of water very much farther by virtue of a much heavier strain or push behind it. One of these streams might thus furnish a great quantity at the delivery, and the other a comparatively small quantity at a very much greater distance away.

Now, one of these may be compared to a commercial current of electricity which is used by the electrotypers and platers. The flow of current is large but the pressure is minimum. There is next to no necessity for careful insulation, for such a current has little tendency to escape; there is not that form of energy in its make-up. It is not potent for harm in the way of shocks; men handle it with perfect impunity. The surroundings of the electroplater's bath are wet; the men are wet, and their wet feet are in constant contact with the wet floor. The solution in which the plating is going on is a far better conductor of electricity than ordinary water, yet the attendants are constantly handling the metal articles, removing and replacing them without the slightest inconvenience. Here is a current of electricity capable of dissolving a metal which would withstand some thousands of degrees of heat in a furnace, carrying that metal in solution to the opposite pole of the bath and re-depositing it in a metallic form on the article to be plated, yet a current which has not the element of push or pressure energy sufficient to propel a spark through the air across a space of one thirty-second of an inch—probably not one-half that. It is known to the electrical craft as a current of extremely low tension, a current of high quantity or high current flow. It is an extreme manifestation of one of the characteristics of an electrical current.

There is, on the other hand, a form of current which has a diametrically opposite character to this. It is possible to have a current of so much push or pressure that it is next to impossible to restrain it or keep it from escaping, even through the atmosphere. The flow from a frictional electric machine is of that character. The spark from one of these generators may be sent through the air (and air is one of the very best insulators known) two or three feet; it can be made to bore a hole through a plate of glass, and yet, although it may be discharged into a dish of gunpowder and blow the grains away, it is not at all certain that it will set them on fire. The spark which so many persons first saw developed last winter during the extreme cold weather by sliding across the carpet, and touching the gas pipe, is another example. The air in winter is far drier than in summer. Moisture makes the air a conductor, better in proportion to the amount of water it contains, and a small amount of moisture in the air is sufficient to prevent an accumulation of this high potential electricity. We cannot get these spark demonstrations in the summer season because of the moisture in the atmosphere, which serves as a vehicle for its escape.

Now for commercial use we have currents combining these two characteristics in different proportions. For telegraphic purposes, a certain amount of pressure is required, sufficient to push a small amount of current a long distance, but this pressure is not sufficient to permit it to dissipate itself in the surrounding air, except to a limited extent, save in a very misty rain. The lines are insulated at every post, and the limbs of trees are cut away to prevent escaping current. There is only a very limited amount of current flowing, and while a considerable shock may be obtained from a telegraph current, there is little if any danger to life or property by contact with it.

A still lower level in the scale of risks is the current used by the telephone companies.

Ascending in the scale, we come to the low potential current used for lighting and power purposes. The pressure here is no heavier than on short lines of telegraph, the same virtually as with an ordinary blue vitriol or gravity battery of 50 to 110 jars. The difference between it and the telegraph current is in the characteristic of quantity, or current flow. It remains constant in pressure—usually 50 to 110 volts—but in proportion as openings for the flow are made, that is, as lamps are turned on or motors are brought into service, the increased demand is met by a greater supply, and the quantity is thus varied, while the push, the voltage, remains stationary. This pressure is not necessarily a dangerous one to life, and is not sufficient to force the current through more than a mere fraction of an inch of atmosphere. It produces an unpleasant sensation when received through the person, and is not safe to handle in a district where other and more powerful currents may be accidentally crossed with it. If a contact of good conductivity is made with the wire carrying this current, heat results, and without the safeguard known as the fusible metal, which acts on much the same principle as the soft plug in a boiler, and opens the circuit, the danger from electric lighting would drive it out of existence.

The next grade in the upward scale of voltage is that generated for street railway service—about 500 volts—which also remains constant in pressure, but varies in the output, according to the demand. This pressure, too, is incapable of jumping through a very short, dry air space, but it is a dangerous current to encounter.

Above this last in the scale comes the ordinary high-tension arc system. This differs materially from the systems in which the quantity is variable but the pressure is constant. Here the quantity, or flow, is always the same, but the pressure varies, increasing with each additional lamp. These lamps require a pressure of from 45 to 50 volts each, but they do not vary the flow. Now, with ten lamps only in the line there would be 450 to 500 volts of pressure, and with 50 lamps there would be 2,250 to 2,500 volts, and even then the pressure is only a small fraction of what it is in the spark generated by sliding on the carpet, or the spark from the friction machine. But it has the other characteristic not possessed by these carpet-generated sparks. There is sufficient quantity or flow of current to make such a current extremely dangerous. It is the combination, if it may be so called, of high and low powers; that is, the possession of the two characteristics—volts and amperes—that makes this dangerous. It will kill, but it cannot jump an air space. It has pressure enough to require high insulation to restrain it, but the insulating properties of the atmosphere (which, when ordinarily dry, are far in excess of those of either glass, porcelain or india rubber) are proof, where this medium is as thin as an eighth of an inch, against the jumping of an electric light current, by virtue of its initial pressure.

## Telephone Inquiry in England.

[From the *London Electrician.*]

When a government is in want of a policy, or a minister in want of a cue, it is usually sought for inside one of the parliamentary committee rooms. The device is not generally esteemed very dignified, and is often only a roundabout way of shelving the subject altogether. None of these things, however, can be said of the parliamentary inquiry which has just completed its examination of witnesses in respect of the telephone service and its relations with the state. The report may take probably a considerable time to prepare, if the voluminous evidence is to be impartially weighed and digested; or it may be got ready very quickly if, as might happen, the committee are unable to offer any definite recommendation except for the publication in full of all the evidence tendered. On the whole, we are in that position ourselves, and we make no apology for offering some comments at this stage of the case, feeling sure that nothing we can say one way or the other will affect the broad conclusions to be drawn from the numberless suggestions and inexhaustible statistics placed at the committee's disposal.

One of these conclusions certainly is that the public will learn to set a more correct estimate on the value of opinions proffered by self-chosen advocates of particular and novel schemes of telephonic administration. For knocking the bottom out of irrepressible faddists there is nothing so sure as a public inquiry; and it must be said of this one, to its credit, that not a few personages who thought themselves authorities have left the committee room emptied of their reputation, if not of their conceit. It is very easy to collect any number of complaints against the telephone system—or, for that matter, against any human system whatsoever; but when men come forward with schemes of reform they should at least take the trouble to understand something of what they are talking about. Representatives of municipalities, who are greatly to the fore just now, are very much lacking in this respect; and the National Telephone company's contention that its business would be worked less efficiently by municipal bodies than by private enterprise found no little support in the character of the testimony offered by typical members of the former. Not excepting the "evidence" tendered by that superfine organization, the London County Council, the municipal witnesses were, we must admit, far from showing any special capacity for working the telephone. In point of fact, the major part of the witnesses failed to grasp the true problem to be solved, namely, how to convert an imperfect telephone system into one corresponding with that of the perfected telegraph system which exists in government hands. None but the official witnesses fully realized this point—the only one indeed worth considering. What the telephone has suffered from hitherto has been, it may be confidently asserted, a species of parochialism, gradually, it is true, developing on a bolder and more national basis, but still hampered and afflicted by the petty and narrow limitations under which its early years were spent. Nobody is particularly answerable for this; railways grew up in a similar way. Telephones were for a good while supposed to be merely elongated speaking tubes, serviceable for purely local purposes. The plans, therefore, were localized; and if they do not fit in very well with the larger requirements which have arisen in these days, nobody can wonder at it. The latest understanding arrived at by the postoffice with the National Telephone company is a frank admission that competition over the same area is not merely inexpedient but impossible, and the state merely claims the trunk lines as being part and parcel of its main telegraph system. Co-operating in this way it is not unlikely that the company's administration will go on improving to the level of the one administered by the state; and whether the whole may finally fall into the hands of the postoffice will depend very much on how far this dual arrangement contrives to work harmoniously to the satisfaction of the public. There is no half-way house between state acquisition and state abstention, except possibly that which has been already arrived at.

Of the many "progressive" suggestions which came out into the light in the committee room, none was more prominent than that of municipal telephones. The supporters of this latest development of municipalization did not, as we have before remarked, cut a very impressive figure. Against the running of local telephone exchanges by local authorities there is the very obvious argument that where the government itself has failed to compete successfully with the company which at present holds the field, no municipality, however powerful, could possibly succeed. The same considerations which have prevented the state from pursuing a competitive game, namely, the taxpayers' pockets, might be expected to operate in the case of local authorities. There is, however, something to be said in favor of the practicability of municipal telephony. England and Scotland afford many striking examples of what can be done municipally wherever a strong municipal spirit is in existence. When two companies compete in the same town telephone users are moved to cast in their lot with one or the other by purely business motives; the concern which can induce the public to believe that it offers on the whole the better service will win, and the advent of the day of victory will be hastened by the innumerable petty vexations inherent to the rivalry of the two exchanges. But given the existence of a real grievance against the telephone company and an able municipality backed by a powerful municipal spirit, and we should be sorry to risk the dogma of editorial prescience and omniscience by dogmatically predicting disaster. With the magnificent network of trunk wires on its hands, the National Telephone company was, indeed, in an impregnable position; but to-day the trunk wires are open to all comers and municipal telephony has as good a chance as it is ever likely to have. Whether it is economically expedient or morally right to adventure the ratepayers' money in such a campaign of competition is a big question, which we need not now discuss. All we contend is that municipal telephony cannot be contemptuously dismissed as utterly impracticable, and that one single successful instance of it would in all probability save the necessity of a second.

One of the most useful pieces of evidence furnished to the committee was that by Mr. Staats Forbes, the president of the National Telephone company, giving statistics of users and charges for this and other countries where the telephone is in popular demand. We have never been the apologists of this company; but we gladly admit that the figures adduced by its able representative before this parliamentary committee go far to exculpate the management from many of the accusations which have been freely hurled against it for many years past unchallenged. Compared with those of other countries, its charges are not higher and its services are not less efficient or popular when the national conditions are fairly taken into account. No importance can be attached to statistics of complaints against this one company, seeing that no corresponding efforts have been made to obtain similar figures from other countries. If a round-robin could be got from all quarters we suspect that a majority could be obtained for voting the telephone an unmitigated nuisance which everybody would wish to see abated and perhaps even abolished altogether. And this, not because of its defects, but by reason of the demands it makes on the nervous energies of its users. But it is too late to consider their nerves; the only question is the efficiency of the service; and obviously this can best be obtained by a system which is virtually controlled by one administration.

## Telephone Construction Notes.

Reports from the South and Southwest indicate that considerable work is being done in that territory in developing the telephone field. A correspondent announces that the people in that section have got tired of paying high rates and have decided to cast their lot with new companies. "They are paying no attention to 'recent decisions,'" says this correspondent, "but are going ahead putting in telephones, and the new exchanges are making rates that will enable everybody to subscribe." As evidence of what has already been done this correspondent gives a list of recent installations by Bottenfield & Wood of Carthage, Mo., the general western agents for the American Electric Telephone company of Kokomo, Ind. Among these installations are the following: Joplin, Mo., is putting in an exchange, using the 'Hunnings' long-distance 'phone, manufactured by the American Electric Telephone company. The company was organized last winter, and every one of the subscribers is a stockholder; the exchange has 200 or more subscribers. Galena, Kan., has organized a telephone exchange, and Bottenfield & Wood are finishing the 'phone and switchboard. Carthage, Mo., has got one of the largest list of subscribers of any city in Southwest Missouri. A private company, called the American Telephone company of Carthage, has just been organized. This company will build a line to Webb city and Carterville, and put in an exchange there, and these will connect with Joplin, Mo., and Galena, Kas., and give free service to all its subscribers over its 30 miles of line. Neosho, Mo., capitalists are put-

ting in an exchange of 100 instruments made by the American Electric Telephone company of Kokomo, Ind. Frederick H. Brown is putting in a fine telephone system of 200 telephones at Parsons, Kas. The equipment was supplied through Bottenfield & Wood of Carthage, Mo. Mr. Brown will use the 'Hunnings' long-distance 'phone, made by the American Electric Telephone company of Kokomo, Ind. Parsons had the old Bell system, but has discarded the entire outfit. Lickwood and Greenfield, Mo., have been connected by a telephone line, and 18 to 20 'phones have been placed in each town. The line is being operated by Wheeler & Mann of Greenfield. They use the 'Hunnings' instruments.

The Aberdeen, S. D., telephone exchange is equipped with new instruments purchased from the Standard Telephone & Electric company of Madison, Wis. The Western Electric Telephone company of Britt, Ia., has contracted with the Standard Telephone & Electric company of Madison, Wis., for 10,000 telephones, to be used on the toll lines and exchanges through Iowa, Southern Minnesota and South Dakota. This is undoubtedly the largest contract ever made for telephones. The Western Electric Telephone company already has 600 miles of toll lines completed.

A dispatch from Indianapolis says: Prominent capitalists of this city have organized the Phœnix Telephone company and are asking for a franchise with a view to aggressive opposition to the Bell monopoly. The new company has agreed to establish an exchange and put in instruments at $30 a year for business houses and $20 a year for residences, and will pay the city a percentage of the gross earnings in the event a franchise is secured. Their agents recently made a canvass of the city and secured 1,500 subscribers, four-fifths of whom are now patrons of the Bell company. Notwithstanding a general demand that the new company be permitted to come in, the Board of Public Works is insisting on conditions that may keep it out.

## Milwaukee Street Railway Taxes.

Among the important cases decided by the State Supreme Court at Madison, Wis., last week was that of the Milwaukee Street Railway company versus Anderson, city clerk, determining the right of the city to include the street railway company's franchise in the assessment roll for the purpose of taxation. City Clerk Anderson included the street railway's property in the assessment of 1894, placing the value at $2,063,000.

The common law writ of certiorari was issued out of the Circuit Court to the appellant as city clerk of Milwaukee and ex-officio clerk of the board of review of that city, to bring before the court the assessment of the relator's property for 1894 in order that it might be corrected, reversed or set aside. The Circuit Court reversed and set aside the assessment of $2,063,000 for franchises, together with tracks, etc., and also set aside assessments of $12,000 and $25,000 for the franchises of the Electric Illuminating company belonging to the company. The clerk appealed from this judgment. In his brief City Attorney Hamilton said:

The assessor of the Third ward testified that in making the assessment of $1,800,000 he estimated the track, right of way, etc., at about half, and the value of the franchise at about half. That the value of the track, etc., $900,000, is amply sustained by the testimony, is unquestioned.

The details of the assessment for 1894 against which the company protested are as follows:

| | |
|---|---|
| Real estate | $ 553,790 |
| Personalty | 200,000 |
| Franchises, tracks, poles, etc. | 2,063 000 |
| Merchants' stock | 5,000 |
| Personalty in Second ward | 2,000 |
| Franchises of Badger Illuminating company | 25 000 |
| Franchises of Edison Electric Illuminating company | 12,000 |
| Total | $2.860,790 |

This was an increase over the assessment for 1893 of $1,714.050. The objections of the company were solely to the items of $2,063,000, $25,000 and $12,000, for the three franchises, tracks, poles, etc. The judgment of the Circuit Court of Milwaukee county was affirmed. The decision settles only the matter of taxation for the year 1894, as the street railway company succeeded in bringing about the passage of a law by the last Legislature which provides that the company shall simply pay a percentage of its gross earnings to the city treasurer.

## Death of Henry W. Frye.

It is with sincere regret that the announcement is made of the death of Henry W. Frye at Folsome, New Mexico, on Thursday, June 20th. Mr. Frye had been compelled last fall to give up his work on the *Electrical World* and seek improved health in New Mexico. In September last he suffered a severe attack of pneumonia and in January he determined to visit New Mexico. Since that time little has been heard from him, but in a private letter from Clayton, N. M., under date of April 10th, he announced considerable improvement and at that time seemed hopeful, although evidently realizing the serious nature of his complaint. He wrote: "I am much improved in health, but far from well yet. I hope to return in the early fall and if I stop in Chicago, I shall certainly call to see you." The announcement of his death will, therefore, be a severe shock to his many friends.

Mr. Frye had been engaged in electrical journalism since April 5, 1892, when he took a position on the staff of the *Electrical World*. He had taken a course at Johns Hopkins under Dr. Louis Duncan, and was well equipped for his work. Mr. Frye was graduated from Colby University, Maine. He was an associate member of the American Institute of Electrical Engineers. Personally, Mr. Frye was a very estimable gentleman, and his death will be considered a personal loss by everyone connected with electrical journalism is this country.

## Accident in an Electric Light Station at Rochester, N. Y.

On Thursday evening, June 20th, Foreman Frank E. Grover of the Rochester, N. Y., Gas & Electric company leaned against a dynamo at the lower falls power house, where he was employed, and nearly lost his life. Grover had just gone to work when the other employes' attention was attracted by cries from the foreman, who seemed to lean over against one of the big power generators and then fall writhing to the floor. The current was immediately turned off and Dr. C. W. Wilbur was summoned. Grover was unconscious and apparently dead. Nevertheless the employes of the station set to work to resuscitate him. William Julian, William Ziegler and Ernest Roth labored fully three-quarters of an hour before there was any sign of returning life. Then respiration began slowly. Grover was still in a critical condition and the men worked over an hour before they dared cease in their efforts. Grover was removed to his boarding house, where it was found he was badly burned about the limbs and sides. The total voltage of the current with which Grover came in contact was between 2,000 and 3,000 volts. Grover is of course very weak after his terrible experience. His body is very lame and sore and his heart is weak, and on this account Dr. Wilbur prohibited him from talking more than was absolutely necessary, but to a reporter he made the following statement:

I can't tell you how the accident happened. I don't know myself. All that I remember is that I was standing near one of the dynamos, and the next moment I thought I was an angel; then I knew nothing at all until I awoke and found the doctor and the men working over me. When I returned to consciousness I hadn't the slightest idea what had happened and I was the most surprised man in the world when they told me that 2,899 volts had been pumped into me. I don't think that I leaned against the dynamo, as I have been an electrician too many years to do so foolhardy a thing. I must have moved my arm in such a manner that it swept the brushes, thus coming in direct contact with the current. My arms and legs feel stiff and lame and my muscles are quite sore. But I am feeling as well as a man can be expected after wrestling with lightning. I think I will be at work to-morrow all right.

Dr. Wilbur said that the man would recover beyond doubt, but that the vital organs had received too great a shock and were too weak to allow any exertion.

## BOOK TABLE.

TELEGRAPHERS OF TO DAY: DESCRIPTIVE, HISTORICAL, BIOGRAPHICAL. By John B. Taltaval. 1894. The Electric Age, New York. Price, $5.

It is not generally appreciated that many of the leading men in commercial, professional and public life to-day have at some period been engaged in telegraphy, but a glance over the list of those whose sketches and portraits adorn the pages of this work is all that will be required. The author announces that it was his intention to present portraits and sketches of those who are at present, or have been during the last fifty years, prominent in telegraphy. Mr. Taltaval's familiarity with this branch and his wide acquaintance with those engaged and interested in it gave him a decided advantage in the preparation of this work over any other person who would undertake such an exacting task. It is enough to say that he has faithfully performed the work, and as a result the book is an accurate and valuable contribution to electrical literature, and makes a very creditable souvenir for the fiftieth anniversary of telegraphy. It is handsomely printed, as might have been expected, and the mechanical features are in keeping with the importance of the work.

AMERICAN STREET RAILWAY INVESTMENTS. Edward E. Higgins, editor. 1895. The Street Railway Publishing company, New York. Price, $3.

The publishers have endeavored to make this year's edition more accurate and complete than the last work. A feature of this issue is the introduction, in which the experience of the year, in all the principal cities of the country, is briefly reviewed, and the outlook for the coming season reported. Other special features of the work are: The municipal statistics of the large cities; clearness in arrangement, brought about by the liberal and systematic use of sub-headings and tables; the maps of the principal systems; careful indexing; accuracy due to the fact that proof has been sent to every street railway company for revision in advance of publication. All of these are very excellent features of themselves, and when combined they contribute largely to the value of this work.

ELECTRICAL ENGINEERS AND STUDENTS' CHART AND HAND BOOK OF THE BRUSH ARC LIGHT SYSTEM. By H. C. Reagan, Jr. 1895. Norman W. Henley & Co., New York. Price, $1.

This is the second work that has been placed on the market for the avowed purpose of giving the student, engineer and dynamo tender an opportunity to familiarize themselves with the design, construction and operation of the apparatus manufactured by one company. It contains descriptions of the very latest Brush dynamos. It is important that those having charge of the care of these machines should understand them fully. A feature of the work is the revolvable celluloid chart, representing a Brush dynamo with a revolvable armature. It shows the manner of cutting the lines of force, the directions of the flow of current induced in the armature coils; the method of commuting the current; the flow of current to the external circuit and return to the negative brush. The action of the chart is the same as a real Brush dynamo. The book also contains data on the Brush system of arc light dynamos, giving the numbers, capacity, and standard dimensions of horse power required for each dynamo.

THE TELEPHONE SYSTEMS OF THE CONTINENT OF EUROPE. By A. R. Bennett. 1895. Longmans, Green & Co., London and New York. Price, $4.50.

Inasmuch as the conditions under which telephone exchange service in this country is conducted are very different from those that obtain in Europe, the facts and data furnished in this book, valuable in and of themselves, are not of any special practical importance her . Yet there is much valuable information contained in its pages, and as an historical work and for reference it is a valuable acquisition, especially at this time, when data of the kind contained in it are eagerly sought.

## Street Railway Changes at Washington, D. C.

W. L. Elkins, P. A. B. Widener, and Thomas Dolan of Philadelphia have disposed of all their interests in street and suburban railroads in the District of Columbia to the Maryland capitalists who are interested in the building of the boulevard electric railroad between Washington and Baltimore. The holdings of Messrs. Elkins, Widener and Dolan comprised the majority of the stock in the Eckington and Soldiers' Home and the Belt Line railroad. The value of the stock in both companies was in the neighborhood of $1,000,000. The Philadelphia gentlemen, who are recognized as forming the most powerful street railway syndicate in the United States, secured the control of the Eckington and Belt Line roads in February, 1893. Both ventures were losing ones at that time. Since then a large amount of money has been expended upon them, notably in the extension of the Eckington road in the northeastern section of the city. Under the control of the Philadelphia syndicate the business of the roads increased to a certain extent, but not sufficiently to admit of such large capitalists finding their permanent ownership without other connections sufficiently profitable as an investment. In connection with the Boulevard road, however, and as a means of giving this important line an entrance to every portion of Washington, it is confidently expected that the Eckington and Belt system will be of immense value to its new owners. President Newbold, representing the Baltimore gentlemen who have always held a considerable interest in the roads, will remain as president of both lines. It is expected upon the completion of the Boulevard line that a new system of rapid transit will be introduced on the Belt line as well as the Eckington. In this connection it is interesting to note that the work upon the Boulevard road between Washington and Baltimore is progressing rapidly. Construction parties have been organized, and all the plans necessary to the rapid completion of the work have been arranged. The contracts that will shortly be awarded, the specifications of which are now being drawn, and which in many instances are being considered by builders, call for the completion of the entire road in the spring of 1896.

## Electrical Securities.

[From the *Boston Herald*.]

General Electric was affected unfavorably by the statement given out early in the day that Manhattan elevated had closed a contract with the Westinghouse instead of General Electric for electrical equipment of the road. Later it was asserted by Manhattan officials that a contract for the equipment of the elevated railroad with electricity had not been given to the Westinghouse or any other company. Mr. Sage says that Mr. Westinghouse has been at work on the problem for a long time, as have other electrical interests.

A General Electric official says: "It is quite probable that the Westinghouse manager has made an arrangement with Manager F. K. Hain to look over the Westinghouse plant, but this does not necessarily mean a sale of the equipment. Negotiations between Manhattan and General Electric have been in progress for a long time. Manhattan has been waiting for the practical operation of the Metropolitan West Side elevated of Chicago, which was recently supplied by General Electric. We have every reason to believe that engineers' reports of these operations have not yet been rendered."

## Weston Instrument Company's Removal and Extension.

The Weston Electric Instrument company, of which Prof. Edward Weston is the head, has found its quarters too contracted in the building at the corner of William and Shipman streets, Newark, and has arranged for an extensive plant at Waverley, N. J. The company has purchased about 48 acres of land on both sides of Frelinghuysen avenue for the purpose. This will be opened up in building plats for employes of the works, and the property will be rented or sold upon easy payments to the employes of the company. About 100 cottages will be built upon this tract by the company. The factory tract extends 905 feet on Frelinghuysen avenue, 326 feet on the road to the station, 1,413 feet on the line of the Pennsylvania railroad and 1,286 feet upon the south side. On the large tract between the avenue and the radroad the factory buildings will be erected. They will be modern structures, with immense floor space, and not exceeding two stories in height. In addition Prof. Weston will erect a model laboratory on the tract and will equip it with fine machinery, instruments of accuracy and a complete stock of chemicals. Prof. Weston has other things in view besides the manufacture of his direct-reading voltmeters and ammeters, and will begin upon a new line of work as soon as the details of the present line of manufacture are completed and the new plant is in perfect operation. It will be a model establishment in every respect, and it is proposed to employ nearly 1,000 persons at the Waverley shops. Every detail of the work will be systematized thoroughly. The actual work of building can hardly be started until early in September, as the plans are not yet made. The buildings upon the factory tract will all be constructed of steel and brick, with a view to making them as nearly fireproof as possible. A spur will be run into the yard from the Pennsylvania railroad when the plant is completed, and the company will thus have every facility for getting stock and fuel and for shipping its products. At the same time it will have the advantage of the proximity of the Lehigh Valley road on the west and the trolley line on Frelinghuysen avenue.

## The Pacific Cable.

[From the New York *Sun.*]

Nearly twenty months ago, when, on October 16, 1893, the first telegraphic message was flashed between Bundaberg, in Queensland, and Gomen, in New Caledonia, Audley Coote, at the resulting festivities, proposed as a toast: "Success to the first section of the Pacific cable," mentioning with praise the name of M. Rouilliard, as "director of the first section." It was thus made evident that, while the immediate purpose of that wire was to join New Caledonia to Australia, France furnishing the greater part of the subsidy and Queensland and New South Wales the rest, the projectors already meant to carry it across the ocean.

Now we hear that Mr. Coote, representing the company that laid this cable, is in Hawaii prosecuting a plan for its extension, and intends to present it also to Congress next winter, at least in relation to the section which he desires to lay between Honolulu and Monterey.

We do not understand that this Australian-French enterprise has anything to do with the British undertaking represented by Messrs. Fleming and Mercer, which was laid by Mr. Cleveland before congress last winter, with a view to the acquisition of a landing station for it in Hawaii. The company which Mr. Coote represents is the Société Française des Télégraphes Sous-marins, and both the British government and the Dominion are said to have looked with some uneasiness, if not jealousy, upon its purpose, so that what was done at Ottawa last July in favor of a cable between Australia and Canada had been considerably stimulated by the success of this French enterprise. A portion of the British press deprecated any assistance to the extension of the French line to the American coast. Nevertheless that company is in the field, with the advantage of nearly 800 miles already laid.

What interests our own country in the matter is the proposal of the French company to land at a California port, and to arrange that the entire section between Honolulu and Monterey shall either be owned by our government or controlled by it. That is a very different proposition from the one offered to Congress last winter, namely, the furnishing of our consent to the lease of a Hawaiian island for a British cable which was to terminate at Vancouver. The soundings taken by the Thetis and the Albatross, under the authority of Congress, for an American-Pacific cable, were between Monterey and Honolulu, and between Point Conception and Hilo bay. At Monterey bay the shore incline is said to be well protected, as it may also be in the Santa Barbara channel.

Besides the 792 miles of wire already laid between Bundaberg and Gomen or Noumea, the existing enterprise has a reasonably direct route in view by way of the Fijis, Samoa, Fanning, Honolulu, and Monterey. It certainly gains over 300 miles in the last stretch, over a line terminating at Vancouver.

However, the line which will receive encouragement from Congress may be a wholly new one, and American throughout. Such a company could make its own arrangements with the French line or any other for extension beyond Honolulu to New Caledonia, or to Japan. Indeed, the project before Congress last winter was that the government itself should build, own, and operate the line. Whether this is to be the final form of the enterprise or not, we may hope and expect that when Hawaii comes into the Union an American cable will bind her to the mainland.

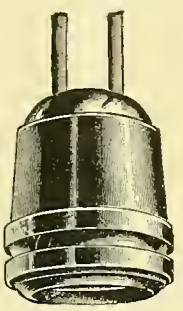
## Theosophical Electricity.

Apropos of the fact that Mrs. Besant, the leader of the English theosophists, claims to have had an interview with a mahatma, and noted the interesting phenomenon of throbbing electricity throughout the room, Prof. S. P. Thompson of London, with characteristic scientific ardor, has written the following letter to the *Westminster Gazette:*

As the whole mahatma business depends, not on the *bona fides* of the narrators, such as Mrs. Besant, but on the competence and accuracy of their observations, permit me to point out a very simple line for testing such accuracy. In your interview with Mrs. Besant you report her as saying that on the occasion of the mahatma appearing to her the room was throbbing with electricity. Now that is a very clear and simple statement. But is it supported by the slightest evidence? Did Mrs. Besant use an electrometer to measure the degree to which the room throbbed? If so, was the electrification positive or negative? Or was it alternating in sign? If so, how many volts did the electric potential change, and what was the frequency of the change? Was it once a second, or once a minute? Or was it a high frequency such as 100 a second? If no electrometer was used how is it known that there was any electric action at all? Did the room itself throb, or did the air only in it throb? If the latter, how could the potential of the air alter without affecting the material objects and the walls? Lastly, were any optical tests applied to ascertain (as can be done without any apparatus) whether that which was seen was objective or subjective? In short: What are the hard facts?

## Trolley Measures in the Chicago City Council.

At last week's meeting of the Chicago City Council the ordinance of the Chicago Passenger Traction company was passed granting the company a twenty-year franchise to operate an electric line on the following streets: On Fullerton avenue from Milwaukee avenue west to the city limits, on Central avenue north from Fullerton avenue to Maywood



MEDBERY WEATHERPROOF SOCKET.

avenue, thence on Maywood avenue northwesterly to the city limits, on Tanner avenue from Bryn Mawr avenue northwesterly to the city limits.

Resolutions protesting against the erection and maintenance of trolley wires as dangerous and a hindrance to the fire department in the business district, which were adopted at a meeting of the Chicago Fire Underwriters' association, were presented at the same meeting and referred to the committee on fire and water.

## Medbery Weatherproof Socket.

The superiority of the Medbery weatherproof socket has been thoroughly demonstrated in its use for illuminated sign work as well as for other special work. There can be no danger from fire, as all the connections are inside, while the composition, which is absolutely waterproof, is forced around them under enormous pressure, making a socket of great strength and durability and one that is practically indestructible. Water cannot follow the wires and make a short-circuit.

The Mason Electric Equipment company, 307 Dearborn street, Chicago, is the western agent, and it keeps a stock on hand in its warehouse.

## Villard and the North American Company.

Just now the affairs of the North American company are receiving attention among eastern capitalists. The New York *Sun* says:

There are no indications that Villard, who was the original promoter of the North American company as a blind speculative pool under the title of the Oregon & Transcontinental company, has any interest whatever at present in its securities. He certainly has no voice in its management. The present directors represent themselves and other stockholders who suffered on account of Villard's reckless mismanagement of the company, and whose only aim is to save what they can from the wreck he bequeathed them when he retired from the management. In pursuance of that policy, the loans of the company were recently transferred to friendly hands, and steps have been taken to reorganize the Milwaukee Street Railway company upon a basis that will make its securities marketable, and thus enable the company to liquidate its indebtedness. The present management has nothing to conceal, and any stockholder who is interested solely in conserving and improving the value of his security can without difficulty obtain full information regarding the affairs and prospects of the company.

## A Model Chinese Lighting Station.

[From the Shanghai, China, *Gazette.*]

The new electric light station which the municipal council of Shanghai is erecting at the corner of Yuhong and Fearon roads, is of bold and handsome proportions, its design having evidently been to combine a striking exterior with internal adaptability to the purposes for which the edifice is intended. The building throughout is constructed of blue and red brick, and the most striking feature about it is the tall chimney, which will be the largest in Shanghai, measuring 120 feet in height, with an internal diameter of seven feet, the outside diameter at the base being 20 feet, from which it will gradually taper to 13 feet at the top. The engine house measures 116 feet in length by 35 feet in breadth and 25 feet in height.

It is intended to place no fewer than 14 compound horizontal surface condensing engines by the firm of Marshall & Co. of Gainesborough, England, whose machinery seems to be growing in popularity in China, there being now some 40 engines manufactured by them working in Shanghai alone.

The dynamos for arc lighting are by the Brush company of Cleveland, O., and the alternators, switches, transformers and such instruments are the work of the Brush company of England.

The boiler house is also a very spacious and lofty apartment, in which will be placed three Lancashire boilers, each measuring seven feet by 28 feet, and capable of sustaining a daily working pressure of 140 pounds. These three boilers are the largest of the description in Shanghai. There will also be two locomotive boilers working at the same pressure.

Adjoining the electric light station are two nice, airy dwelling houses for the superintendent and assistant superintendent. The superintendent's office and workshop adjoining will be fitted up with all of the most modern electrical appliances. All the buildings are roofed with galvanized corrugated iron, with the exception of the dwelling houses, which are roofed with Marseilles tile.

## Poor, Persecuted Bell Company.

[From the *Boston Herald.*]

The opinion of the United States Circuit Court of Appeals in the Bell telephone case, as written out by Judge Putnam, not only absolves the Bell company from the charge of having conspired with the Patent Office officials to delay the issue of the Berliner patent for their own benefit, but it turns the tables by declaring that if there was any dereliction of official duty it was in the form of a continued hostility to the Bell company, and of an indisposition to grant the application for the Berliner microphone, with a concurrent disposition to nurse and favor the Drawbaugh application, either for its own direct advantage, or for the purpose of defeating inventions controlled by the Bell company. The government is thus smartly rebuked in its own court and it seems to have deserved it.

## Unique Electrical Experiment.

The following interesting narrative is from the "Scientific and Technical Papers" of W. von Siemens:

I stood upon the highest point of the pyramid and held up my own forefinger in the air. There was a slight, hardly perceptible prickling observable on the skin of the finger which was opposed to the wind. I could only explain this fact, observed by all of us, as an electrical phenomenon, and such it proved to be. When I held up a full bottle of wine, the top of which was covered with tinfoil, I heard the same singing sound as when the finger was held up. At the same time little sparks sprang continually from the label to my hand, and when I touched the head of the bottle with my other hand I received a strong electric shock. It is clear that the liquid inside the bottle, brought into metallic connection with the metallic covering of the head of the bottle through the damp cork formed the inner coating of a Leyden jar, while the label and hand formed the outer coating. When I had completed the outer coating of my bottle by wrapping it in damp paper, the charge was so strong that I could make use of it as a very powerful weapon of defense.

After the Arabs had watched our proceedings for a time with wonder, they came to the conclusion that we were engaged in sorcery, and requested us to leave the pyramid. As their remarks, when interpreted to us, were without effect, they wanted to use the power of the strongest to remove us from the top by violence. I withdrew to the highest point and fully charged my strengthened flask, when the Arab leader caught hold of my hand and tried to drag me away from the position I had attained. At this critical moment I approached the top of my flask to within striking distance of the tip of his nose, which might be about ten millimeters. The action of the discharge exceeded my utmost expectations. The son of the desert, whose nerves had never before received such a shock, fell on the ground as though struck by lightning, rushed away with a loud howl, and vanished with a great spring from our vicinity, followed by the whole of his comrades. We had now a full opportunity of carrying out our experiments.

## Chloride Accumulators on Paris Railways.

Attention is called to the fact that chloride batteries are used on the electric railways of Paris operated by accumulators which were described and illustrated in the WESTERN ELECTRICIAN June 22d. These batteries are manufactured by the Electric Storage Battery company of Philadelphia.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, June 22.—General Manager F. K. Hain of the Manhattan Elevated Railway company, since his return from his trip of inspection to the Westinghouse shops, says that his company proposes to let others do the experimenting on electric elevated railways. "When I get the time," he says, "I am going to Chicago to see the electric system in use on the Metropolitan elevated railway in that city, and also to Schenectady, to see the General Electric company's system there. Nothing definite has been decided yet. We intend to go slow and watch developments." Colonel Hain said that he had made no report to the directors, unless informal talks had with one or two of them could be construed as a report. It is reported that the officials of the Manhattan company are very favorably impressed with a modification of the Wheeless underground system which it is proposed to apply to the elevated structure. By this plan the conducting rail is cut into sections and only that portion under the passing car is in the power circuit. The Westinghouse company, having absorbed the Electro-magnetic Traction company, has secured control of the Wheeless patents.

The hearing on the appeal of the Nassau Electric Railroad company and the Kings County Electric Railroad company, commonly known as the Flynn roads, from the judgment of Justice Smith of the Supreme Court, declaring their franchises void and stopping the construction of the roads, took place a few days ago before Justices Brown, Dykman and Pratt, composing the General Term of the Supreme Court in Brooklyn. Elihu Root, counsel for the companies, contended that the income which would accrue to the city on the percentage basis agreed upon would be about $29,124 a year, a sum much greater than the interest offered by the unsuccessful competing companies. In closing Mr. Root said the court had no right to touch the franchise unless the strongest external proof of fraud was adduced. Jesse Johnson for the respondent went over the line of argument he followed when the case was before Justice Smith. He asserted that the franchises were void, having been granted without any competition as to the rate of fare, and he also maintained that the franchises were worth $2,000,000. The justices reserved their decision.

In Albany there is considerable unfavorable comment owing to the fact that without giving any other contractors a chance to bid, the capitol trustees have awarded to the Municipal Gas company of Albany the contract for lighting the capitol by gas and electricity at $30,000 a year for three years. After doing this the fact that the contract had been awarded was kept as secret as possible. At the executive chamber, however, it was thought best to make this statement: "The Board of Trustees of Public Buildings has authorized and approved a contract made on May 15th by the superintendent of public buildings with the Municipal Gas company of Albany for the gas and electric lighting of the capitol and the executive mansion at $30,000 per year for a term of three years. The contract was approved as to form by the attorney-general and will result in a saving of about $10,000 a year and avoid the necessity of renewing the electric machinery at the capitol, estimated to cost $60,000." On the other hand, it is stated that the Municipal Gas company is furnishing the state with some ancient relics in the shape of dynamos in lighting the building. To purchase new dynamos, it is estimated by people well versed in the matter, would cost about $12,000 annually and to run the plant would not require more than $15,000.

The following are the names of the officers elected at the annual meeting of the New York Electrical society, held on the 18th instant: President, John W. Lieb, Jr.; vice-presidents, Herbert Laws Webb, Edward Caldwell, Francis Forbes, Nelson W. Perry, Prof. L. H. Laudy, Prof. Morris Loeb; secretary, George H. Guy; treasurer, H. A. Sinclair. From the secretary's interesting report these extracts are taken: "There have been five deaths and eight resignations during the year; 33 members have been elected, and the net increase in membership is 20. The number of members now on the books of the society is 370. * * * Although last year the average attendance showed a marked improvement on the preceding year, during the season just concluded the society has had most gratifying evidence that its lectures have been on the whole even more thoroughly appreciated than ever. The range of subjects has been wide and in almost every instance the society has been fortunate in an able and exhaustive treatment of the theme selected. Some of the best lectures promised are still on the programme for next season, and will in all probability be delivered at an early date." W. F. O.

## Buffalo and Niagara Falls.

BUFFALO, JUNE 21.—A new electric trolley company which promises to provide a most successful financial investment for its 150 stockholders has been incorporated in this city. The new line will be known as the Buffalo, Gardenville & Ebenezer railway and is to be four miles in length and will run from the Buffalo city line along the Indian-church road to Gardenville and thence to Ebenezer. The board of directors is composed of the Hon. Charles F. Schoepflin, Ed. H. Ballou, Jacob Doetsch, William F. C. Trier, Gardenville; Charles Rung, J. Lester Osgoodby, Frank J. Bissing, Christopher Smith, S. C. Rogers, Will P. Smith, Buffalo; Michael Ansteth, Ebenezer, and Henry C. Lien, West Seneca. The company's principal offices will be at Gardenville.

William Morrison of the American Battery company has been here looking for a good site for his company, which is now located in Chicago. He has given it out as an assured fact that the company will locate at Tonawanda when the current is turned on at the Falls.

George P. Smith is about to open his trolley line from Buffalo to the Falls. The route is over the Buffalo cars to Hertel avenue; thence to the city line and to Tonawanda; from there by boat to Echota, and from that point by cars to the Falls.

W. B. Rankine, secretary and treasurer of the Cataract Construction company, stated that when the meeting of the American Institute of Electrical Engineers is in session the delegates will have free access to the power house, the dynamos being run for their express benefit.

A project is on foot for the operation of an international street railroad belt line, starting at Niagara Falls, Ont., passing through Drummondsville down past the Clifton House and thence across to the American side over a new bridge that will be built adjoining the present new suspension bridge. If satisfactory traffic arrangements can be made some of the cars of the new line will run over the Buffalo & Niagara Falls road to Lewiston. The right of way on the Canadian side has been secured. Mr. Kyle of Toronto is one of the principal capitalists interested in the scheme. It is also proposed to build a branch line from the Grand Trunk railway station at Niagara Falls, Ont., to St. Davids and thence to the Whirlpool.

The consent of the stockholders of the Niagara Falls & Lewiston Railroad company for the increase of the capital stock from $100,000 to $400,000 has been filed with the county clerk.

County Clerk Bingham has received for filing the certificate incorporating the Buffalo, North Main Street & Tonawanda Electric Railway company. The company is capitalized at $75,000 and has the following named directors for the first year: S. W. Petrie, Thomas H. Feany and J. H. Pardee of this city; H. H. Crowell of Syracuse; John F. Farrell of Albany, and James O. Carr, H. M. Francis, C. G. Smedburg, S. D. Greene, Hindsill Parsons and Howard and C. Lewis of Schenectady.

Electricity will soon take the place of horses on the street railroad doing the local service of the three Canadian villages now known as Niagara Falls South, Niagara Falls Center and Niagara Falls, Ont.

Dynamo No. 1 has been running in the Niagara Falls power house to-day and ran rapidly and satisfactorily. Electrical tests are being made, the speed being 250 to 300 revolutions.

The Buffalo & Niagara Falls Trolley company has decided to erect a power house at North Tonawanda. The location of it will be on the north side of Sweeney street and on the Jackson property. The building will be of brick 96 by 60 feet in the clear, with engine and dynamo rooms. The work will be started at once. The new car sheds will cost $25,000 and will be 365 feet long by 75 feet wide and have a capacity for 40 cars. F. C. P.

## St. Louis, Mo.

ST. LOUIS, June 20.—In the mandamus proceedings instituted by the Laclede Gaslight company last fall seeking to compel the street commissioner to issue a permit to excavate streets and alleys and construct conduits for electric wires for lighting purposes, Judge Macfarlane of the state Supreme Court in banc has filed an opinion adverse to the gas company and thereby sustaining the action of the street commissioner. The Laclede Gaslight company has long contended that it held unusual rights and privileges under its old state charter and this decision is regarded as a victory for the city. Briefly outlined, the cause of this suit is as follows: Last October the Laclede Gaslight company, after giving notice, but without formal permit, began to excavate on Broadway and Mound streets for the purpose of constructing a conduit in which to lay wires for lighting purposes. The work was stopped by the street commissioner. The gas company then made formal application for a permit to excavate the streets for the purpose. This application was refused, on the ground that the gas company had no municipal franchise authorizing such work. The gas company then instituted mandamus proceedings in the state Supreme Court. It was expected that the court would incidentally bring up and pass upon the broad features and claims of the gas company, but to the contrary it has passed over all such matters and confined its attention entirely to the subject matter as indicated by the title of the proceedings.

The Missouri Electric Light & Power company is making arrangements for the installation of two large alternators, each of 1,000 kilowatts capacity. They will be directly connected to two engines of the marine type, made by the Lake Erie Engine company, each engine having a capacity of 1,800 horse power. These large alternators are of the two-phase type, but are designed so as to give two or three-phase or monocyclic currents and are over compounded for 20 per cent. overload. They will be worked in multiple and will supply current to the Edison station or to the Missouri company's territory as may be required to accommodate the night and day loads. These large units are being built on special designs made by H. A. Wagoner, general superintendent of the Edison and Missouri lighting and power companies. The entire arc light service of the city will be carried by four large alternators of the Edison and Missouri companies. By means of step-up converters, located in the power stations, the 1,000 volt current will be changed to 3,000 volts. The regular series arc circuits, each circuit carrying 60 arc lamps, will be supplied from the 3,000 volt secondary of these step-up converters. The regular direct current arc lamps are being changed so as to enable them to work with alternating currents, but no other change in apparatus will be necessary. By the use of these large alternators and this radical change in the arc lighting system the companies will be enabled to improve their service in every way and also reduce their operating expenses. Arc and incandescent lamps and power currents will be supplied by one type of generator—the multiphase alternators.

During the session of the State Legislature last winter an act was passed authorizing municipalities to sell to the highest bidder all public franchises. The city counselor has declared this law to be unconstitutional. So far as it relates to street railways it is contrary to the state constitution, which prohibits the Legislature from making any laws on the subject. The sale of city franchises is left entirely with the municipalities. Aside from this the city counselor points out that the method provided for regulating the amount to be paid to the city is an impracticable one. From this it seems that the city can regulate such matters by its own ordinances, a position which has heretofore been questioned. R. J. H.

## Milwaukee, Wis.

MILWAUKEE, June 22.—The new law in regard to the taxation of street railways provides that they shall pay a percentage of their gross earnings in lieu of all other taxes and that they shall file with the city treasurer on December 1st a statement which shall show what the gross earnings of their lines have been during the twelve months preceding, and that on or before the 1st of February following they shall pay to the treasurer a sum equal to 1 per cent. on the first $250,000, 1½ per cent. on the second $250,000 and 2 per cent. on all earnings in excess of $500,000. The amounts so paid are to be in lieu of all taxes so far as the city is concerned, but the companies must pay county, state and school taxes just the same as they have done in the past. The city treasurer is required to pay to the county treasurer 9 per cent. of what he receives and the county treasurer must pay to the state treasurer a third of what he receives.

The new law in regard to vestibuling street cars provides that half of the winter cars shall be provided with vestibules by the end of the present year and the balance by November 1, 1896. Receiver Payne of the Milwaukee Street Railway company is doubtful whether the work of putting vestibules upon the cars can be done in time and the lines operated as at present. The law, he states, does not give sufficient time to make the changes, as every car will have to be taken off the lines and sent to the shops, and the time between seasons is not sufficient to do this. The changes will cost the Milwaukee Street Railway company thousands of dollars. The company has about 150 cars that will have to be changed to conform to the law. Similar laws are in effect in Ohio, Minnesota, Michigan and several other states.

The suit of H. B. Tanner, F. M. Charlesworth and H. C. Tanner of Kaukauna against the Kaukauna Electric Light company, John Earles of Kaukauna and Dr. W. H. Earles and A. Bunke of Milwaukee, for the appointment of a receiver for the company, has been denied by the Circuit Court of Outagamie county. It was charged by the plaintiffs that the defendants had been guilty of fraud, and had so managed the affairs of the company as to cause a depreciation in the value of the capital stock. In their answer the defendants denied all the charges made in the complaint, and brought forward some counter-charges.

The Milwaukee Board of Public Works has advertised for an electric tower clock for the new city hall. The Johnson Electric Service compaoy has made a proposition to the board to put in a small clock anywhere in the building and connect it with the 15 foot dials in the tower by a system of air tubes. The company asserts that this system will ensure exact time, and that the cost will be much lower than that of the ordinary system. It is proposed to connect all the clocks in the city hall and operate them by this air system, only the dials and the small works necessary to move the hands being used except in the principal works.

Robert Duerr, of the firm of Duerr & Rohn, whose death occurred recently, was one of the pioneer electricians of Milwaukee. He was born on a farm near this city and his business career covered a period of thirty years.

All the electric wiring in the Pabst building, the costliest business block in the city, and one of the newest, has been done over recently. There were several leaks in the old system, and the electricians could not locate them. The work of rewiring the building was a decidedly expensive one, costing several thousand dollars, but it had to be done.

The Bucyrus Steam Shovel & Dredge company of South Milwaukee recently shipped to the Gold Dredging company of Red Rock, Mont., the first electric elevator dredge ever built.

The new Waukesha Beach electric railway will be opened next Tuesday with a great deal of ceremony. There will be speeches, a banquet and a general jollification. Mayor Swift of Chicago is expected to be present. The road, which runs from Waukesha to Pewaukee Lake, has been in operation for several weeks. It is expected to be a profitable enterprise.

Receivers Henry C. Payne and George R. Sheldon have been authorized by the United States court to pay the interest on the $1,000,000 of bonds issued by the Milwaukee City Railroad company and upon $500,000 of bonds issued by the West Side Railway company. These bonds are prior liens upoo the property and the interest upon them has to be paid.

The new transfer system, according to General Manager Wyman, has had little effect upon the receipts of the Milwaukee Street Railway company. The system is a general one, in a way, but no passenger is allowed more than one transfer. Mr. Wyman is of the opinion that the new system will eventually reduce the receipts, but not much. The time limit now in vogue and the fact that the passenger must state, as soon as he gets on the car, just what line he wishes to be transferred to, have stopped the abuse of the transfer system.

The Milwaukee Street Railway company is still opposing the effort of the Wauwatosa line to get a franchise into the city and has succeeded in having action delayed again.

The matter of interurban electric railways in the Fox River valley is still a matter of uncertainty. There has been a fight between the Central Wisconsin Electric company and the Oshkosh Street Car company. The Wisconsin company's line was supposed to enter Oshkosh by way of Jackson street, but the Oshkosh company got possession again of all that part of Jackson street lying north of New York avenue, which compels the other company to "go around" and bring its own cars to the fair grounds.

The Janesville street railway system averages about $100,000 a month in gross earnings, a sum which is barely sufficient to keep the lines in operation. There is talk of several extensions, which it is thought would make the system profitable. C.

## Northwestern Notations.

MINNEAPOLIS, June 22.—Judge Nelson has handed down a decision in the United States Circuit Court in Duluth, Minn., declaring H. B. Moore receiver for the Great Western Manufacturing company's plant at West Duluth. Moore was appointed by the District Court in Duluth, while E. H. Fowle was appointed receiver by the federal court in Chicago. The latter took no steps to secure possession of the West Duluth property until Moore had been appointed receiver, and his negligence enabled Moore to win the suit. No damages were granted. It is thought that the First National Bank of Chicago will release its bill of sale to all the personal property of the company, given to secure indebtedness.

The Hastings, Neb., electric light plant was sold on a mortgage held by Adam Cook, Jr., of New York, for $13,000. It was bought in by Mr. Cook for $10,000.

General Manager Erb, of the Leavenworth, Kas., electric lines, has bought a searchlight which was used at the World's Fair and will use it at various points on the electric lines during the summer. A balloon ascension at night is proposed, the balloon to be followed up and down with the searchlight.

Prof. Geo. D. Shepardson of the University of Minnesota is drawing plans for the Willmar, Minn., electric light plant, to cost about $8,000.

Iosurance rates in Council Bluffs, Ia., have been raised one per cent. where electric motors are used.

Lanesboro, Minn., is having an electric light plant put in and will dedicate the plant July 4th.

Work has been begun on the light and power plant at Bayfield, Wis.

It is understood that the Clark Water Power company and the Electric Lighting company of Stevens Point, Wis., will consolidate. If the deal is consummated a new electric power house will be built at the dam to furnish power for the lighting plant and for the prospective street railway.

John A. Cole estimates the cost of an electric light plant for La Crosse, Wis., at $25,000.

The Vermillion Milling company of Vermillion, S. D., has ordered electrical equipment for a 1,200 light electric plant.

Worthington, Minn., has voted to put in a $15,000 electric light plant.

Jackson, Minn., people think they want a 1,500 incandescent light and a 50 to 75 arc light electric plant.

George Nelson proposes to build an electric line between Aberdeen and Hoquiam, Wash.

The Mason City, Ia., Electric Light company has been reorganized and Mrs. M. I. Clark elected president, T. S. Roberts secretary and treasurer. They expect to put in at once an electric street car line.

An electric light plant will be in operation at Roseau, Minn., by June 15th.

The real estate board has passed condemnatory resolutions on the "midnight policy" of the Oshkosh Street Railway company. The latter announces it will probably substitute electricity for horse power at the annual meeting next month.

Fremont, Neb., will put in a municipal electric light plant.

The Omaha Street Railway company will have the Lake and Thirtieth street line to Bedford place changed into an electric line in 30 days.

The City Council of Sheboygan, Wis., passed the contract to the electric lighting company for 10 years at $95 per light over the veto of Mayor Born. Work on the street railway line is now assured. C.

## PERSONAL.

H. H. Brooks of the American Circular Loom company, Boston, spent a few days last week in Chicago.

## ELECTRIC RAILWAYS.

Bids have been called for by the Washington & Great Falls Electric Railway company for an issue of $100,000, first mortgage 6 per cent. thirty-year gold bonds, part of the total authorized issue of $500,000.

The building of the Buffalo, Gardenville and Ebenezer road from Buffalo, N. Y., along the Indian church road to Gardenville to Ebenezer is now assured. The trolley will be used. The directors have chosen the following officers: President, Charles F. Schoepflin of Gardenville; vice-president, Dr. E. H. Bellow, Gardenville; attorneys, Hodson & Webster.

In the Circuit Court at Rochester N. Y., last week the jury in the case of Penny against the Rochester Electric Railway company brought in a verdict of $5,000 for the plaintiff. The plaintiff is a child of eight years and sues by guardian. He was injured while returning from school. His right leg was amputated close to the hip in consequence of the injury and he will be a cripple for life. The question in the case was, of course, whether the motorman was negligent.

## MISCELLANEOUS.

About one person in every 100,000 was struck by lightning in this country last year, a fact which leads the *Chicago Tribune* to remark that the average human being is in a great deal more danger of being elected alderman or run over by a trolley car than of being struck by lightning.

According to Charles Booth, in his latest volume of "Life and Labor of the People in London," the great majority of men employed in all the branches of electrical work in London are under 25 years of age. It is also stated that of some 5,000 men engaged in different electric works only 13 per cent. are members of a trade union.

The jubilee of car horses has come in Philadelphia, says the *Chicago Tribune*. Monday, the 17th inst., the last horse car line disappeared with the advent of the trolley cars on the Baring street branch of the Philadelphia Traction company's system. In a few days the last of the cable lines will also go, and electricity will be the only motive power in the entire city. Evidently also the jubilee of horses is on the way for New York, as a demonstration is to be made in a few days to prove to the owners of department stores that mechanical power is cheaper and more efficient in the delivery of packages than horses. The motive power of these horseless wagons will be the petroleum engine, and they will be constructed on the pattern of those which recently carried off the prize in the race from Bordeaux to Paris. It is claimed that these engines can do the work of one horse at a cost of only one cent an hour. What with electric and petroleum motors the emancipation of the horse as a draft animal is rapidly approaching, and it is not out of the bounds of possibility to assert that the iron horse itself will soon be gathering rust. It is to be regretted that the pavements will not permit the introduction of storage battery wagons into this service.

## TRADE NEWS.

The American Carbon company has removed its offices from Dayton, O., to Noblesville, Ind.

J. S. Parker, who has been connected with R. B. Corey as general accountant, has accepted a position with the Standard Thermometer company of New York, in the arc lamp department.

The New England Butt company of Providence, R. I., reports new work on hand and future orders which show a large increase in business over last year, and indications are favorable for a good trade on the company's braiding apparatus, used in the manufacture of covered wire.

The Metropolitan Electric company, 186–188 Fifth avenue, Chicago, is not complaining about slow business, the sales having multiplied this year three times the amount shown at the same period last year. The company is young in age, but a giant in strength and has entered upon an era of prosperity that is marvelous for these times. It handles some of the best known specialties on the market, among them P. & B. goods, N. I. R. rubber wire, Solar arc lamps, Metropolitan incandescent lamps and the portable hose bridge.

The Brush Electric company of Cleveland seems to be particularly fortunate in securing large orders for its apparatus in foreign countries. The new electric light station of Shanghai, China, will be the most complete and the largest on the continent of Asia. The city of Shanghai erects the station at its own expense. Shanghai has a population of about 280,000. Some idea of the size of the station can be gained from the fact that the buildings are very similar in size to the large new electric light station recently completed in Cleveland. In the city of Manila, Phillippine Islands, a city of about 300,000 people, a large new electric light station has just been completed, all the work being done by the Brush company of Cleveland.

The Phillips Insulated Wire company has been among the first to note the large increase in the covered wire trade. It has been working its force at the factory to the full extent, and is considering the advisability of adding to the factory building. This concern has been particularly fortunate when brought in competition with other manufacturers in the sales of "Ideal" wires and cables, and also the "O. K." brand during the past year. It claims the only authorized fiber covered wire for inside and tube work which will not deteriorate by long use, or oxidize the copper. From a small beginning, through the careful management of Treasurer H. O. Phillips, this company has grown to its present large proportions, and is to-day one of the best known manufacturers of covered wire. A large share of its production is sent to the central and western states.

## BUSINESS.

The Bryant Electric company has a specially designed K. W. cutout for switchboard work. It also makes a 10 ampere double pole cutout for 500 volts, covered with mica.

G. W. Conover, western manager of the Perkins Electric Switch Manufacturing company, reports that the demand for the Gibbs switches has grown so fast that the company has found it necessary to double its facilities for the manufacture of these wide and favorably known switches.

Royce & Marean, the large electric supply house on Pennsylvania avenue, Washington, D. C., reports business exceedingly good. They have just received a contract for a new dynamo to be placed in the Washington brewery and a contract for wiring the Metropolitan power house. More orders have been received for electric fans this season than they can fill.

One of the beneficent results of the World's Fair, from an electrical point of view, was the impetus given to the manufacture and sale of electric launches. The Electric Launch company of Morris Heights, New York city, has taken advantage of this opportunity and fills a promising field worthily and acceptably. The company is prepared to furnish all kinds of electric boats, from open skiffs for hunting and fishing to elaborately fitted cruising yachts. Interesting details and pleasing illustrations are furnished in a handsome little book, "Electric Launches," which the company has just issued. All interested in boating should obtain a copy.

Central station and electric power managers will be interested in hearing of what would seem to be a record breaker for quick shipment of a large belting order by the Jewell Belting company of Hartford, Conn. An order was received by that company from Rochester, N. Y., for a three-ply belt, 72 inches wide and 118 feet long. In 19 hours and 20 minutes after the receipt of this order, it was on the wagon ready for shipment. Taking into consideration that the leather for the manufacture of this belt was taken from stock, and that the full guarantee of this company was sent with it, this feat is another demonstration of the fact that although the Jewell Belting company is, with few exceptions, the oldest concern in its line, it has kept fully abreast of the times.

The Electric Appliance company is general selling agent for the Russell automatic switch, having just closed exclusive arrangements. By means of this device a light or group of lights can be controlled independently from any number of points without any additional electric light wiring. The Russell switch is usually placed in the cutout box and a single circuit run to the light or group of lights

to be controlled. From the switch circuits of No. 18 wire are run to the points from which the lights are to be controlled, where an ordinary gas key does the work. Pressing the white button results in turning on the lights and pressing the black button turns them off. The Russell devices are now approved by the National Board of Fire Underwriters and will undoubtedly meet a large sale.

A paper box make after the fashion of an egg crate, to hold twenty lamps, is the unique production of General Manager J. J. Gates, of the Perkins Electric Switch Manufacturing company of Hartford, Conn. A representative of the WESTERN ELECTRICIAN saw one of these boxes filled with incandescent lamps thrown down two flights of stairs, and, when opened, there was no breakage. This box is made after a special design and is peculiarly adapted for its purpose, and will fill a requirement of hardware merchants, who are beginning to carry a stock of incandescent lamps in many cities. These merchants can now have their lamps placed upon the shelves of their stores in a compact manner. This company is rapidly increasing the facilities for the manufacture of incandescent lamps, by additional help and apparatus, but the demand has been so large that the present capacity has been taxed to fill orders promptly.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued June 18, 1895.*

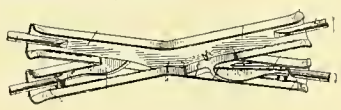
541,073. Electric Car Brake. George B. Damon, Lowell, Mass. Application filed April 30, 1894.

A double controlling stand carries two systems of contacts, one adapted to control the supply of current to the car propelling motors, and the other adapted to control the supply of current for a shunt circuit. A cylinder, a piston reciprocating therein, a brake shoe attached to the rod of the piston, a spring adapted to press the brake shoe away from the wheel of the truck, and a valve inserted in the pipe, through which pneumatic pressure enters the cylinder from the source of pneumatic pressure, and governed by electrical devices through which the shunt circuit governed by the controlling stand passes, are also features of the invention.

541,077. Telephone System. William W. Dean, St. Louis, Mo. Application filed February 21, 1895.

The combination comprises a local transmitter circuit, including two parallel branches, two induction coils having their primaries included one in each of the branches of the transmitter circuit, and their secondaries included in the telephone line in series, a microphone included in the transmitter circuit, and a battery adapted to direct current through the branches in parallel.

541,081. Storage Battery and Method of Making Same. Nathan H. Edgerton, West Whiteland, Pa. Application filed February 27, 1894.



NO. 541,098.

A series of cells is arranged, with intervening conducting partitions and surrounding non-conducting frames molded thereon, the cells filled with a permeable material, charged with an electrolytic fluid, and the terminal partitions having conductors connected therewith, in combination with an envelope of plastic non-conducting material in an inclosing case adapted to retain the gaseous elements evolved in the charging and discharging of electric currents through the series of cells.

541,098. Crossing for Trolley Wires. John Kroger, Pleasantville, N. J. Application filed November 3, 1894.

There is a central depression, and portions of the grooves are cut away; locks or guards are hinged or otherwise set in the cut-away portions of the grooves, and adapted to be raised by the passage of a trolley, as shown in the cut.

541,121. Device for Conducting Electricity to Lamps, etc. George F. Rose, London, Eng. Application filed February 27, 1895.

The cut shows a fixture for electric lighting on dining tables, sideboards or other analogous places, in which flat conducting strips and contact devices, consisting of spikes and metal brushes or webs for connecting the lamps thereto, are utilized,

541,136. Rheostat or Other Circuit Controller. Charles Willms, Baltimore, Md. Application filed November 26, 1894.

A feature of the invention is the combination of a series of contacts, and a spring pressed contact piece, one member being movable relatively to the other for making contact between the contact piece and the different contacts, the contact piece having an edge by which the contact is made.

541,146. Electrolytic Process and Apparatus. Henry Blackman, New York, N. Y. Application filed July 2, 1894.

The improvement in electrolytic processes described consists in first cooling the electrolyte, then introducing it to the cell, and then subjecting it to electrolysis and again cooling it during the electrolysis.

541,147. Process of and Apparatus for Bleaching. Henry Blackman, New York, N. Y. Application filed June 28, 1894.

This process consists in first electrolyzing a solution of a chloride of an alkali or alkaline earth, heating the electrolyte containing the resulting hypochlorite and bleaching with it while at an elevated temperature, then cooling it and again electrolyzing it, whereby the bleaching is performed at a high temperature and the electrolysis at a low temperature.

541,148. Current Strength Indicator. Percival G. Burgess, Boston, Mass. Application filed March 25, 1895.

The first claim follows: In a current strength indicator the combination of an electro-magnet and armature, a mechanically actuated detaching mechanism for applying to said armature a steadily increasing force in opposition to the attraction of the magnet, an indicating device or pointer actuated by the said detaching mechanism, and a stopping or locking device controlled by the detachment of the said armature from the magnet poles, and operating at the moment of detachment to arrest and prevent the further movement of the said indicating device, whereby an approximate indication is obtained of the resistance offered by said magnet to the movement of the armature.

541,149. Transmitter, John Burry, New York, N. Y. Application filed October 23, 1893.

Among the features claimed is the combination of a rotary shaft, the switch thereon, the brushes bearing on the switch, the opposing electro-magnets, the armature between them, a source of electrical energy and electric conductors.

541,152. Distributing Frame for Telephone Circuit Conductors. Frank B. Cook, Chicago, Ill. Application filed January 9, 1895.

This is an appliance for transferring or interconnecting electric conductors, consisting of a support or plate, upon the front side of which parallel insulating blocks are secured at a suitable distance therefrom, the blocks having upon their upper and lower edges metal conductor terminals, from which conductors extend through the support to its rear side and there divide, all the conductors coming from the lower terminals extending in one direction, and all coming from the upper terminals extending in another direction.

541,165. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa. Application filed September 7, 1889.

The combination consists of the car body, the axles and wheels therefor, an electric motor having its shaft connected with the axle by a hinged frame, a power transmitting connection between the motor shaft and axle, and an elastic support for the motor, permitting it to rise and fall bodily while maintaining the transmitting connection with the axle.

541,179. Electric Arc Lamp. Charles A. Pfluger, Chicago, Ill. Application filed July 2, 1894.

In an arc lamp two carbon holders or tubes are arranged at an angle to each other with a controlling solenoid; the solenoid and the two tubes are pivotally connected together toward one end of such tubes, and the core of the solenoid and the tubes pivotally connected together at the other end of the tubes.

541,194. Electric Switch for Railways. Leonard Wheeler, Sioux City, Ia. Application filed June 8, 1894.

In an electric switch there is the combination with false rails or plates secured between the track rails, and possessing conductivity of current and insulated from track rails, and adapted to independently receive the current from the car, of electromagnets situated in a water-tight casing near the swinging rail, wires separately connecting the false rails and the electromagnets, so that the current may be connected with either of the magnets, an armature movably situated between the electro-magnets, a rod connecting the armature and the swinging rail, means for lengthening and shortening the rod, hard rubber packing for the rod to prevent too great concussion of the switch, and a water-tight casing for the rod.

541,200. Electric Elevator. Rudolf Eickemeyer, Yonkers, N. Y. Application filed October 1, 1890.

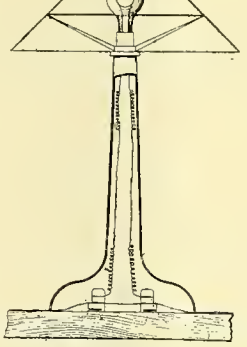
A shunt wound electric motor, an armature circuit supplied from generators and accumulators, and a resistance which is automatically adjustable to counter-electromotive force as it is developed in the motor, are features claimed.

541,225. Repeater. Moses G. Crane, Newton, Mass. Application filed August 4, 1894.

A controller for each circuit is adapted to respond to changes therein, a secondary motor controlled by the main motor, an independent locking device for each controller, adapted to move automatically to a predetermined position, and engaging portions of the locking device adapted to co-operate with the secondary motor and controller respectively.

541,227. Electric Switch. Chaimsonovitz P. Elieson, London, Eng. Application filed July 16, 1894.

This device is a circuit controlling switch, comprising among its members a receptacle composed of non-conducting material, supporting pivots therefor, engaging the receptacle adjacent to one end thereof extending within the same, and forming circuit terminals and a movable conducting body within the receptacle.



NO. 541,121.

541,233. System of Electrical Distribution. Charles K. Huguet, New Orleans, La. Application filed January 30, 1895.

This method of distributing alternating electric currents consists in passing a current of constant potential through a circuit, and maintaining the current at a constant volume by relative inductive action between the current on the constant potential circuit and the current on a separate constant current circuit.

541,287. Electric Stop Motion for Engines. Eugene C. Myrick and George C. Doeg, Providence, R. I. Application filed May 23, 1893.

The governor and the valve detaching mechanism in combination with mechanism for connecting the governor and the valve detaching mechanism is a prominent feature. The connecting mechanism is constructed in two parts, detachably connected together, and means for automatically disconnecting the parts of the connecting mechanism through an electric circuit by the abnormal movement of some part of the engine.

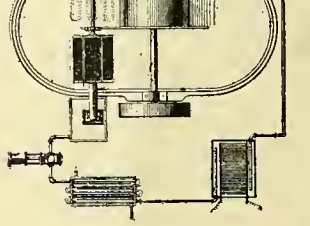
541,290. Arc Lighting. Samuel W. Rushmore, Brooklyn, N. Y. Application filed March 20, 1895.

In a circuit of four or more arc lamps in series the lamps are arranged in pairs, the feeding of one lamp of each pair being controlled or modified by a coil in shunt to its own arc and by a coil in shunt to the arc of the second lamp only of the pair.

541,332. Insulator. James M. Patterson, Springtown, Tex. Application filed April 10, 1895.

An insulator, comprising two sections of insulating material adapted to fit together, and each provided on its inner sides with a longitudinal recess, and blocks notched on their inner faces and adapted to be inserted in the longitudinal recesses in the sections, with their notches coinciding to form a passage for the wire.

541,338. Underground Closed Conduit System for Electric Railways. Adolph J. Smith, Milwaukee, Wis. Application filed June 6, 1894.



NO. 541,147.

In an underground conduit system for electric railways there is the combination with a conduit having one or more trolley chambers, of an independent conducting chamber and conducting wire located therein, insulated metallic shafts communicating at intervals from the conducting chamber to the trolley chamber, provided with a contact arm in the conducting chamber, adapted to be rocked into contact with the conducting wire, and an actuating arm in the trolley chamber, a reciprocating trolley track connected with the actuating arms and supported independently in the trolley chamber, and means for taking up the lost motion of the actuating arm when rocked by the reciprocal motion of the track.

541,341. Electric Alarm Signal and Indicator for Trolley Railroads. Jacques A. Buisson, New Orleans, La. Application filed April 2, 1895.

A main trolley wire or feeder and a short auxiliary wire extended parallel therewith and in the same horizontal plane are combined, and there are means for rigidly and mechanically connecting the two wires, the ends of the auxiliary wire being turned up to form upwardly inclined planes or shoes capable of readily receiving a trolley wheel, and a wire connected to one upturned end of the auxiliary wire, the connection being out of the plane in which the main portion of the auxiliary wire is located.

541,357. Compound Wound Alternating Generator. John D. Hilliard, Jr., Bluefield, W. Va. Application filed June 21, 1894.

One claim is given: The combination with the alternating current generator, the commutator arranged in a shunt circuit from the generator and in circuit with the series winding of the field of the generator, the variable resistance coil arranged in said shunt circuit, the armature actuated by the said coil, a latch held by the armature, and a circuit closer operated by the latch and adapted to short-circuit the coil.

541,365. Switch for Overhead Railways. Eugen Langen, Cologne, Germany. Application filed April 6, 1895.

A switch or point for two meeting lines of an overhead railway for suspended vehicles consists of a laterally movable triangular structure, two sides of which are curved to correspond with the curvature of the meeting lines of railway, so that when the switch is moved over into either position its one side lies against the outer rail of the one line of rails, while its other side forms a continuation of the inner rail of the other line of rails, meeting at its end the outer rail of the other line.

541,366. Switch for Overhead Railways. Eugen Langen, Cologne, Germany. Application filed April 6, 1895.

This includes a single tongue switch for two meeting lines of rails, which, being pivoted to the line at its base, and having its point formed with a separate piece pivoted thereto, lies close against the rail when moved over into either extreme position.

541,380. Armature for Electric Motors and Generators. James F. McLaughlin, Philadelphia, Pa. Application filed December 5, 1891.

The invention comprises an armature for electric motors and dynamo-electric generators, composed of a cylindrical iron body provided with troughs opening into the periphery, armature coils removably seated in the troughs, and an iron wire wrapping constituting a magnetic shield continuous both longitudinally and peripherally over the cylinder.

541,389. Electric Train Signal. Edward J. Devine, Port Arthur, Can. Application filed December 11, 1894.

A series of wires and a circuit closer are provided with a frame and a movable shield or tongue, the wires being extended into or mounted on the frame and tongue, one of them having an uninsulated portion, another of the wires also having an uninsulated portion extending across the plane of the former uninsulated portion.

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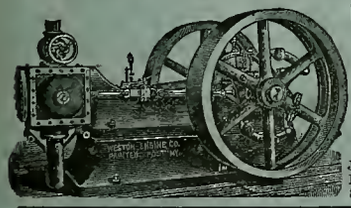

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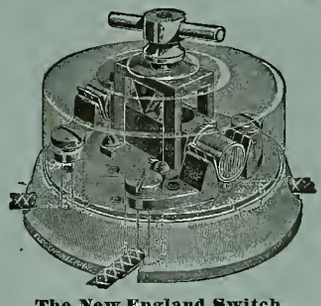

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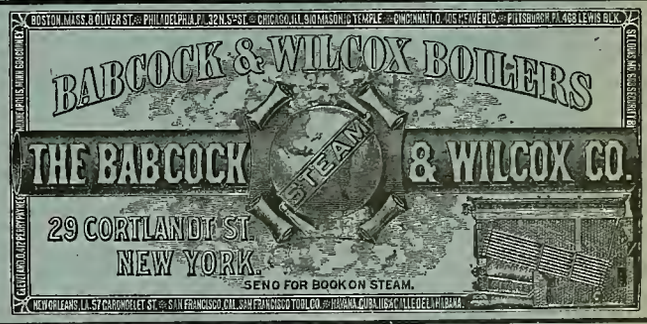


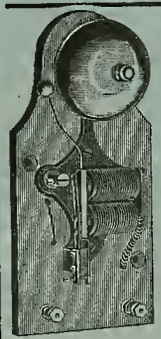

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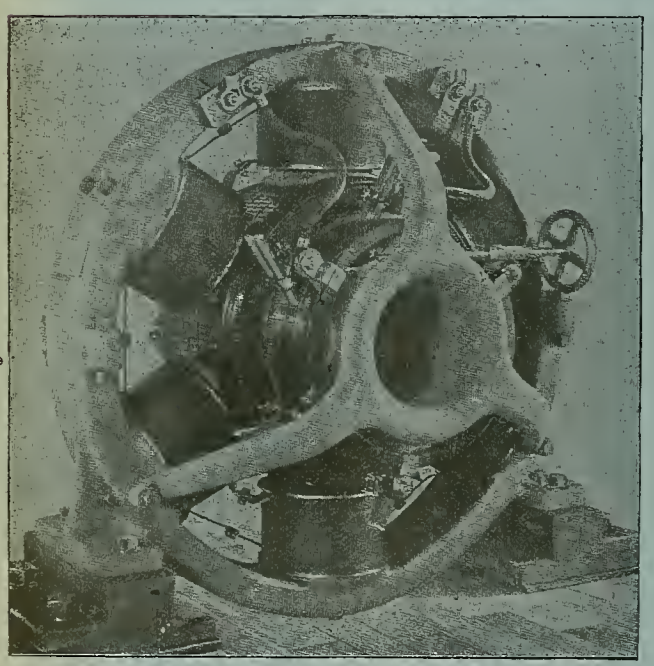

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**Globes and Electrical Glassware.**
Chicago Gen'l Fixture Co.
Gleason, E. P. Mfg. Co.
Jaeger Mfg. Co., The.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.

**Induction Coils.**
Splitdorf, C. F.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Bernard Co., The E. G.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Chicago Gen'l Fixture Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Holtzer-Cabot Electric Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
Large & Twining.
Lee & Collins.
Little, F. P. Elec. C. & S. Co.
Morse & Co., S. F. B.
Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Paragon Insulating Co.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Technic Electrical Wks.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Bishop Gutta Percha Co.
Bunnell & Co., J. H.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Godfrey, J. W.
Independent Electric Co.
Lee & Collins.
Moore, Alfred F.
Morse & Co., S. F. B.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Wallace Electric Co.
Western Electric Co.
Western Elec. Supply Co.

**Lamps, Incandescent.**
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Beacon Vac Pump & Elec. Co.
Bernstein Electric Co.
Buckeye Electric Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
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New York & Ohio Co.
Partrick & Carter Co.
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Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

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(See Insulated Wires.)

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Bliss Co., E. W.
Hine & Robertson Co.

**Mica.**
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Munsell & Co., Eugene.

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C & C Electric Co.
Colburn Electric Mfg. Co.
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Eddy Elec. Mfg. Co.
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Roth & Eck.
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Garlock Packing Co.

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National India Rubber Co.
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Okonite Co., The.
Phillips Insulated Wire Co.
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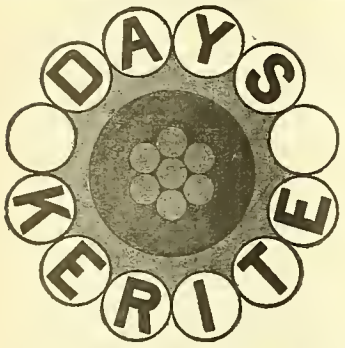


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**THE BEST KNOWN AND MOST RELIABLE OF ALL INSULATIONS FOR ELECTRIC WIRE AND CABLES.**

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Commercial Elec. Supply Co., ST. LOUIS, MO.

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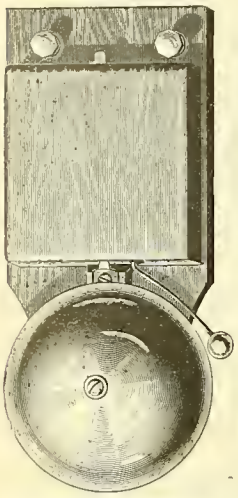
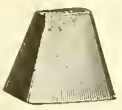


Ask your Supply House for

# "REX" FANCY GONGS.

Made of Cast Bell Metal.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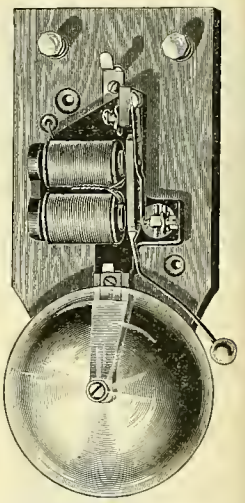

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Remember our Motto: The very best goods at the very lowest prices.

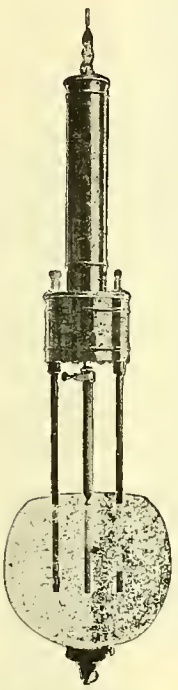
# THE HELIOS

## New Alternating Arc Lamp

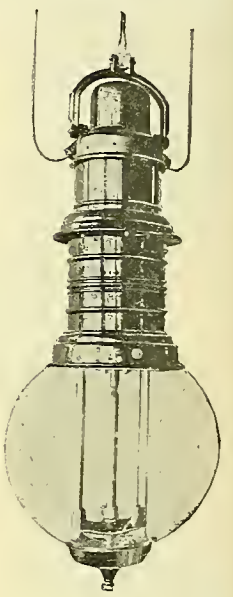
### For Street Lighting

No. 13.
Inside 7 Ampere 7 Hour Lamp.

New Alternating Lamp 900 c. p, 7 amperes at 28 volts or 4½ amperes at 50 volts, 2¼ amperes at 100 volts. It consumes the energy of 3½ 16 c. p. incandescent lamps. A small alternating lamp is only possible with a reflector plate.



We have just completed a new direct current lamp which we guarantee will not **SEE-SAW.** The mechanism is entirely novel. By means of this arrangement the most troublesome feature in running lamps in series is eliminated.


No. 10.
Street Lamp, either 12 or 14 hour, to be used in connection with Special 33 Volt Transformer.

*Low Potential Direct Current Lamps*

Write us for Prices and Discounts

Eastern Agents: STANLEY ELECTRIC MFG. CO., Pittsfield, Mass.
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MOUNTAIN ELECTRIC CO., Denver, Col., Agents for Colorado, Utah, Wyoming and New Mexico.
MACHINERY SUPPLY CO., Los Angeles, Cal., Agents for Lower California and Arizona.
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**Helios Electric Company** PHILADELPHIA, PA.

# ROYAL ELECTRIC CO., PEORIA, ILL.

MANUFACTURERS OF

## The Most Reliable ALTERNATING System now on the Market.

**OUR ALTERNATOR HAS:**

NO COLLECTING RINGS. NO COMMUTATOR. NO REVOLVING FIELD OR ARMATURE COILS.

**Step Down TRANSFORMERS.** **Step Up TRANSFORMERS.**

TRANSFORMERS for any desired Voltage. Arc Light TRANSFORMERS. Direct Current Generators and Motors.

CORRESPONDENCE SOLICITED.

THE

# Chloride Accumulator.

The Electric Storage Battery Company has acquired all the patents and patent rights concerning the manufacture of electric storage batteries of the General Electric Company, the Edison Electric Light Company, the Thomson-Houston Electric Company, the Brush Electric Company, The Accumulator Company, The Consolidated Electric Storage Company and the General Electric Launch Company, whereby The Electric Storage Battery Company has secured to itself the sole right to supply in the United States electric storage batteries of all the various important types heretofore developed, as well as the protection of every decision heretofore rendered by the United States courts in the interpretation of electric storage battery patents.

The acquisition of these patents not only terminates all litigation heretofore existing, but insures the company against any future attacks, as the patents acquired, together with those originally owned by The Electric Storage Battery Company, cover all the known principles involved in storage batteries.

The Company has also increased largely its cash working capital, and is fully prepared to fill all orders for storage batteries promptly.

Catalogue containing full description of the various types of elements, weights, capacities, dimensions, etc., and price list, furnished on application.

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# THE C & C ELECTRIC COMPANY

MANUFACTURERS OF

## MULTIPOLAR DYNAMOS,

Direct Driven or Belted, in sizes up to 250 H. P.

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Up to 100 H. P.

Electric Motors, Automatic or Hand Controlled.
Complete Plants for Power Transmission.
Isolated lighting plants, Central Station Apparatus.

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Works: GARWOOD, N. J.
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CLEVELAND, Cuyahoga Building. PHILADELPHIA, 633 Arch St.

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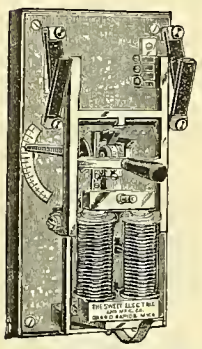
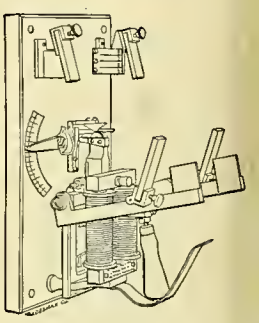


No! we make the final break off from carbons so that it is impossible to get heat enough to fuse points of your copper contact plates; no filing off of rough points, no hanging on after you have had a short circuit or over load, bound to work as easily after opening 1,000 times as it does when opened the first time.

**WE KNOW YOU NEED OUR CIRCUIT BREAKER,** and do not see why you should delay writing us any longer. One burn out will pay for a dozen of our instruments. **To be used on the Alternating or Direct Current Systems.**

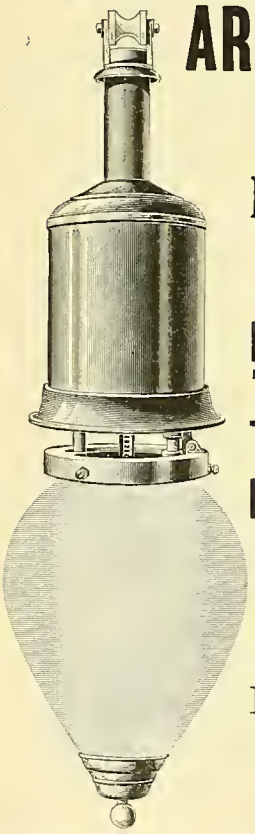


**WRITE US AT ONCE.**

## SWEET ELECTRIC & MFG. CO.,

GRAND RAPIDS, MICH.

## THE E. C. & S. CO.'S ARC LAMP.



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Low Tension, Series Arc,
Street Railway, Alternating.

**Plain and Ornamental.**

The Easiest Lamp to Trim.
It has Universal Carbon Holders.

Its action, electrically and mechanically, is perfect.

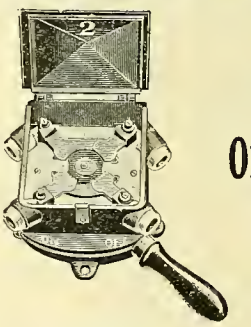
It has fewer operating parts than any lamp on the market.

**SEND FOR CIRCULAR.**

## Wright's Series Circuit Arc Cut-Out.

MANUFACTURED BY
THE HOPE ELECTRIC APPLIANCE CO. Providence, R. I.

The Best Arc Cut-Out Made.



From One to Ten Lights.

*Approved by Every Board of Fire Underwriters.*

Heavy Porcelain Insulation,
Large Contact Surfaces,
Fire-proof, Water-proof, Storm-proof.

**Send for Circulars of Complete Line of Arc Cut-Outs.**

## WALLACE ELECTRIC CO., Western Agents, 307 Dearborn St., CHICAGO.

# WHEN YOU ADVERTISE A MAN

IT'S FOR A PURPOSE.

**NOTICE TO THE TRADE.**

We beg to announce that Mr. James W. Godfrey is no longer in our employ.

New York Insulated Wire Co.,
December 8, 1894. 15 Cortlandt St., N. Y.

Above TRUE; but it's a clear, honorable and successful record as general manager in developing their business to its present condition.

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## TO THE TRADE.

December 22, 1894.

I beg to announce that I have arranged with the INDIA RUBBER AND GUTTA-PERCHA INSULATING CO., manufactnrers of the celebrated Habirshaw White Core Insulated Wires, Cables, etc., and shall hereafter manage the sales department of the Company.

Messrs. F. W. Harrington and J. B. Olsen, will be connected with the above Company, January 1st, and we are now prepared to make prompt deliveries on all orders for Habirshaw's high grade Insulated Wire, Cables, Etc.

Soliciting a continuance of your esteemed favors, I am,

Yours obediently, J. W. GODFREY,
Room 52, 18 Cortlandt Street, New York City.

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PATENTS FUNDAMENTAL—NON-INFRINGING.

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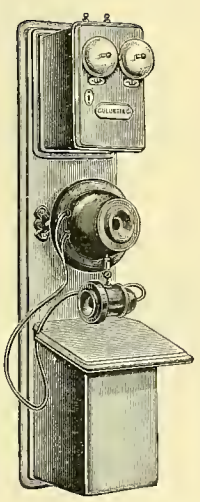
**LONG DISTANCE BATTERY TRANSMITTERS**

of the latest and newest designs sold outright. No adjustment. Nothing to get out of order. Nothing demanding repair. Will convey articulate speech 1,000 miles. Constructed of the best material.



**A TELEPHONE RECEIVER**

of the newest and best pattern. Unique in design. Perfect in action. Moderate in cost. Small instruments made of the finest rubber. All wires and connections within the case. No unsightly thumbscrews.

This Company owns the patent for the improved Switch for changing the circuit of the Telephone on battery transmitters. Also for perfected system of telephone exchanges. The best DRY BATTERY manufactured. Send for Circular.

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**136, 138, 140 Front St., New York City.**

# "THERE ARE OTHERS"

Who make great claims of their ability to handle electrical supply trade. They however make deceptive

## BIDS FOR BUSINESS

By cutting prices on a few staple articles and "roasting" their customers on their specialties and other goods.

OUR POLICY has always been to furnish all of our material at LOW PRICES

And give all of our customers the advantage of the best prices we can make on every order. You can send us your open rush orders with perfect assurance that they will be filled promptly at right prices.

# SEND THEM ALONG

— TO THE —

ELECTRIC APPLIANCE COMPANY,

ELECTRICAL SUPPLIES, 242 Madison Street, CHICAGO.

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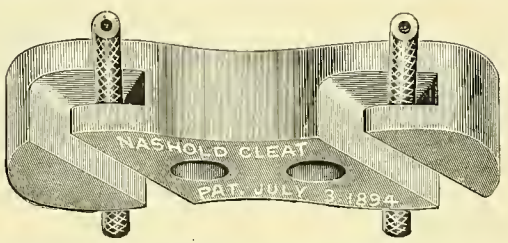
# NASHOLD

# Self-Locking Cleat.

PATENTED IN U. S., CANADA, ENGLAND, FRANCE, AND APPLIED FOR IN GERMANY.




IT IS THE MOST PRACTICAL CLEAT MADE.
IT IS MADE OF FINEST GLAZED PORCELAIN.
IT IS IN ONE PIECE.
IT HAS THE STRENGTH.
IT WILL LOCK THE WIRE FIRMLY.
IT WILL NOT BREAK IN PUTTING UP.
IT WILL NOT HOLD MOISTURE.
IT WILL NOT HURT THE INSULATION.

The wire can easily be put in place or removed without loosening the Cleat. It is a great saver in Time and Labor over any other Cleat in use for putting up Electric Light or other Wires.

FOR SALE BY ALL ELECTRICAL SUPPLY HOUSES.

## The Nashold Cleat Company,

934-935 MONADNOCK BUILDING,

Telephone, Harrison 636. CHICAGO, ILL.

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## OCTAGONAL PINE POLES, NORWAY PINE CROSS-ARMS, WHITE OAK PINS.

It will pay you to get our prices

BROWNLEE & CO., - Detroit, Mich.

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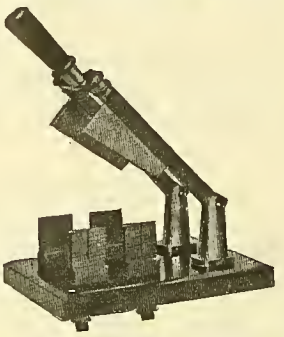
**Switches, Switch-Boards, Tablet-Boards.**



*Estimates and designs furnished on Application.*

Charges reasonable for superior work.

Technic Electrical Works, 129 Bread Street, PHILADELPHIA.

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All Colors and Descriptions.

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**Automatic Mercurial Pumps**

OF LATEST DESIGN

For Incandescent Lamp Companies.

Scientific glass apparatus for Laboratories, Colleges, etc. Reliable workmanship and lowest prices. Agents wanted in Western Cities. **Send for new Catalogue.**

The Jaeger Mfg. Co.,

169 William St., NEW YORK.

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SEND FOR SAMPLES AND PRICES OF

**SAMSON SPOT CORD**

For Arc Light and Trolley Cord.

SAMSON CORDAGE WORKS, - BOSTON, MASS.

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**Boswell Storage Battery.**

For Traction Work, Electric Lighting, Electric Launch, Telegraph, Phonograph, Surgical, and for all purposes where Light and Power are required.

Prices on Application.

D. E. BOSWELL & CO., 154 Lake St., Chicago.

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Procured. **30 Years' Practice. GRANT INSURED.** Pamphlet, references and advice **free.**

CHAS. J. GOOCH, Washington, D. C.

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NO WINDING. CORRECTED HOURLY.

SELF-WINDING CLOCK CO.,

26 Broadway, NEW YORK.

*Clocks Sold. Clocks Rented.*

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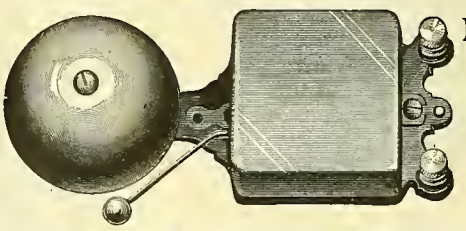

**BELLS,**

BRONZE PUSH BUTTONS,
WINDOW AND DOOR SPRINGS,
FLOOR PUSHES,
SWITCHES.

Send for New Catalogue.

HUEBEL & MANGER, Manufacturers, 286-290 Graham Street, BROOKLYN, N. Y.

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# HELIOS CORED CARBONS For Alternating and Direct Currents.

Attempts have been made in this country to produce a satisfactory cored carbon, but failure resulted in every case. We can now assure the Electric Light Companies that our "HELIOS" CARBON is made of the same ingredients, in precisely the same way,

**By the man who made them in Germany.**

We shall be glad to hear from the Electric Light interests of the country in relation to carbons for both alternating and Direct Currents. A memorandum book, with tables showing the relation between millimeters and inches, with a list of ordinary sizes of "HELIOS" CARBONS of our manufacture will be sent on application. **Reduced Prices on Solid Carbons for Series Arc Lighting.**

## A · Departure · In · Business · Methods!

*NOTE THIS OFFER:—Let us know by telegraph the price you are now paying, stating yearly consumption, and we will guarantee to beat it from 50 cents to $2.00 per thousand.*

# THE WASHINGTON CARBON COMPANY, - PITTSBURG, PA.

EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Secy.

# AMERICAN ELECTRICAL WORKS,

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BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,

Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

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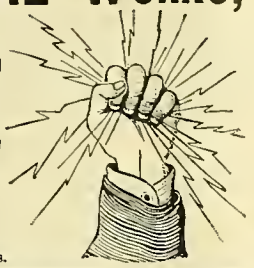

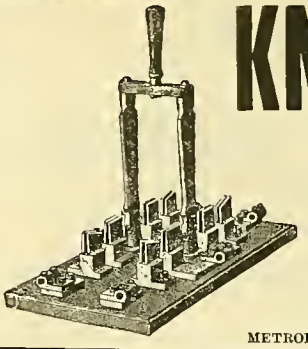

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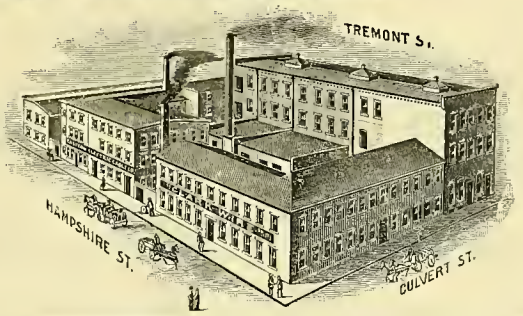


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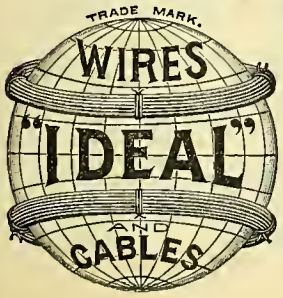


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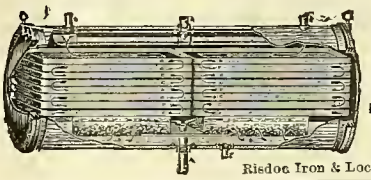

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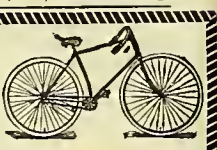

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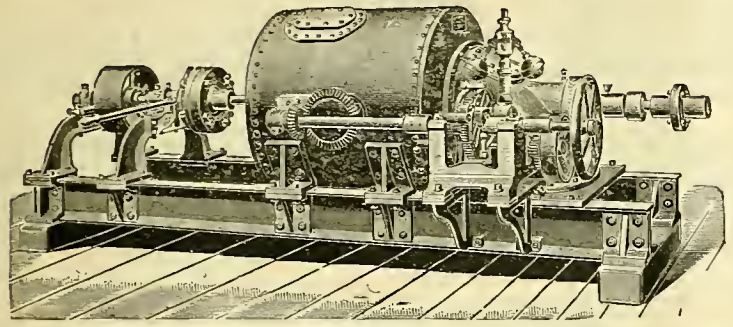

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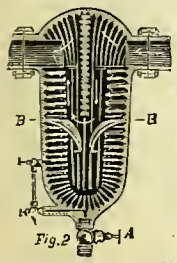


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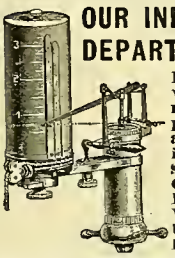

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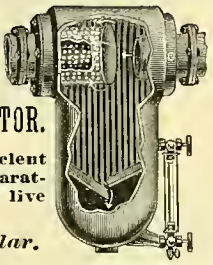

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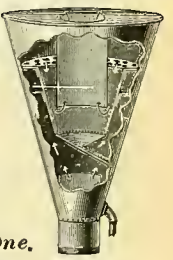

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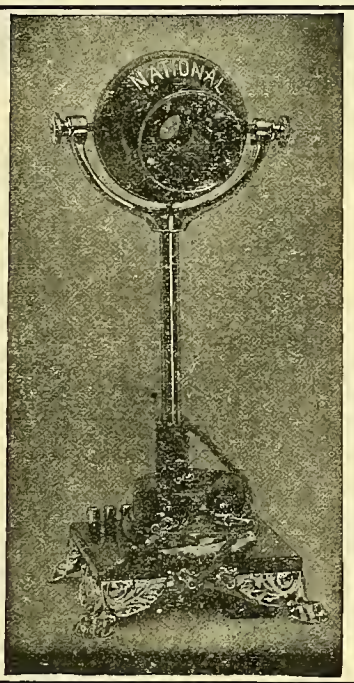


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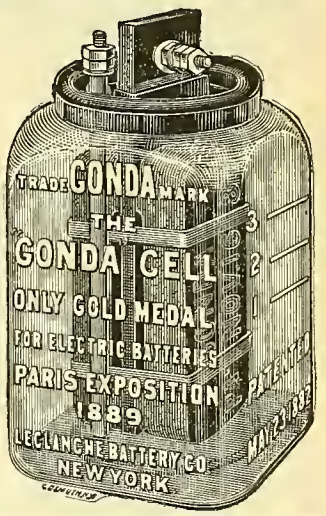


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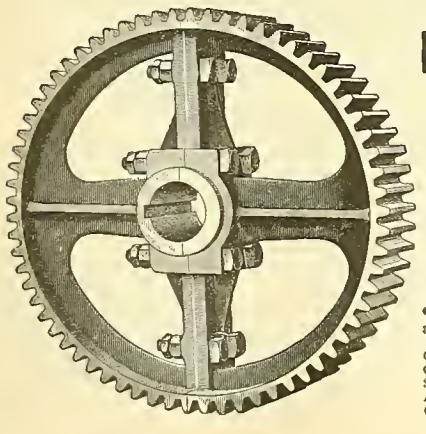

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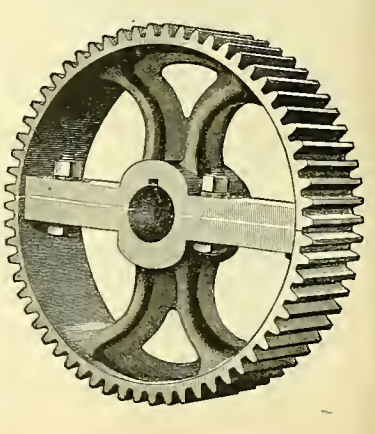

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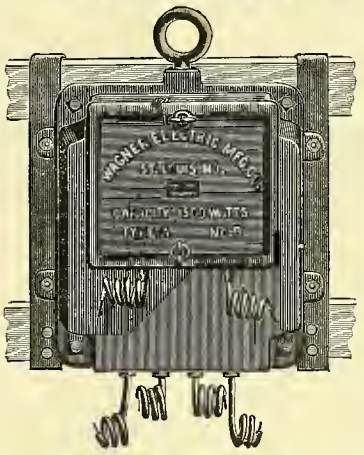

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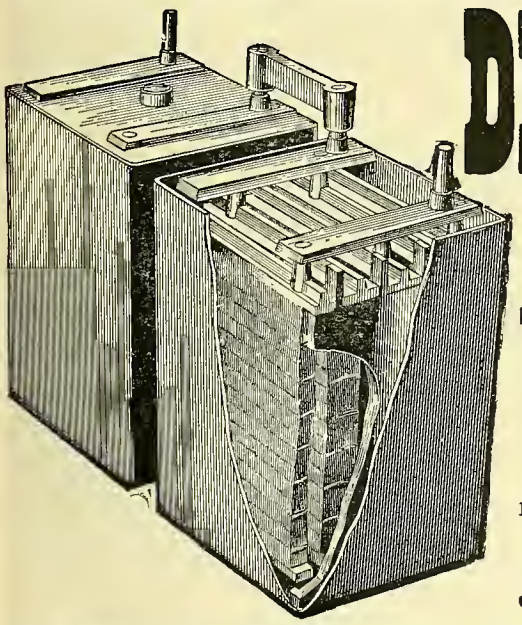

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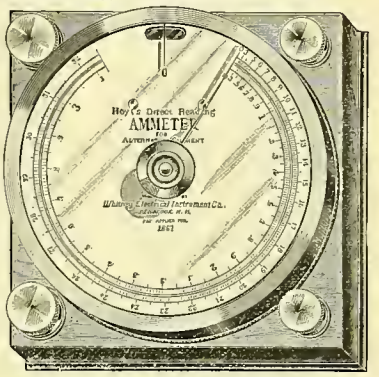


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|---|---|---|---|---|---|
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| Ammonium Sulphate | " | " | " | 0.03 | " |
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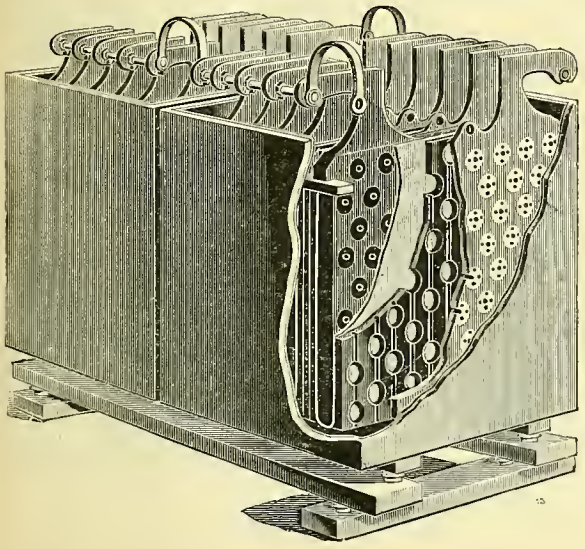

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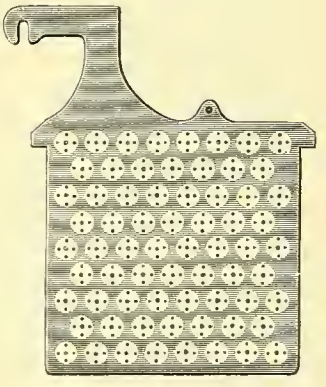

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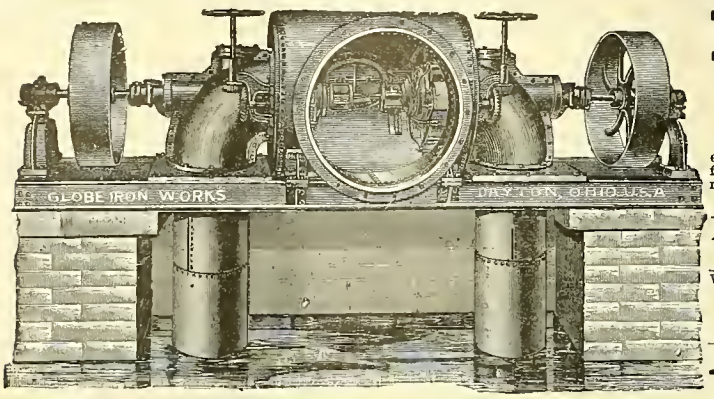


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|---|---|---|---|---|---|
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| 7/8 " | 16.42 | 122.00 | 127.18 | 195.19 | 82.58 |
| 3/4 " | 16.78 | 117.33 | 112.60 | 175.74 | 82.18 |
| 5/8 " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| 1/2 " | 16.88 | 118.67 | 82.07 | 118.40 | 75.52 |

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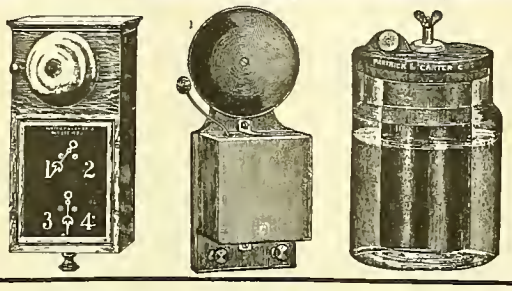

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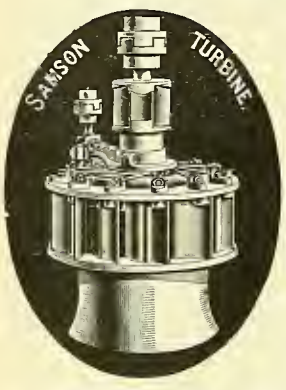


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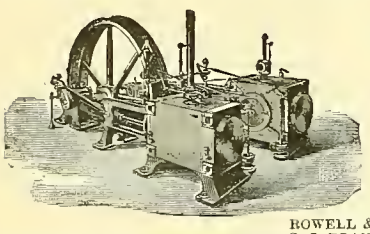

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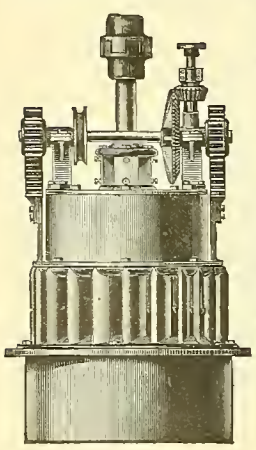

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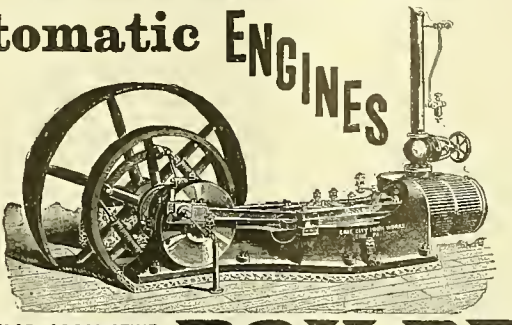

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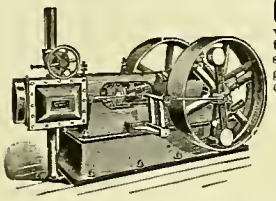

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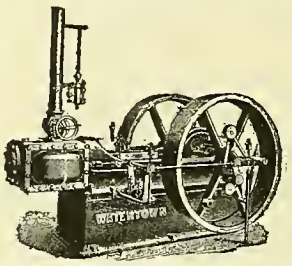

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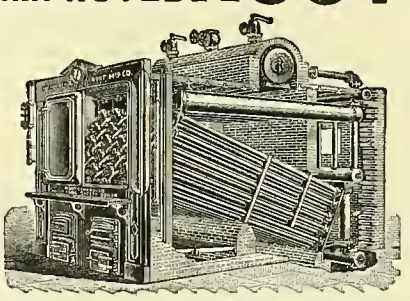

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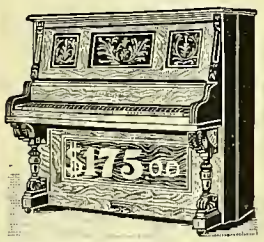

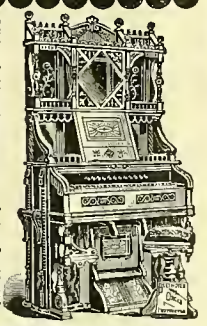

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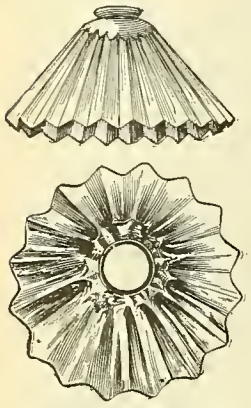

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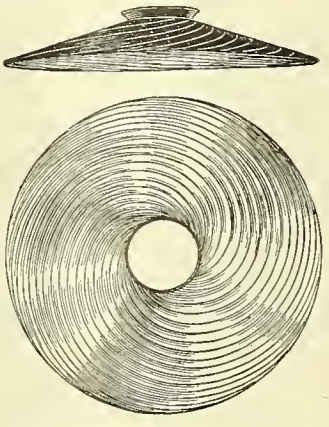

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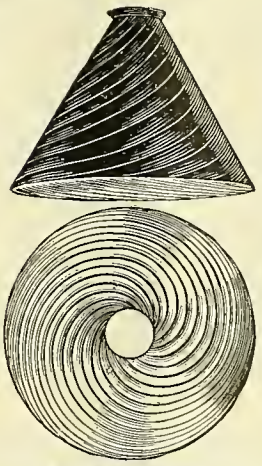

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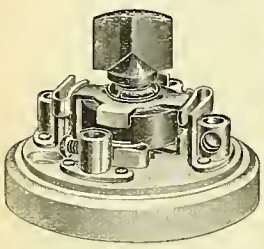

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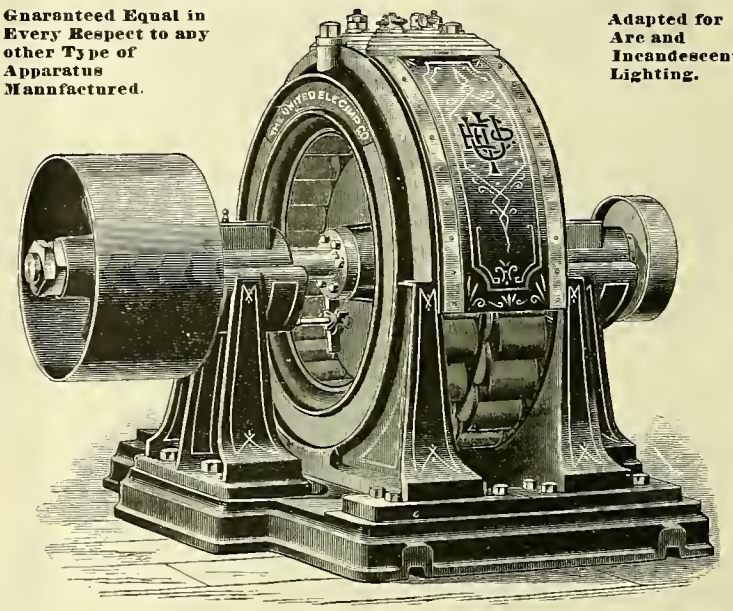

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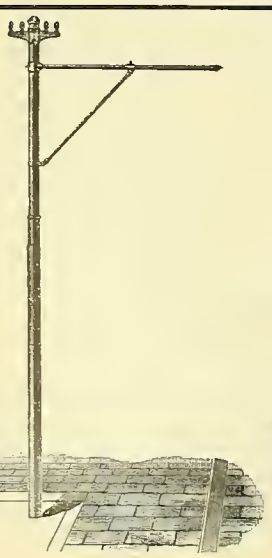

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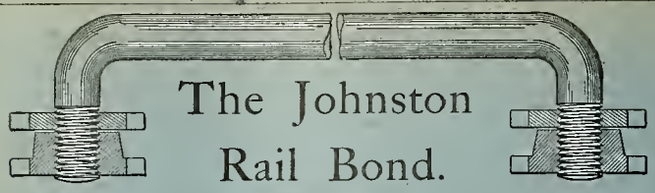

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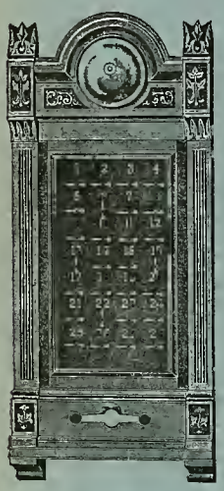

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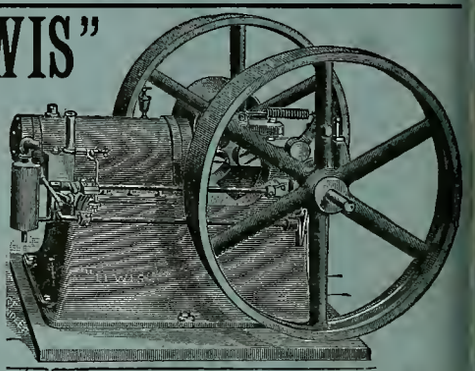

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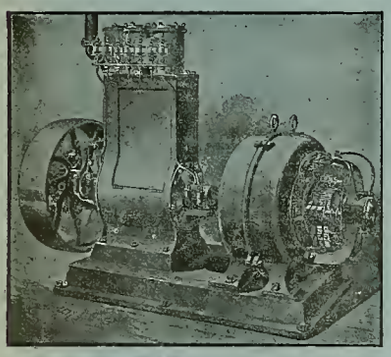

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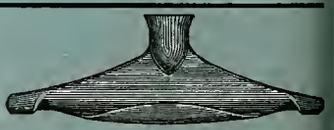

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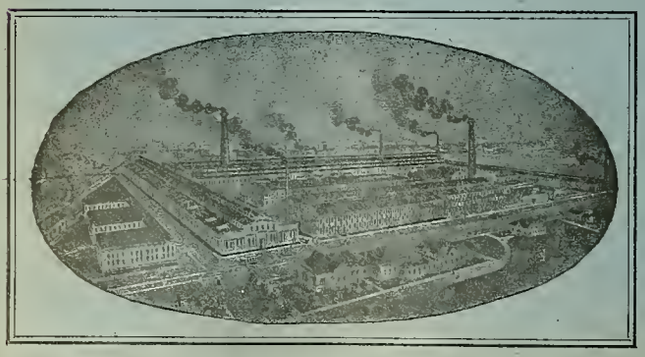

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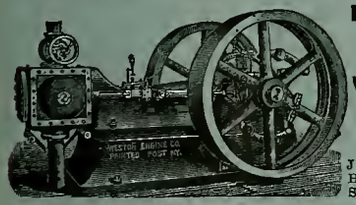

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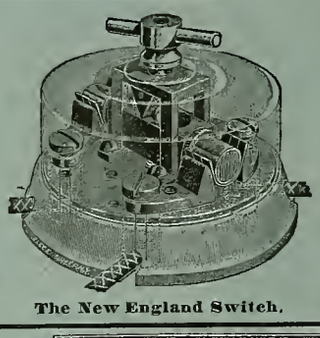

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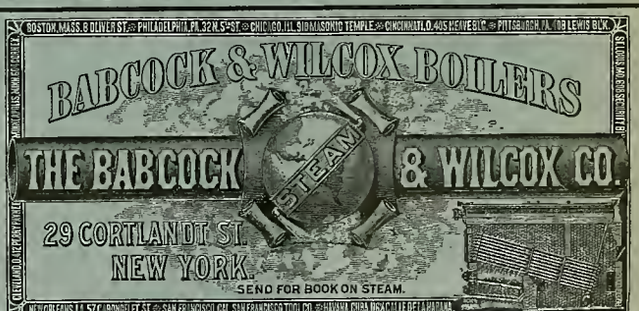


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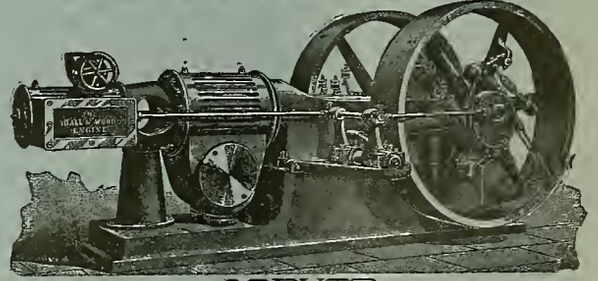

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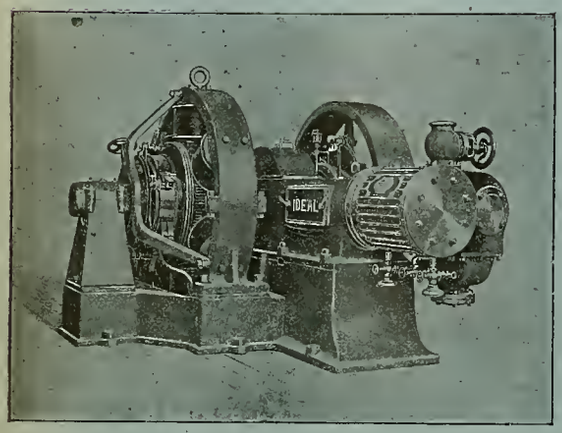


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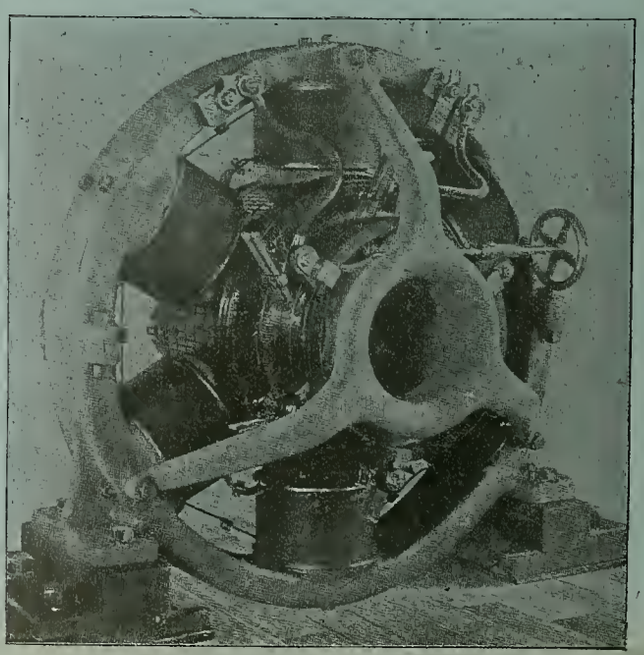

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Western Telephone Construction Co..... .. xi
Westinghouse Elec. and Mfg. Co..... xiv
Weston Engine Co..... i
Whitney Electrical Instrument Co. ..... .... xx
Worthington, Henry R.... x


## CLASSIFIED LIST.


**Accumulators**
Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Cons. Electric St rage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Haschke & Creelman.
Porter & Buerdorf.

**Annunciators.**
Chicago Gen'l Fixture Co.
Dearborn Electric Co.
Electric Appliance Co.
Lee & Collins.
Nowotny Electric Co.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Washington Electric Co.
Western Elec. Supply Co.

**Arc Lamps.**
Auerbach-Woolverton El. Co.
C & C Electric Co.
Clark Electric Co.
Crocker-Wheeler Elec. Co,
Electric Cons. & Supply Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
General Inc'd'cent Arc Lt. Co.
La Roche Electric Wks.
Little, F. P. Elec. C. & S. Co.
Mather Electric Co.
Washington Electric Co.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Dearborn Electric Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Haschke & Creelman.
Law Battery Co.
Leclanche Battery Co., The.
Lee & Collins.
Miamisburg Electric Co.
Nowotny Electric Co.
Partrick & Carter Co.
Phœnix Carbon Mfg. Co.
Wallace Electric Co.
Western Electric Co.

**Bells.**
Dearborn Electric Co.
Electric Appliance Co.
Lee & Collins.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Electric Co.

**Belting.**
Shultz Belting Co
Phœnix Carbon Mfg Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Brownell & Co., The.
Clonbrock Steam Boiler Wks.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

**Brushes.**
Partridge Carbon Co.
Phœnix Carbon Mfg. Co.

**Burglar Alarms.**
Electric Appliance Co.
Lee & Collins.
Partrick & Carter Co.
Wallace Electric Co.
Washington Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** . (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Bishop Gutta Percha Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
Morse & Co., S. F. B.
New York Ins. Wire Co.
Roebling's Sons Co , J. A.
Simplex Electrical Co
Standard Underground C. Co
Wallace Electric Co.
Western Electric Co.

**Carbons Points & Plates.**
General Electric Co.
Partridge Carbon Co.
Phœnix Carbon Mfg. Co.
Reisinger, Hugo.
Washington Carbon Co.
Western Electric Co.

**Clocks Electric.**
Self-Winding Clock Co.

**Conduits.**
Interior Conduit & Ins. Co.
National Condnit Mfg. Co.

**Construction & Repairs.**
Allen-Hussey Co.
Amstutz, N. S.
C & C Electric Co.
Comstock Co., The Louis K.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation
Washington Electric Co.

**Contractors and Electric Light Plants.**
Allen-Hussey Co.
Amstutz, N. S.
Armstrong, Chas. G.
Arnold, B. J.
Ball, Wm. D.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Clark Electric Co.
Comstock Co., The Louis K.
Consolidated Engineering Co.
Crocker-Wheeler Elec. Co.
Dearborn Electric Co.
Fontaine Crossing & El. Co.
Ft Wayne Elec. Corporation.
General Electric Co.
Goltz & Sinclair.
Interior Conduit & Ins. Co.
La Roche Electric Wks.
Mather Electric Co
Siemens & Halske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.
Law Battery Co.
Miamisburg Electric Co.

**Copper Wires**
American Electrical Works.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Bunnell & Co , J. H.
Dearborn Electric Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Lee & Collins.
Morse & Co., S. F. B.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brownlee & Co.
Electric Appliance Co.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Bryant Electric Co.
Bunnell & Co., J. H.
Chicago Gen'l Fixture Co.
Colgate Co , Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Interior Conduit & Ins. Co.
Lee & Collins.
Little, F. P. Elec. C. & S. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Technic Electrical Wks.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Clark Electric Co.
Colburn Electric Mfg Co
Crocker-Wheeler Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
La Roche Electric Wks.
Mather Electric Co.
Palmer Bros.
Roth & Eck.
Royal Electric Co.
Siemens & Halske Elec. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

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Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Allen-Hussey Co.
Amstutz, N. S.
Armstrong, Chas. G.
Arnold, B. J.
Ball, Wm. D.
Bryan, Wm. H.
Comstock Co., The Louis K.
Consolidated Eng. Co.
Crocker-Wheeler Elec. Co.
Goltz & Sinclair.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bunnell & Co., J. H.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Lee & Collins.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.
Washington Electric Co.
Whitney Elec. Instrument Co.

**Electrical Specialties.**
Holtzer-Cabot Electric Co.
Lee & Collins.
Nashold Cleat Co.
Proctor-Raymond Elec. Co.

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Edwards, W. S. Mfg. Co.
Gleason, E. P. Mfg. Co.

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Besly & Co., Chas. H.
Colburn Electric Mfg. Co.
General Electric Co.

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Otto Gas Engine Wks.
Webster Mfg. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Brownell & Co., The.
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Freeman & Sons Mfg. Co.
McEwen Mfg. Co., J. H.
Racine Hardware Co.
Sioux City Eng & Iron Wks.
Watertown Steam Engine Co.
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Interior Conduit & Ins. Co

**Feed Water Heaters.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Fibre.**
Butler Hard Rubber Co.
Kartavert Mfg. Co.
Standard Paint Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Butler Bard Rubber Co.
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Lee & Collins.

**Gas Lighting, Electric.**
Holtzer-Cabot Electric Co.
Lee & Collins.
Partrick & Carter Co.

**Gears**
Besly & Co., Chas. H.
Grant, Geo. B.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bryant Electric Co.
Bunnell & Co., J. H.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
General Electric Co.
High & Co., J. Grant.
Holtzer-Cabot Electric Co.
Interior Conduit & Ins. Co.
Lee & Collins.
Little, F. P. Elec. C. & S. Co.
Nashold Cleat Co.
Nowotny Electric Co.
Palmer Bros.
Partrick & Carter Co.
Platt O. S.
Proctor-Raymond Elec. Co.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Technic Electrical Wks.
Washington Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Gleason, E. P. Mfg. Co.
Jaeger Mfg. Co., The.

**Graphite Specialties.**
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Dixon Crucible Co., Jos.

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Splitdorf, C. F.

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Bunnell & Co., J. H.
Butler Hard Rubber Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Hart & Begeman Mfg. Co.
High & Co., J. Grant.
Holtzer-Cabot Electric Co.
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Kartavert Mfg. Co.
Lee & Collins.
Little, F. P. Elec. C. & S. Co.
Morse & Co., S. F. B.
Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Nowotny Electric Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Paragon Insulating Co.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.
Technic Electrical Wks.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Bishop Gutta Percha Co.
Bunnell & Co..J. H.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Lee & Collins.
Moore, Alfred F.
Morse & Co., S. F. B.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Am. Electrical Mfg. Co.
Beacon Vac Pump & Elec. Co.
Bernstein Electric Co.
Buckeye Electric Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Jaeger Mfg. Co., The.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg. Co.

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Colgate Co , Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery**
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Bliss Co.. E. W.
Hine & Robertson Co.

**Mica.**
Johns Mfg. Co., H. W.
Mussell & Co., Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

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Brush Electric Co.
C & C Electric Co.
Colburn Electric Mfg. Co.
Crocker-Wheeler Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
La Roche Electric Wks.
Mather Electric Co.
Palmer Bros.
Royal Electric Co.
Roth & Eck.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
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Paragon Insulating Co.
Standard Paint Co.

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Gooch, Chas. J.

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Phosphor Bronze Sm. Co. Ltd

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**Platinum.**
Baker & Co.

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Morris, Tasker & Co.
Nuttall Co., R. D.

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General Electric Co.

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Ostrander & Co., W. R.
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Colgate Co , Geo. L.
Diamond Electric Co.
Whitney Elec. Instrument Co.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warre

**Steam Pumps.**
Worthington, Henry R

**Storage Batteries.**
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Bradbury-Stone Elec. S Co.
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
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Morse & Co., S. F. B.
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Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
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National Telep. Mfg. Co.
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Palmer Bros.
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Western Tel. Const. Co.

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General Electric Co.
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Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co
Wallace Electric Co.

**Trolley Cord.**
Samson Co dage Wks

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

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Cor. School of Industrial Sciences.
Scientific Machinist Co.

**Varnishes.**
Lee & Collins.
Standard Paint Co.

**Water Wheels.**
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Smith, S. Morgan.

**Wire, Bare.**
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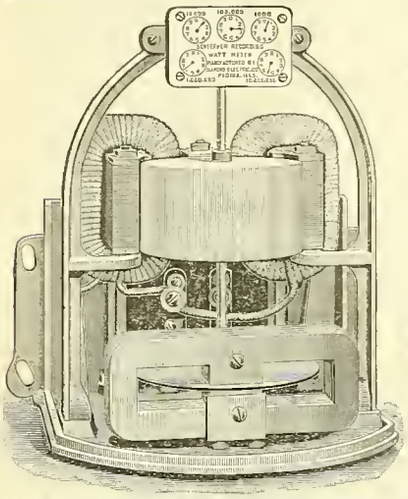
Besly & Co.. Chas. H.
Bishop Gutta Percha Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.



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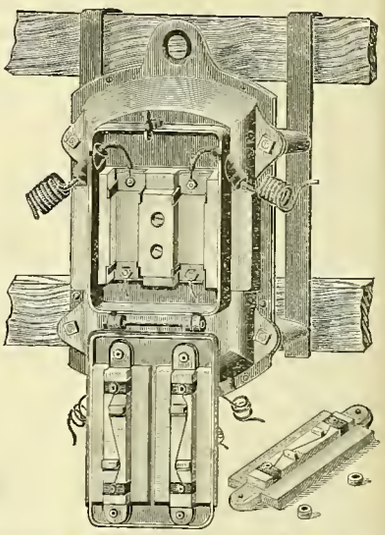

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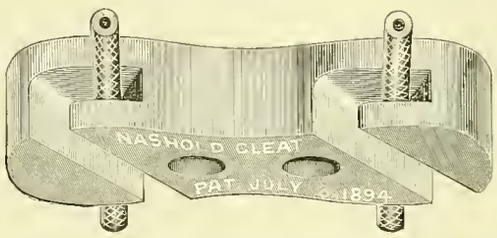


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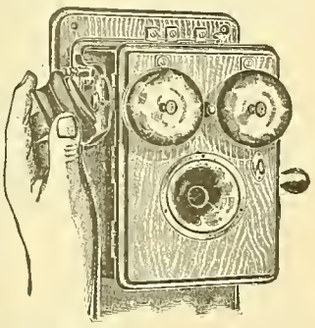

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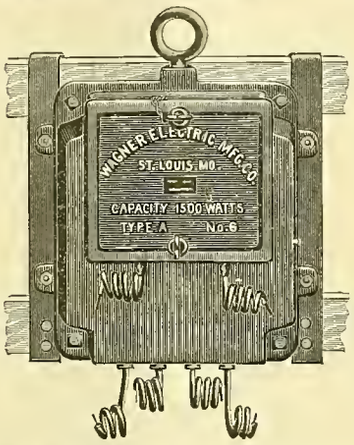


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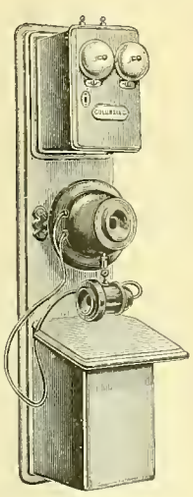

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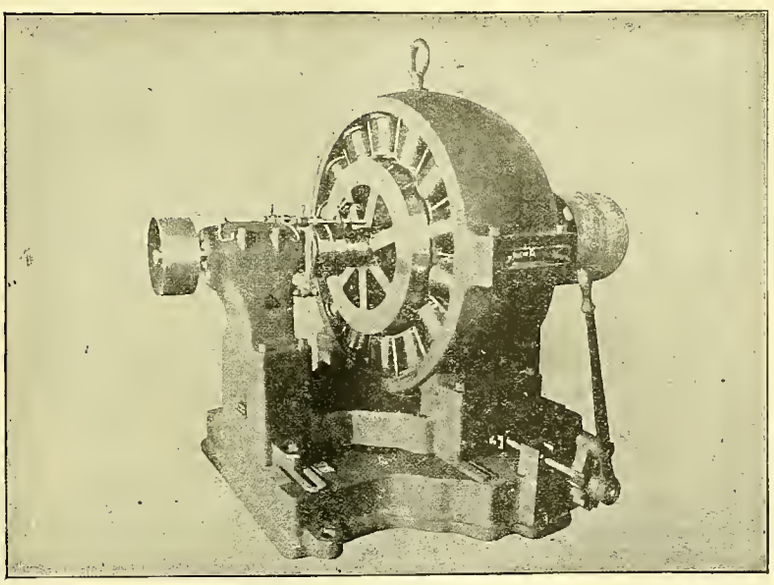

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## MULTIPOLAR DYNAMOS, BIPOLAR DYNAMOS,

Direct Driven or Belted, in sizes up to 250 H. P. Up to 100 H. P.

Electric Motors, Automatic or Hand Controlled.
Complete Plants for Power Transmission.
Isolated lighting plants, Central Station Apparatus.

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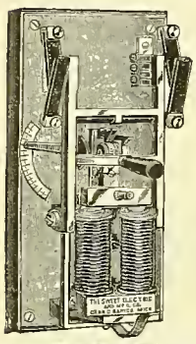
Works: CARWOOD, N. J.
on CENTRAL R. R. of N. J.

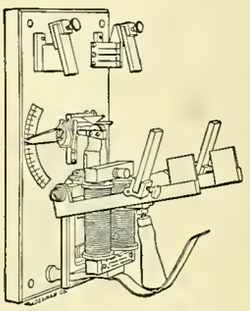
BRANCH OFFICES: { CHICAGO, 1020 and 1021 Monadnock Building. BOSTON, 63 Oliver St.
{ CLEVELAND, Cuyahoga Building. PHILADELPHIA, 633 Arch St.

# Hot Stuff.



No! we make the final break off from carbons so that it is impossible to get heat enough to fuse points of your copper contact plates; no filing off of rough points, no hanging on after you have had a short circuit or over load, bound to work as easily after opening 1,000 times as it does when opened the first time.

**WE KNOW YOU NEED OUR CIRCUIT BREAKER**, and do not see why you should delay writing us any longer. One burn out will pay for a dozen of our instruments. **To be used on the Alternating or Direct Current Systems.**



**WRITE US AT ONCE.**

## SWEET ELECTRIC & MFG. CO.,

GRAND RAPIDS, MICH.

# The New "BERGMANN" Arc Lamps

**For Constant Potential Circuits.**

BETTER THAN ALL OTHERS BECAUSE

**They have No Adjusting Springs and No Escapements and Consequently can Not Get Out of Adjustment or Flicker or Stick.**

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**Send for Descriptive Circular of Direct and Alternating Current Lamps, Blade Switches, Imported Carbons, Etc. Prices greatly reduced on everything.**

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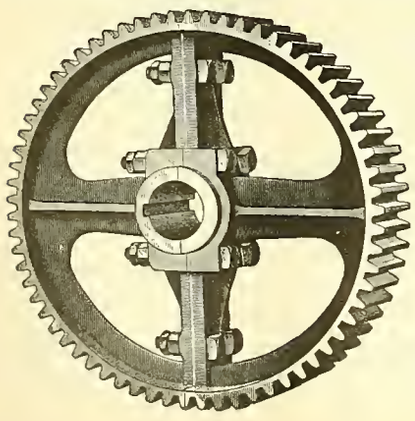
J. R. McGINLEY, Vice-President.
F. S. MARTIN, Superintendent of Works.



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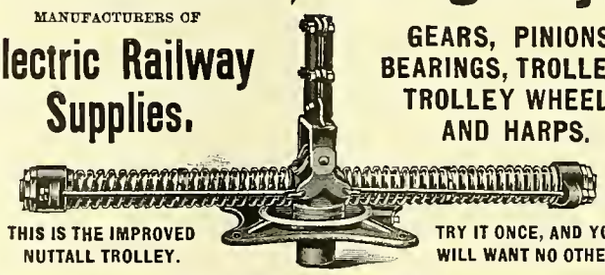
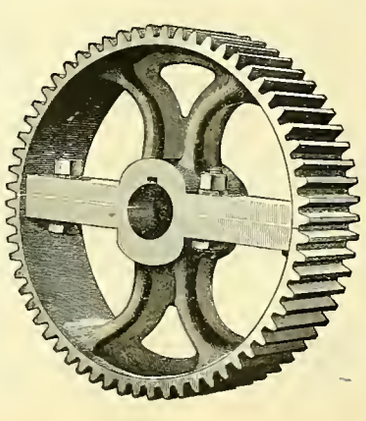
## Electric Railway Supplies.

GEARS, PINIONS, BEARINGS, TROLLEYS, TROLLEY WHEELS AND HARPS.



THIS IS THE IMPROVED NUTTALL TROLLEY.

TRY IT ONCE, AND YOU WILL WANT NO OTHER.



**The largest and most prosperous street railway companies in the country are using our supplies, and they prefer them to all others on account of greater strength and durability. Correspondence solicited.**

CHAS. J. MAYER, 600 Betz Building, Philadelphia, Pa., Middle States Sales Department.
CHAS. N. WOOD, 180 Summer St., Boston, Mass., New England States Sales Department.
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CHAS. A. CAVAGNA, Neave Building, Cincinnati, Ohio, Central States Sales Department.

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We hope you may get an idea from the above illustration. The point we want to bring out is that

## PARANITE INSULATION

Has its beginning in the Para Forests of Brazil, and not in the Rubber Shoe Industry.

## THIS MEANS

That we are giving you a compound with an insulation resistance away above any of its competitors, and a wire that will be doing perfect service when other compounds have "fallen down."

We know that it is easy enough to make claims of this kind, but

## DO NOT TAKE OUR WORD

for it. If you are a user of high grade wire in any quantity, determine these points for yourself and get the information first hand. Get samples, all having the same insulation diameter, of the rubber covered wires on the market, make a comparative test, and

## SEE WHERE PARANITE STANDS.

THEN WRITE US FOR PRICES.

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Electrical Supplies,

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WHITE OAK PINS.
It will pay you to get our prices
BROWNLEE & CO., - Detroit, Mich.

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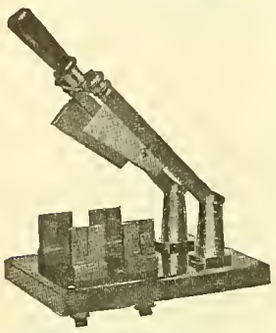

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Charges reasonable for superior work.
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Scientific glass apparatus for Laboratories, Colleges, etc. Reliable workmanship and lowest prices. Agents wanted in Western Cities. **Send for new Catalogue.**

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HORNBERGER ELECTRIC MFG. CO.,
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Boswell Storage Battery.
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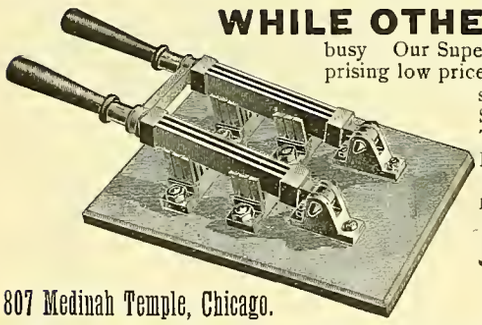

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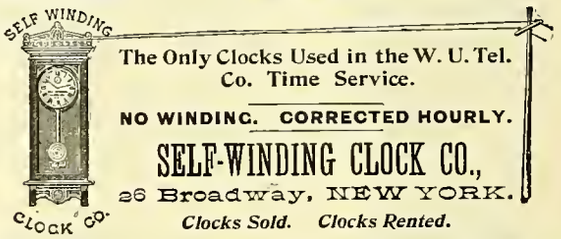


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For under ground, under water, and all other conditions.
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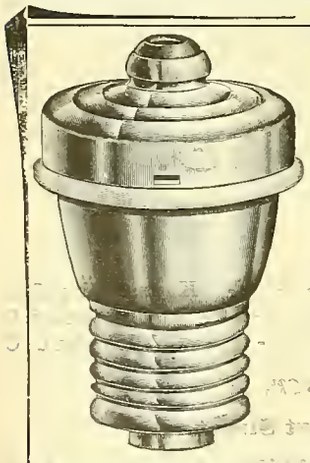

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For Electrical Purposes
Guaranteed 98/99% and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by
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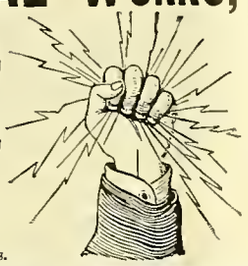

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## A Compound Magneto Telephone

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It talks as well over one hundred miles as any other Telephone talks over one mile.

This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work.

Send for circulars and price lists.

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For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

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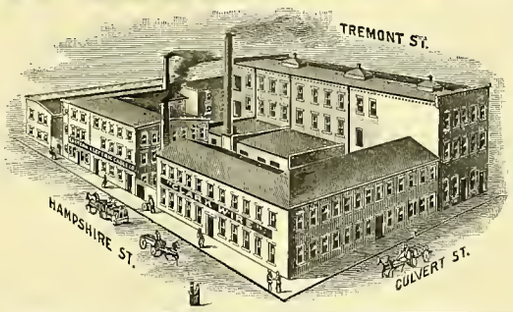


In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."

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# Electric Light Carbons

*We make a specialty of MOTOR and DYNAMO BRUSHES and BATTERY MATERIAL.*

It will pay you to see our product and get our prices before placing your orders.

# "The Electra"

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A highly EFFICIENT and ECONOMICAL Arc Light Service depends on the quality of the Carbons.

**THE BEST QUALITY IS THE CHEAPEST.**

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## High Grade Nuernberg Carbons

For direct and alternating current Arc Lamps, are the most economical and efficient manufactured. They produce a very brilliant and absolutely steady light.

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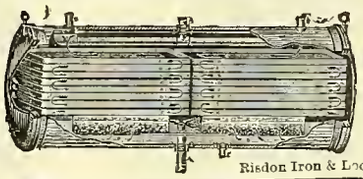

**Removes all Impurities.**

Entirely prevents *scale* in Steam Boilers. Catalogue on application.

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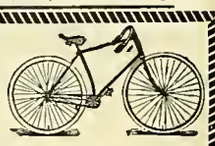

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A young man with fifteen years' experience as an electrical engineer desires a position as superintendent or electrician for street railroad or electric light company. Have had experience in all apparatus in practical use for light and power. Am also expert on steam, and have 6 years' practical experience in storage battery work. Can furnish references. Address **M. E. W.,**
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The books are in good condition, but as they are slightly soiled **will sell them cheap.**
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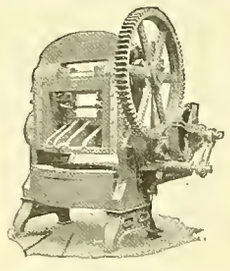

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## C-S Flush Double Push Switch.
Single Pole—Double Pole—Commutation; 3 Wire, 4 Wire.

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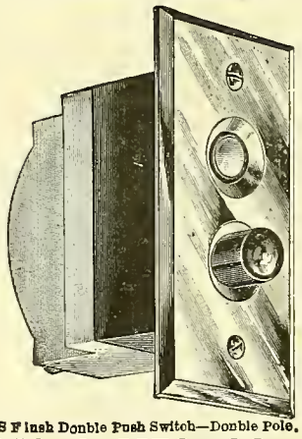
## C-S Flush Automatic Switch.
Single Pole.



C-S Flush Double Push Switch—Double Pole.

ELECTRICALLY MECHANICALLY ARTISTICALLY **PEERLESS.**

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Embodies **new feature** that gives it a decided advantage over other cells. Specially suited for electric launches, traction and lighting work. Write for description of this **new discovery.**
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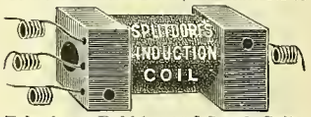


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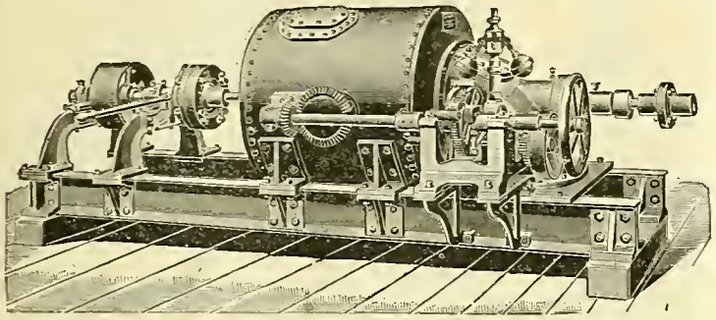

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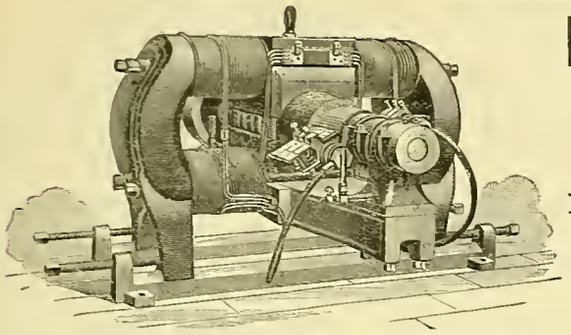

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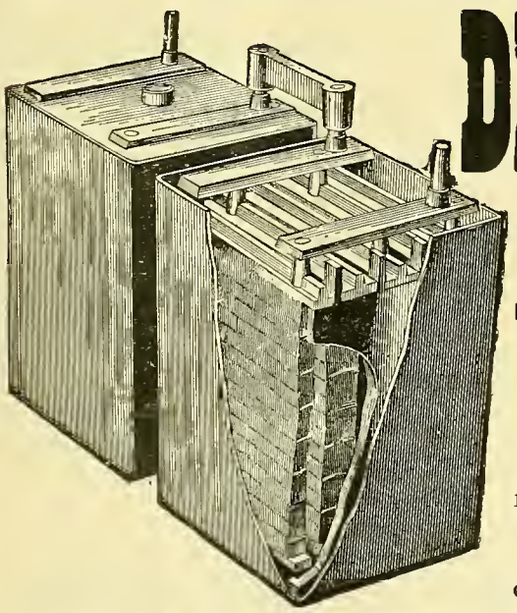

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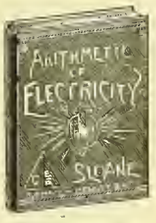

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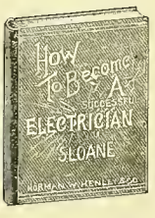

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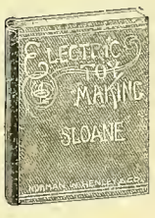

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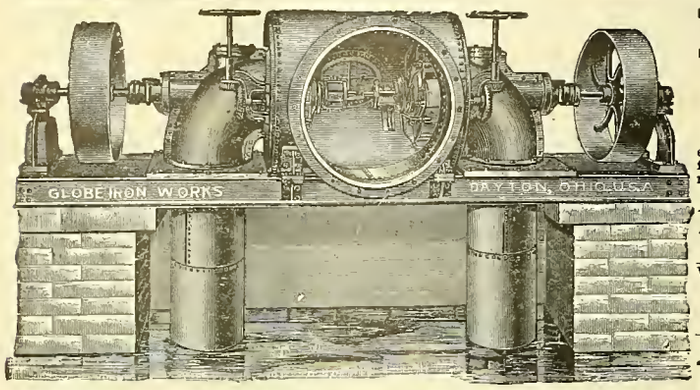


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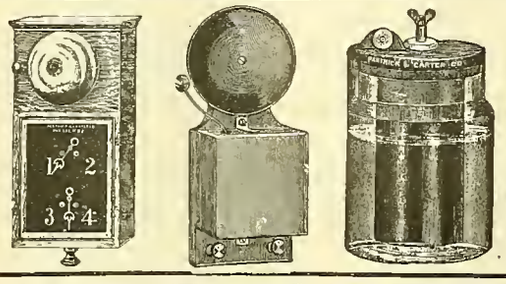

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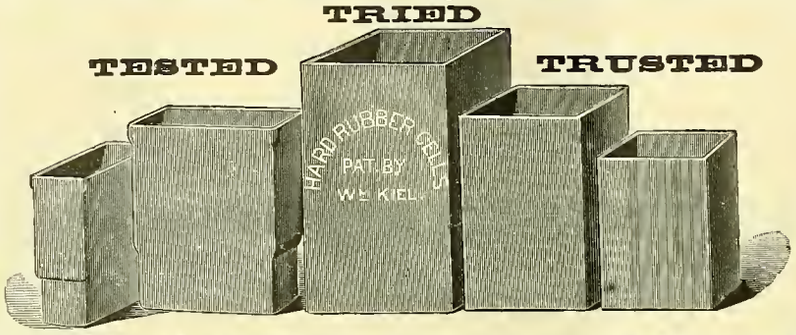


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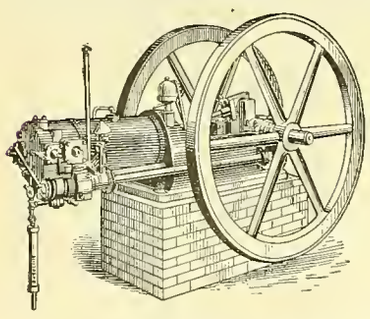

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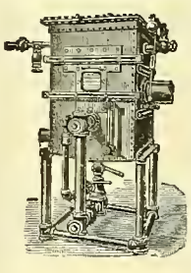

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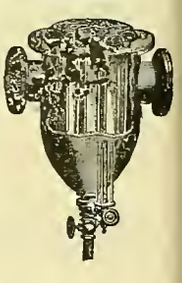

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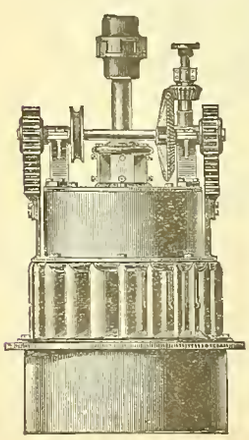

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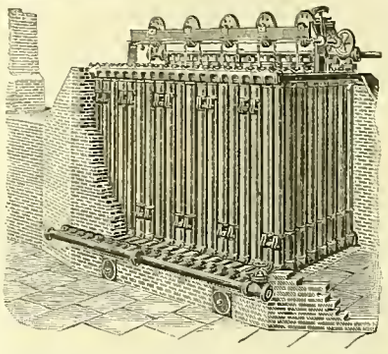

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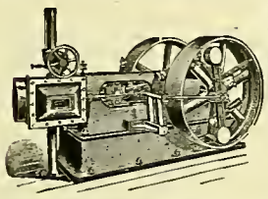

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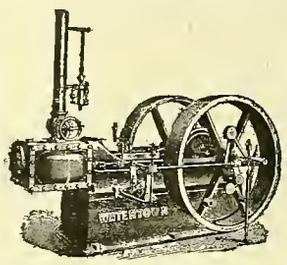

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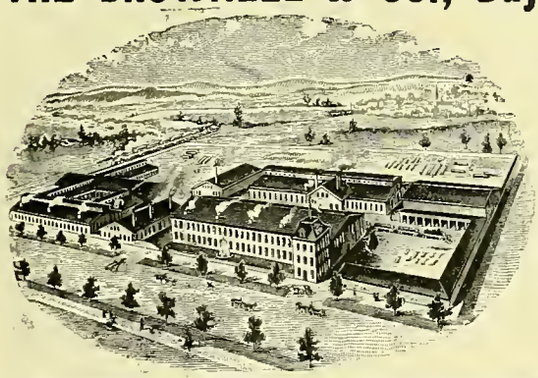

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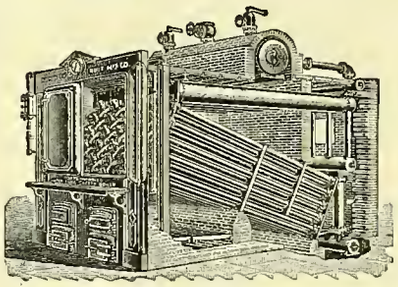

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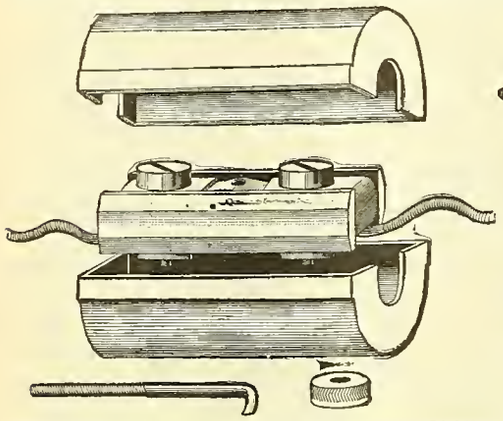

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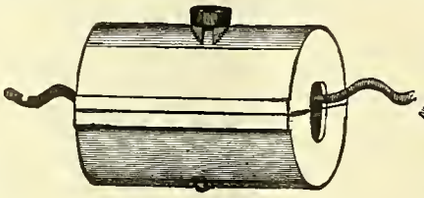

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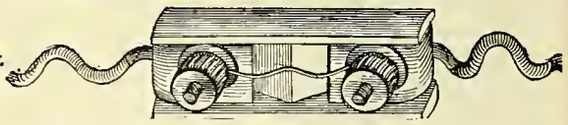

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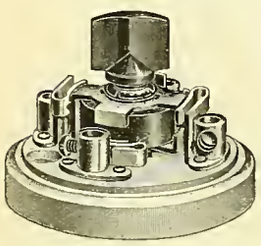

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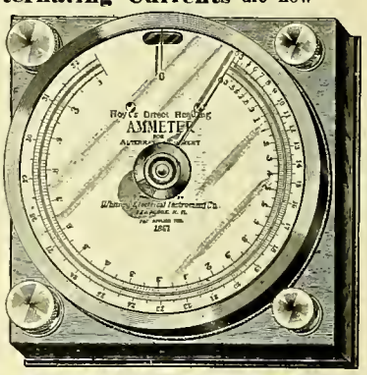


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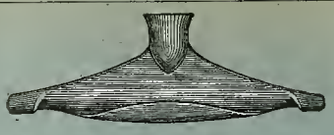

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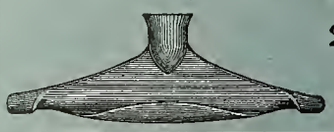

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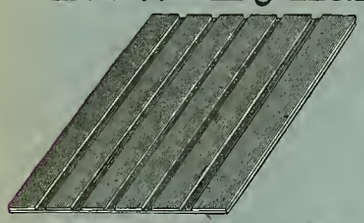

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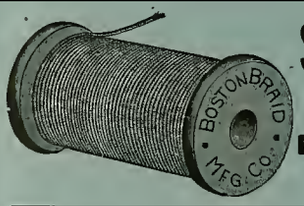


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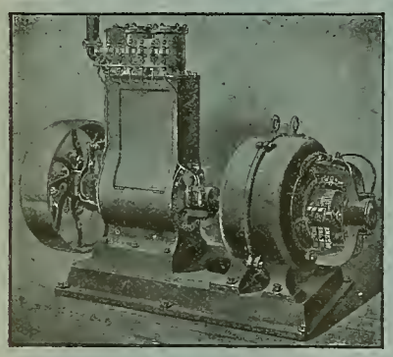

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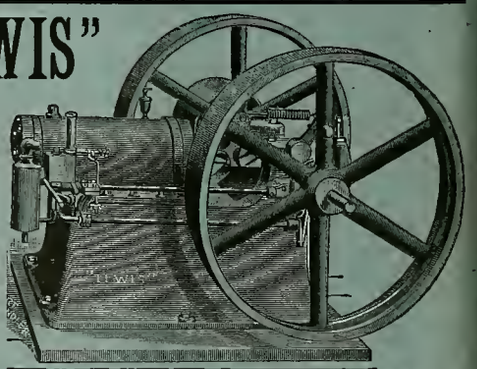

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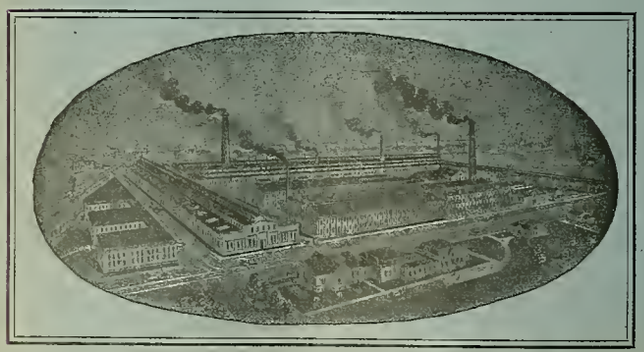

The Brush Double Arc Lamp Patents sustained by repeated decisions of U. S. Courts.

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Vol. XVI CHICAGO, JANUARY 19, 1895 No. 3



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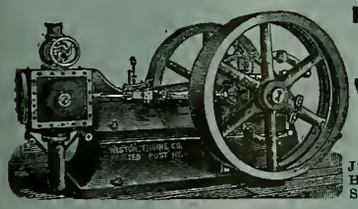

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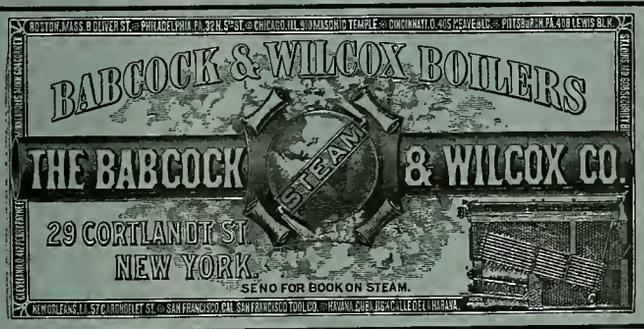


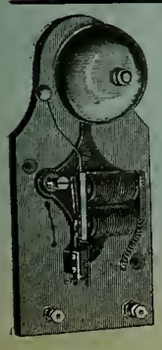

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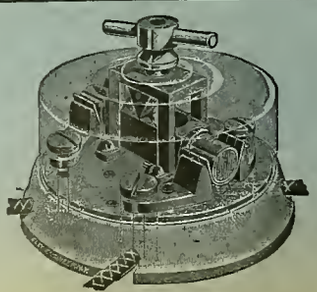

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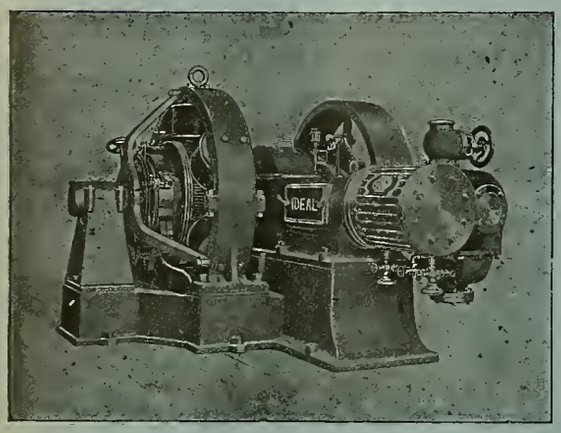


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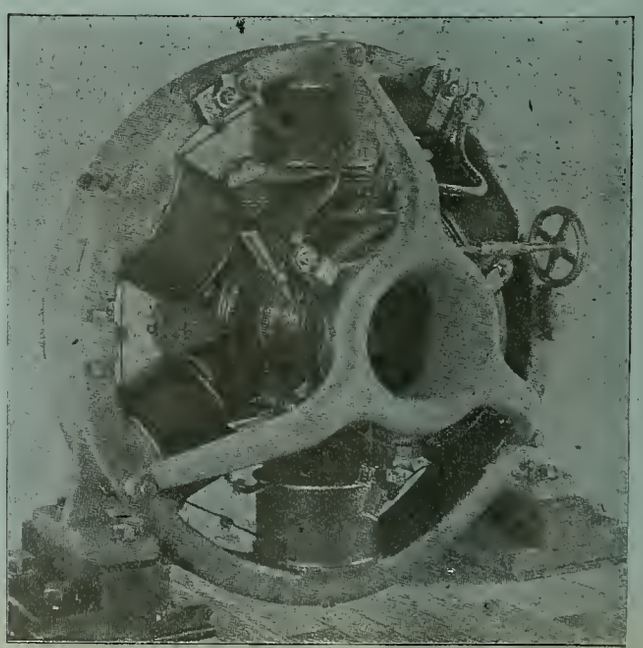

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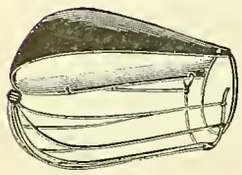
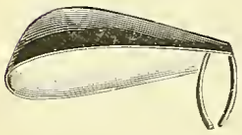
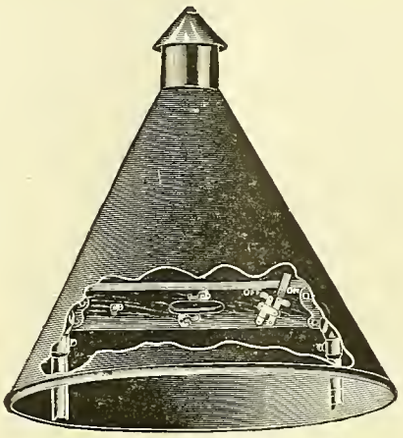
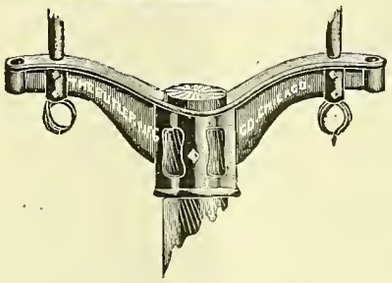

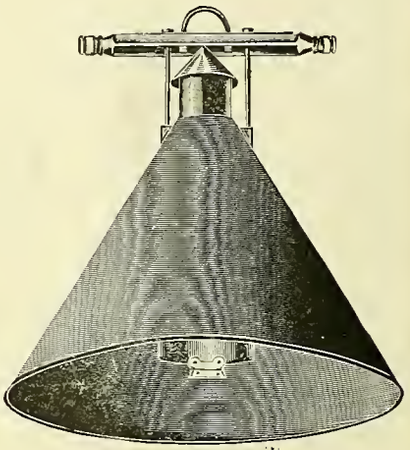
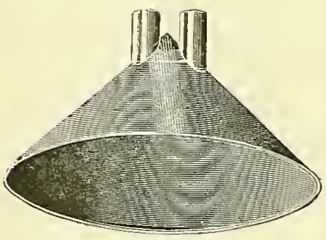
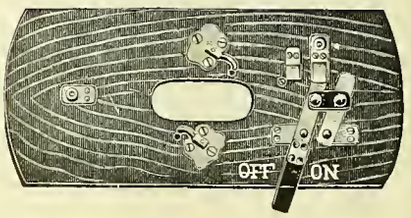

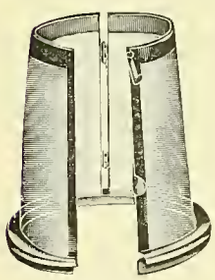
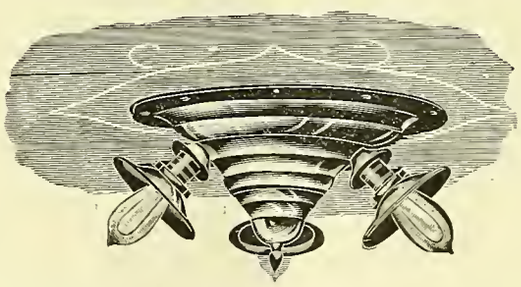
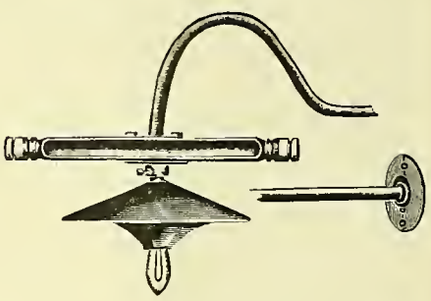
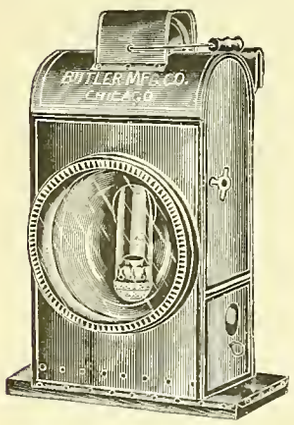

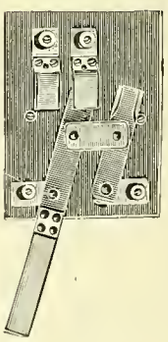
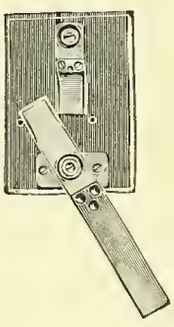
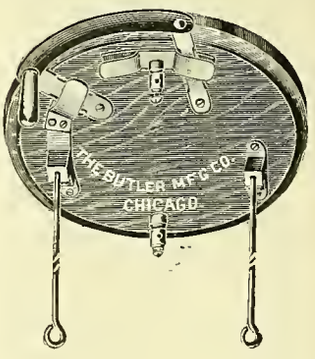


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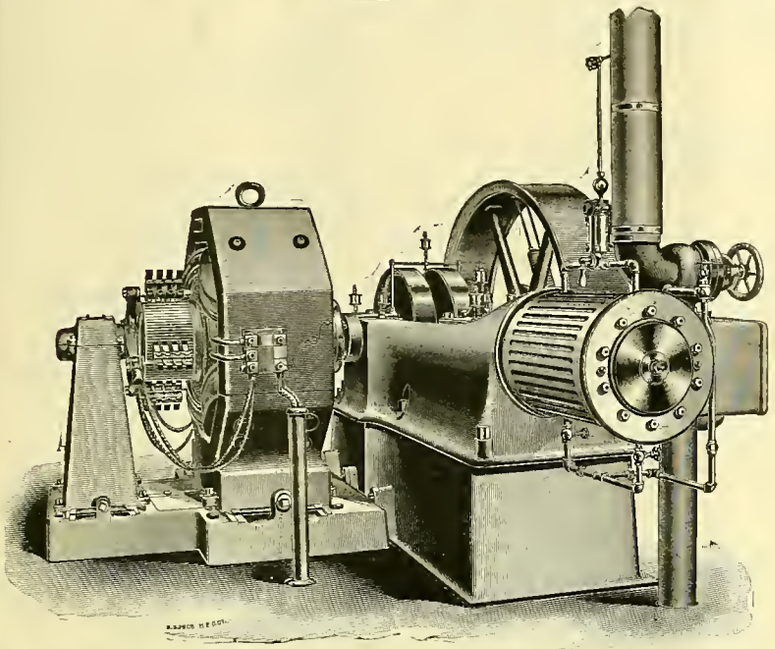

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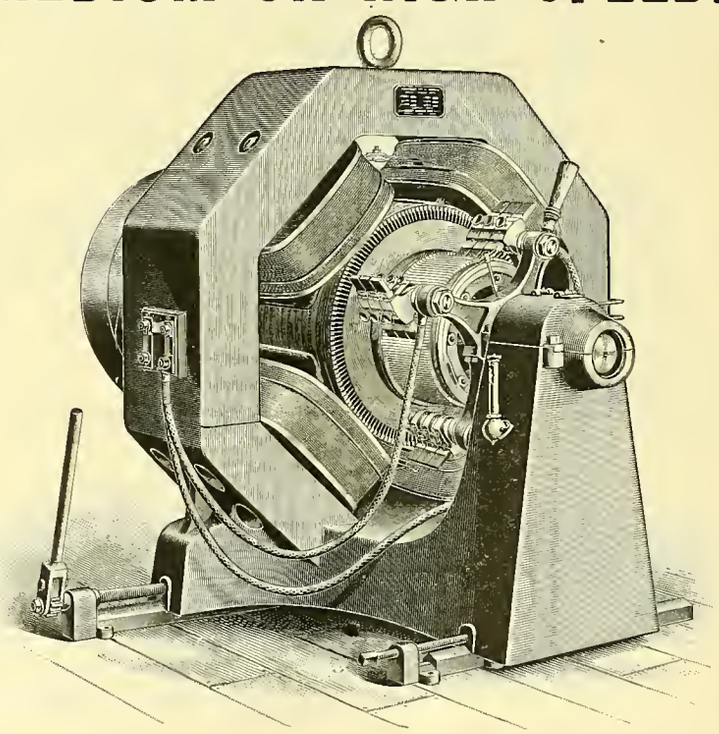

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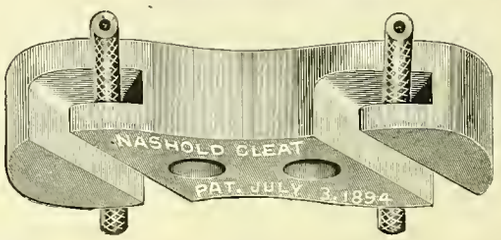


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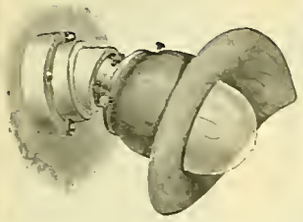

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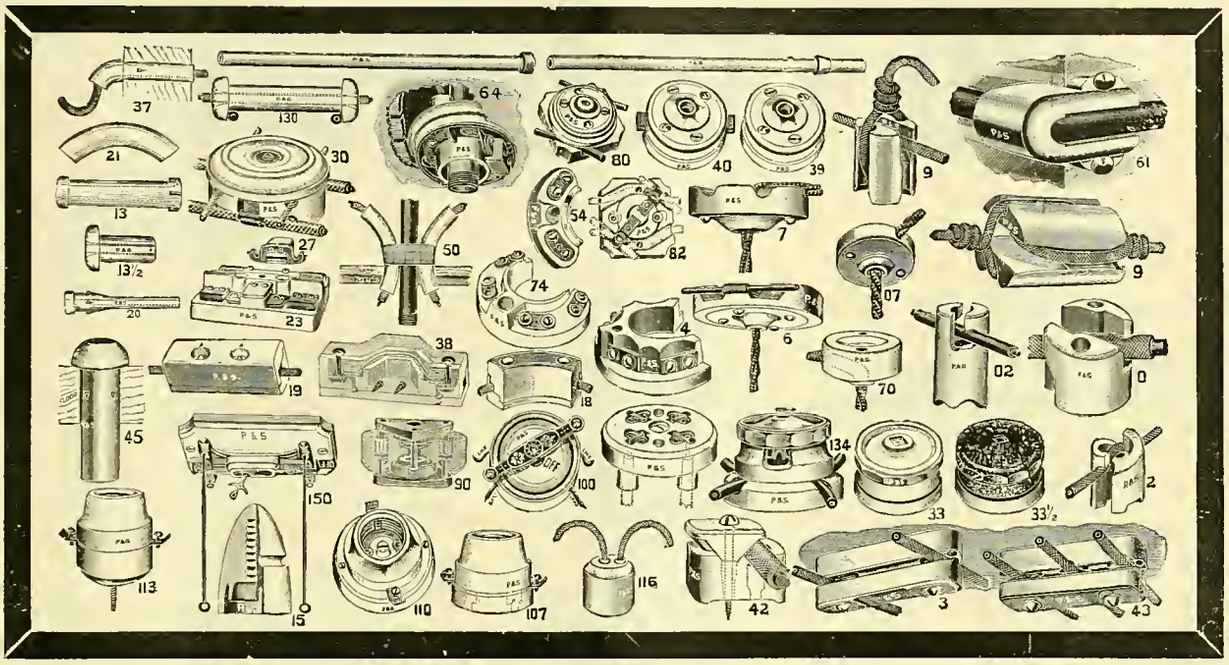

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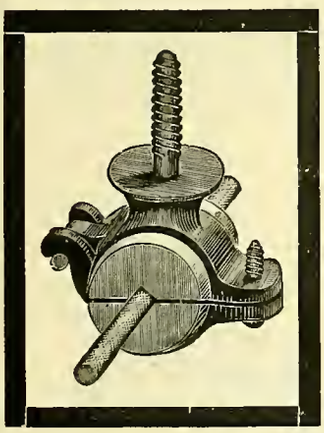


A Complete Stock and Orders Filled on Receipt.
Write for Special Catalogue Covering this Material.

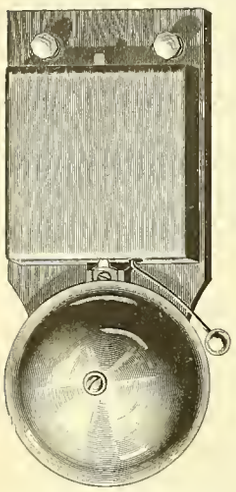
## FLETCHER SPECIALTIES

OF EVERY DESCRIPTION

**Always in Stock.**

# WESTERN ELECTRIC COMPANY,

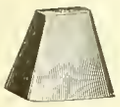
CHICAGO: 227 TO 275 SOUTH CLINTON STREET.



Ask your Supply House for

# "REX" FANCY GONGS.

Made of Cast Bell Metal.


Cow.

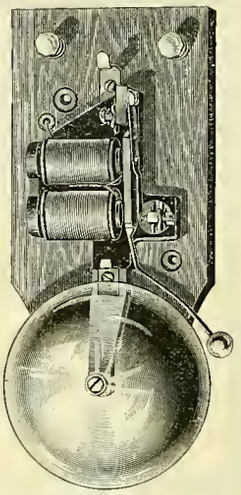
Sleigh.

New Band.

Garland.

Tea.

Dome



ORIGINALITY. SIMPLICITY. DURABILITY. RELIABILITY.

PROCTOR-RAYMOND ELECTRIC CO.

MANUFACTURERS OF ELECTRICAL SPECIALTIES & SUPPLIES

**ROCHESTER, N. Y.**

Remember our Motto: The very best goods at the very lowest prices.

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# THE COLUMBIA

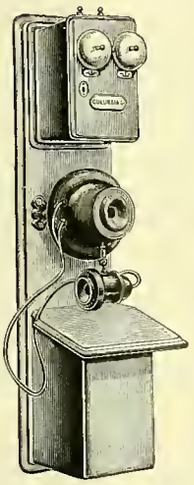
THE LATEST AND BEST.

PATENTS FUNDAMENTAL—NON-INFRINGING.

## Why Not Own Your Telephone?

**LONG DISTANCE BATTERY TRANSMITTERS**

of the latest and newest designs sold outright. No adjustment. Nothing to get out of order. Nothing demanding repair. Will convey articulate speech 1,000 miles. Constructed of the best material.



**A TELEPHONE RECEIVER**

of the newest and best pattern. Unique in design. Perfect in action. Moderate in cost. Small instruments made of the finest rubber. All wires and connections within the case. No unsightly thumbscrews.

This Company owns the patent for the improved Switch for changing the circuit of the Telephone on battery transmitters. Also for perfected system of telephone exchanges. The best DRY BATTERY manufactured. Send for Circular.

# THE COLUMBIA TELEPHONE MANUFACTURING CO.,

**136, 138, 140 Front St., New York City.**

# R. D. NUTTALL COMPANY, Allegheny, Pa.

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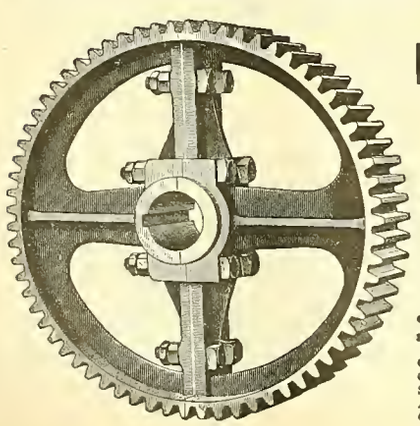
J. R. McGINLEY, Vice-President.
F. S. MARTIN, Superintendent of Works.



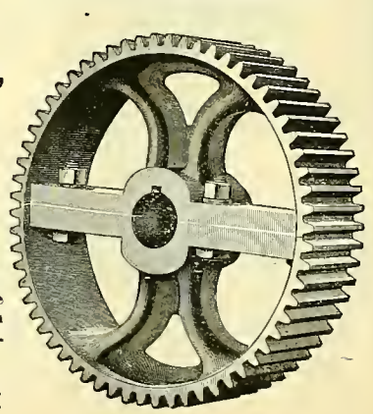
MANUFACTURERS OF

## Electric Railway Supplies.

**GEARS, PINIONS, BEARINGS, TROLLEYS, TROLLEY WHEELS AND HARPS.**

THIS IS THE IMPROVED NUTTALL TROLLEY.

TRY IT ONCE, AND YOU WILL WANT NO OTHER.



**The largest and most prosperous street railway companies in the country are using our supplies, and they prefer them to all others on account of greater strength and durability. Correspondence solicited.**

CHAS. J. MAYER, 600 Betz Building, Philadelphia, Pa., Middle States Sales Department.
CHAS. N. WOOD, 180 Summer St., Boston, Mass., New England States Sales Department.
STANDARD R'Y SUPPLY CO., Mooredock Block, Chicago, Ill., N. W. States Sales Department.
A. S. PARTRIDGE, Bank of Commerce Building, St. Louis, Mo., S. W. States Sales Department.
CHAS. A. CAVAGNA, Neave Building, Cincinnati, Ohio, Central States Sales Department.

C. G. PERKINS, President.
J. J. GATES, General Manager.
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# The Perkins Electric Switch Manufacturing Co.

**WE MANUFACTURE**

THE "WATERHOUSE"
Incandescent Arc Lamp.

THE GIBBS
Snap Switches.

THE PERKINS
Sockets and Receptacles.

THE PERKINS
Dovetail Ceiling Cut-Out.

The "WATERHOUSE, GAMBLE & CO." Arc Lamp is always taken where sale depends upon competitive test. Why?

The "GIBBS" Switch only needs a trial to convince the most skeptical that it is the most durable, simple and efficient Switch in the market.

The "PERKINS" Sockets and Receptacles have been in the market three years on their merits. They are still being sold.

The Dovetail Ceiling Cut-Out speaks for itself.

**OUR PRICES HIGH? NO!**

**NOTE: Full stock of these goods carried in Chicago.**

## Hartford, Conn.

CHICAGO OFFICE: 1536 Monadnock Bldg.
G. W. CONOVER, Manager.
BOSTON OFFICE: 620 Atlantic Ave.
F. B. SMITH, Manager.

WRITE US FOR CATALOGUE AND DISCOUNTS AND BE CONVINCED.

# AN ILLUSTRATED STORY—

## OF 1894-95.

# "WE'VE PROSPERED"—

WILLARD W. LOW. THOS. I. STACEY.

## THE ELECTRIC APPLIANCE COMPANY,

## CHICAGO.

# WHY?—

# —? BIG STOCK! QUICK SHIPMENTS!

Fig. 4. Switchboard. Fig. 5. Basement.
Fig. 6. Shipping Department.

THE ELECTRIC APPLIANCE COMPANY, CHICAGO.

# "SQUARE" TREATMENT!

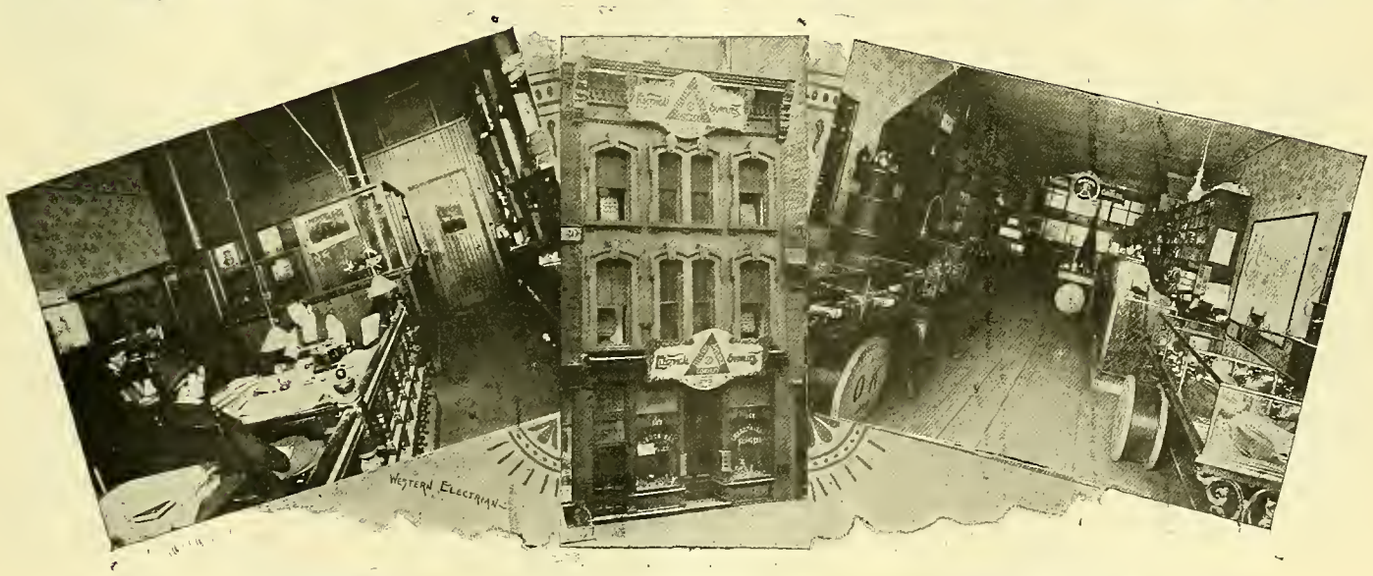
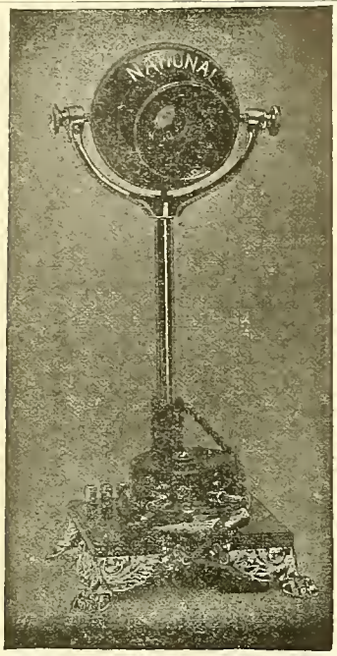



Fig. 1. Offices. Fig. 2. Exterior View. Fig. 3. Salesroom.

THE ELECTRIC APPLIANCE COMPANY, CHICAGO.

# AND PRICES!

## TRY US, AND YOU'LL SOON KNOW THE REASON "WHY!"




# DESK SET,

WITH

*Long Distance Transmitter.*

Now being tested by the U. S. Government at Sandy Hook, N. J.

In use at the U. S. Military Academy, West Point, N. Y.

## NATIONAL Telephone Mfg. Co.,

620 (W) Atlantic Avenue,

**BOSTON, MASS.**

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## OCTAGONAL PINE POLES, NORWAY PINE CROSS-ARMS, WHITE OAK PINS.

**It will pay you to get our prices**

BROWNLEE & CO., - Detroit, Mich.

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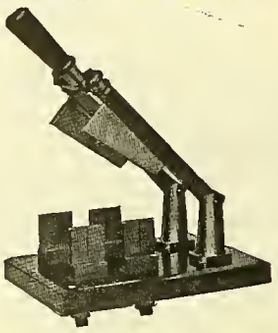
**Switches, Switch-Boards, Tablet-Boards.**



*Estimates and designs furnished on Application.*

Charges reasonable for superior work.

Technic Electrical Works, 129 Bread Street, PHILADELPHIA.

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—OF—

**All Colors and Descriptions.**

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## Automatic Mercurial Pumps

OF LATEST DESIGN

For Incandescent Lamp Companies.

Scientific glass apparatus for Laboratories, Colleges, etc. Reliable workmanship and lowest prices. Agents wanted in Western Cities. **Send for new Catalogue.**

**The Jaeger Mfg. Co.,**

169 William St., **NEW YORK.**

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# ARC LAMPS FOR INCANDESCENT CIRCUITS,

**Both Alternating and Direct.**

Standard "Ward" Lamps, - $10 Each

TWO IN SERIES ON 110 VOLTS. Globe and Resistance, $2 extra per lamp.

**A COMPLETE LINE of ENTIRELY NEW Arc Lamps.**

**SIMPLEST. STRONGEST. SUREST FEED.**

Easiest and Cheapest to Maintain.

SPECIAL LAMPS OF ALL KINDS.

**Write us for Circulars.**

We carry a stock of FIDELITY carbons and IMPORTED CORED carbons, which we are selling at reduced prices.

**Users of Arc Lamps should Write us for Prices.**

## Electric Construction & Supply Co.,

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**(Established 1881.)**

Wallace Electric Co., Agents, 307 Dearborn Street, Chicago, Ill.

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SEND FOR SAMPLES AND PRICES OF

## SAMSON SPOT CORD

For Arc Light and Trolley Cord.

SAMSON CORDAGE WORKS, - BOSTON, MASS.

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## Boswell Storage Battery.

For Traction Work, Electric Lighting, Electric Launch, Telegraph, Phonograph, Surgical, and for all purposes where Light and Power are required.

Prices on Application.

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Guaranteed the best Dry Battery ever made. Internal short circuiting or local action is eliminated. Will not deteriorate when not doing work. Will hold its first value over long periods of time. Internal resistance small; high and constant E. M. F. Will not run down or die on the shelf. No bursting of seals or oozing of salts from the top.

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Cartridge or Porous Cups made of especially prepared paper. One-half the size and one-third the weight of other porous cups. Guaranteed to be equal to any Salammoniac battery made. The cheapest battery now on the market.

### TEMPERED COPPER.

All patterns of tempered copper segments guaranteed true to gauge, free from defects; an alloy; finish and temper equaled by none. Exclusively used by some of the largest companies in the country.

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The Only Clocks Used in the W. U. Tel. Co. Time Service.

**NO WINDING. CORRECTED HOURLY.**

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*Clocks Sold. Clocks Rented.*

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**ELECTRIC CO., 192 Broadway, New York,**

Is the only concern in the world that makes

Arc Lighting

Apparatus for every purpose, and for use on every current.

Our Arc Lamps can be used on any current whatever

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**CONTRACTORS FOR COMPLETE SUBWAY SYSTEMS FOR ELECTRIC RAILWAYS AND ELECTRIC LIGHT, TELEPHONE AND TELEGRAPH COMPANIES.**

**EDWARD S. PEROT, President.**
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## MANUFACTURERS OF WROUGHT-IRON CEMENT-LINED TUBES FOR ELECTRIC SUBWAYS.

**Works, HASTINGS-ON-HUDSON.** **New York Office, TIMES BUILDING.**

We own Patent No. 395,584, covering Wrought-Iron Cement-Lined Pipe for Subways and the method of Laying. Also, Patents Nos. 416,234 and 416,235 for Distributing Boxes. Over 9,000,000 feet of this Subway Constructed by us *now in use in the United States and Canada*

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# INCANDESCENT STREET LIGHTING FROM ALTERNATING CURRENT DYNAMOS.

**Series Lamps.** **Series Sockets.** **Street Fixtures.**

Incandescent Lamps for Arc and Multiple Circuits.

Trial orders mean permanent business. Correspondence solicited.

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# AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,

Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

CABLES FOR AERIAL AND UNDERGROUND USE.

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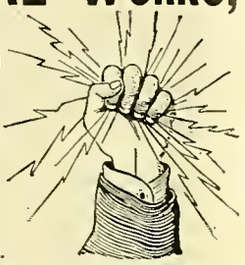
CHICAGO STORE, F. E. Donohoe, 241 Madison St.
MONTREAL BRANCH Eugene F. Phillips' Electrical Works.



GOUBERT

The Goubert Manufacturing Co.

The Goubert Feed Water Heater AND The Stratton Separator

Absolutely Dry Steam

Safety and Economy

14 & 16 Church St. cor. Cortlandt New York.

STRATTON

THE

# "CLARK" WIRE.

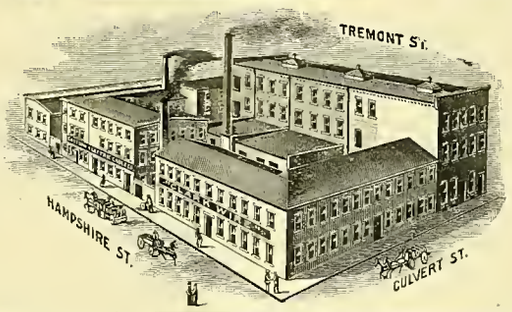
TRADE MARK.

For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

HENRY A. CLARK, Treas. and Gen'l Mgr.

HERBERT H. EUSTIS, Prest. and Electrician.




**In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."**

The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first class Insulated Wire.

We shall be pleased to mail Catalognes with Terms and Discounts for Quantities.

**EASTERN ELECTRIC CABLE CO.,**

61 and 63 Hampshire St., Boston, Mass.

**Send for Catalogue.**

ALL KINDS PRICES OF PARTS Dynamos and Motors AND PARTS OF SAME TELEPHONES ELECTRICAL SUPPLIES

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# Electric Light Carbons

*We make a specialty of MOTOR and DYNAMO BRUSHES and BATTERY MATERIAL.*

It will pay you to see our product and get our prices before placing your orders.

## SPEAKING TUBES AND WHISTLES.

Oral, Electric, Pneumatic and Mechanical

**ANNUNCIATORS AND BELLS.**

Full Line Always in Stock.

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Send for NEW CATALOGUE. Out August 1st.

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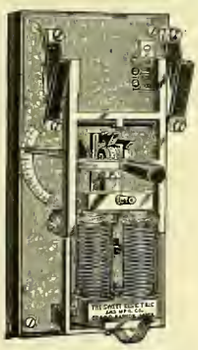
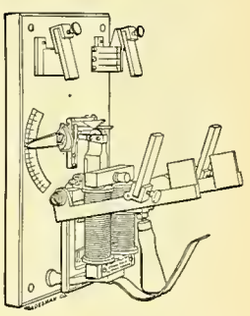


No! we make the final break off from carbons so that it is impossible to get heat enough to fuse points of your copper contact plates; no filing off of rough points, no hanging on after you have had a short circuit or over load, bound to work as easily after opening 1,000 times as it does when opened the first time.

**WE KNOW YOU NEED OUR CIRCUIT BREAKER,** and do not see why you should delay writing us any longer. One burn out will pay for a dozen of our instruments. **To be used on the Alternating or Direct Current Systems.**



**WRITE US AT ONCE.**

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# "IDEAL" INSULATED COPPER WIRE.

**Approved by the New York Board of Fire Underwriters.**

The Only Authorized FIBRE COVERED WIRE for INSIDE, TUBE and CONCEALED WORK GENERALLY.

**It will not Deteriorate by long use, nor Oxidize the Copper. Finished in the following Styles: Black Polished, White and Black Glazed Braid and White Fireproof.**

We can freely recommend this Wire for all inside wiring, from the fact that recent insulation tests made by reliable authorities show that it stands very high.

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Chicago Agents, ELECTRIC APPLIANCE CO.

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# TELEPHONE
## WIRE AND CABLES.

Every Telephone Company in the United States is using Kerite Wire and Cables. Kerite is the Standard of High Grade Insulation, and will Cut Last and Out Class any other on the Market.

SEND FOR SAMPLES AND PRICES.

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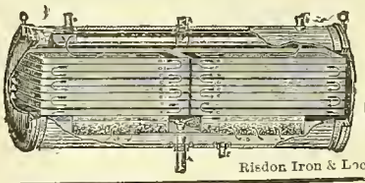
**W. R. BRIXEY, Mfr.**
203 Broadway, New York.

# Stilwell's Patent Live Steam-Feed Water Purifier.



**Removes all Impurities.**

Entirely prevents *scale* in Steam Boilers. Catalogue on application.

The Stilwell-Bierce & Smith-Vaile Co.,
DAYTON, OHIO.

Risdon Iron & Locktive Wks, San Francisco, Cal., Pacific Coast Agts.

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On and after December 1st, Baggage Agents of the B. & O. R. R. Co. will accept coupons from mileage books issued by B. & O. R. R., P. & W. R'y, B & O. S.-W. R'y and Valley R'y of Ohio, in payment for excess baggage charges, at their face value, 2 cents each. This arrangement will not include B. & O. Mileage Books endorsed "good only on B. & O.," B. & O. Southwestern Mileage Advertising Books, nor books older than one year from date of issue.

## Cheap Trans= portation.....

One-twentieth of a cent a mile, on the **Imperial Wheel.** Cheaper than other bicycles because less repairs are needed. Our convincing catalogue for the asking.

AMES & FROST COMPANY
CHICAGO, ILL.

## WANTED.

A young man with fifteen years' experience as an electrical engineer desires a position as superintendent or electrician for street railroad or electric light company. Have had experience in all apparatus in practical use for light and power. Am also expert on steam, and have 6 years' practical experience in storage battery work. Can furnish references. Address **M. H. W.,**
Care WESTERN ELECTRICIAN,
6 Lakeside Bldg., Chicago.

## WANTED.

An electrician of ten years' experience in the manufacture of dynamos and motors, desires position as superintendent or foreman with an electrical manufacturing company. Best of references.
Address "**Foreman.**"
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6 Lakeside Building, Chicago.

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A thorough and competent mechanical superintendent to take charge of an electrical manufacturing establishment. State age, experience and salary expected. Best of references required. Address
"**ROYAL ELECTRIC,**"
P. O Box No. 2107, Montreal, Que.

## WANTED—TO LEASE!

An electric light plant; must be in a town of not less than 3,000 inhabitants, Address, with particulars,
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# For Sale Cheap.

I would like to dispose of the following electrical books, which have been used for a short time only.

| | LIST PRICE. |
|---|---|
| 1 Thompson—Dynamo Electric Machinery | $6.00 |
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| 1 Hering—Dynamo Electric Machines | 2.50 |
| 1 Carhart—Primary Batteries | 1.50 |
| 1 Niaudet—Electric Batteries | 2.50 |
| 1 Badt—Incandescent Wiring Hand-book | 1.00 |
| 1 Watson—Wiring Tables | .75 |
| 1 Prevert—Gas Lighting | .25 |
| | $19.50 |

The books are in good condition, but as they are slightly soiled **will sell them cheap.**
What is your offer? Address "***C. H. S.,***"
Care WESTERN ELECTRICIAN,
6 Lakeside Building, Chicago

# PLATINUM
**For all Purposes.**
Scrap and Native Platinum Purchased.
BAKER & CO., 408-414 New Jersey Railroad Ave., Newark, N. J.

## SEND FOR OUR
New Catalogue of
## Electrical Books.
The most complete of its kind ever published.
Sent Free to Any Address.
## We are Headquarters
In the West for *ELECTRICAL BOOKS*, and fill orders promptly, prepaid, on receipt of price.
**Electrician Publishing Co.,**
6 Lakeside Building,
CHICAGO.

# THE NOWOTNY TELEPHONE

Gives service equal to the best long-distance Bell telephone, and are noted for their wonderful volume of sound and clear articulation of speech.

We also **Manufacture Batteries** for every known purpose, which have a world-wide reputation.

**THE NOWOTNY ELECTRIC CO, Cincinnati, Ohio.**

# TELEPHONES!!

This company is manufacturing **A Compound Magneto Telephone**
Which it sells outright under a guarantee both as to efficiency and as against infringement of patents.
It talks as well over one hundred miles as any other Telephone talks over one mile.
This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists
**WESTERN TELEPHONE CONSTRUCTION CO.,**
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# For Sale Cheap.

## 16x36 ALLIS CORLISS ENGINE, IN GOOD CONDITION.

**Taken in exchange for Sioux City Corliss.**

ADDRESS

SIOUX CITY ENGINE & IRON WORKS, Sioux City, Iowa.

# GOLTZ & SINCLAIR,

## Electrical Engineers and Contractors,

**Manufacturers' Agents.**

*Agents for A. L. Ide & Son, Springfield, Ill.,*
(Ideal Engines)

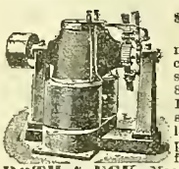
*Agents for Hancock Equipment Co.,*
*Boston, Mass.,*
(Curved Blade Exhaust Fans)

Manufacturers of barrel switches for advertising displays.

377 MILWAUKEE STREET,

*Academy Building,* **MILWAUKEE, WIS.**

**Lightest Storage Battery**
IN THE MARKET.
Embodies **new feature** that gives it a decided advantage over other cells. Specially suited for electric launches, traction and lighting work. Write for description of this **new discovery.**
**HASCHKE & CREELMAN,**
Storage Battery Manufacturers,
20-28 W. Randolph St.,
Agents wanted. CHICAGO.



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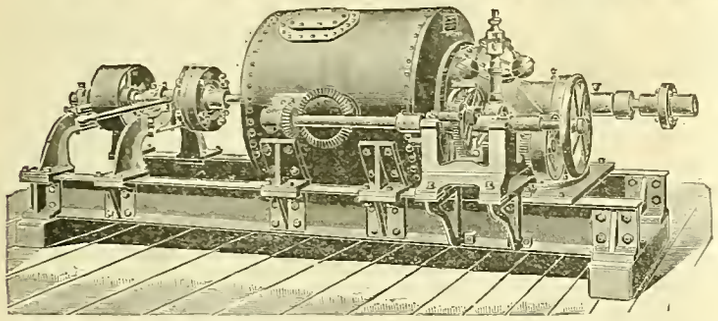

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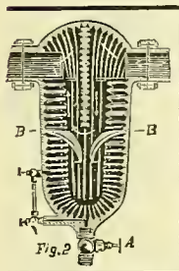


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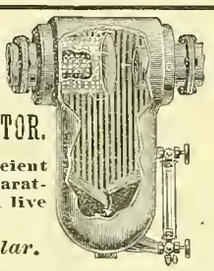

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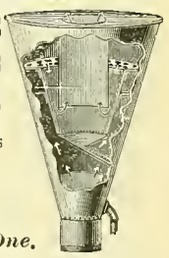

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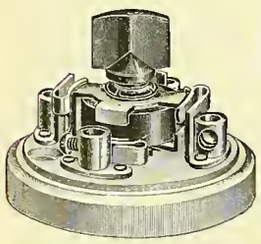

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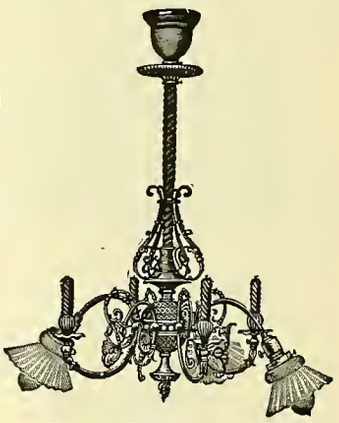

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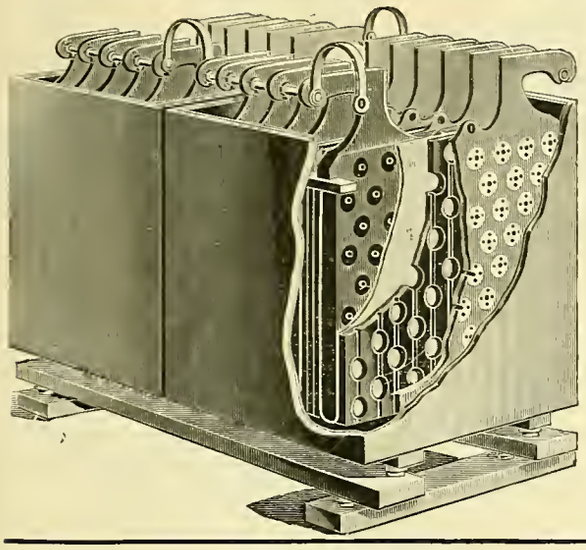

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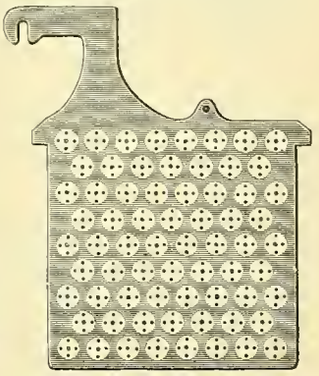

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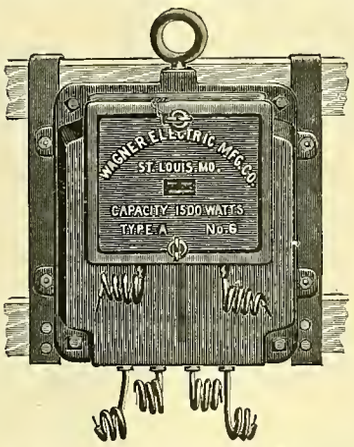


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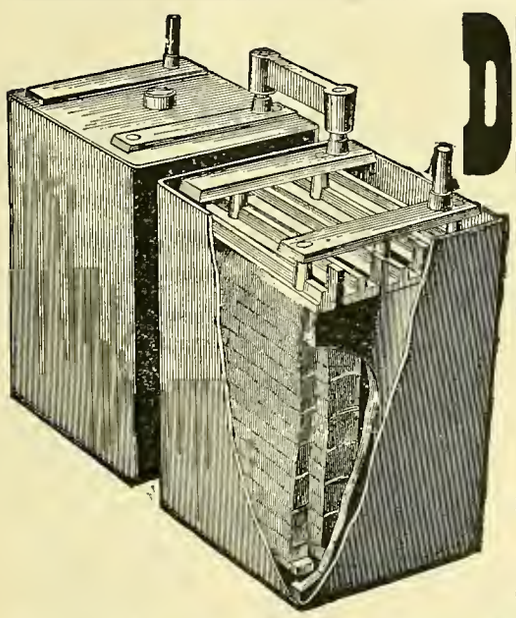

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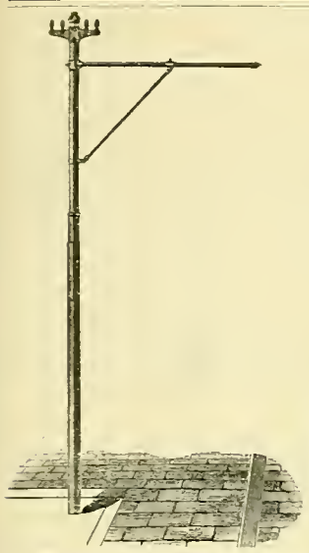

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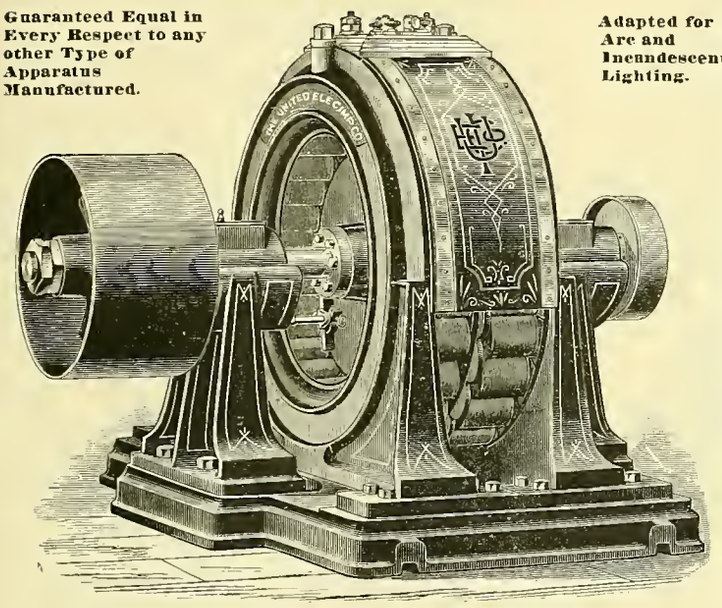


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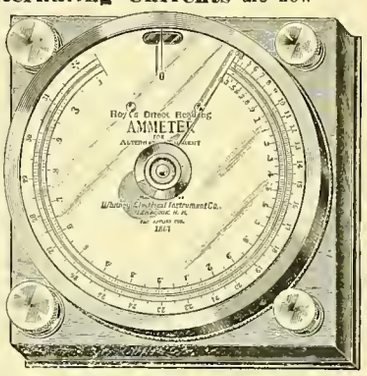


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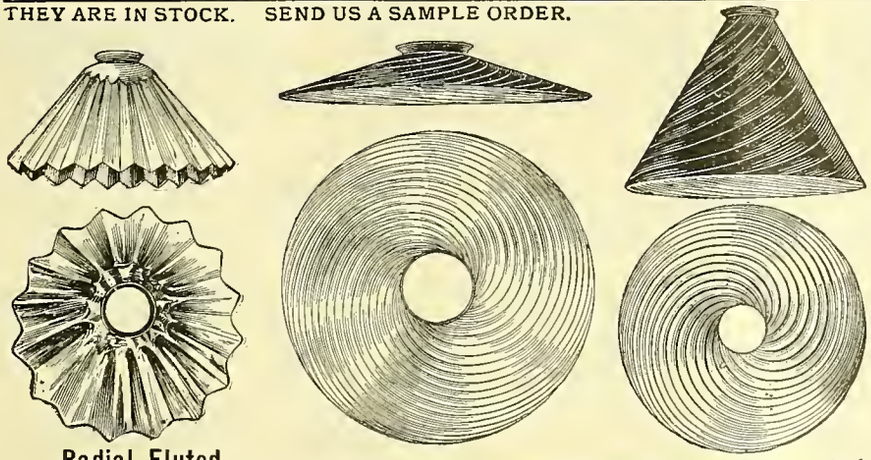

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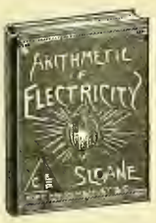

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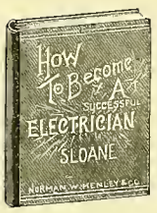

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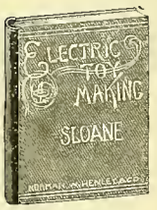

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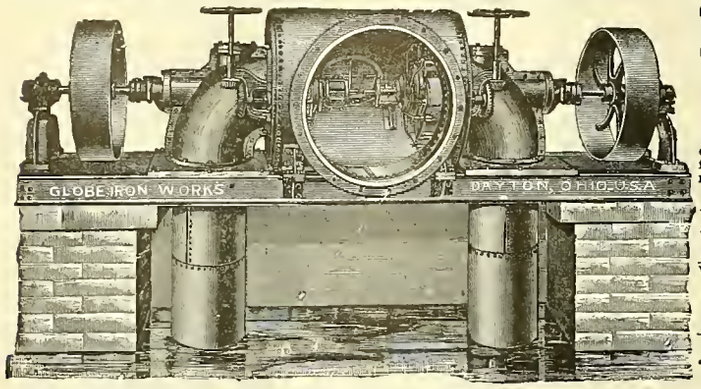


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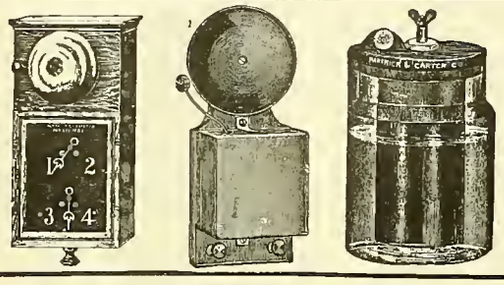

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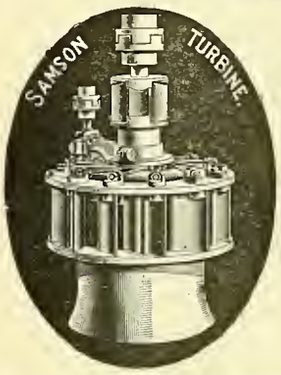


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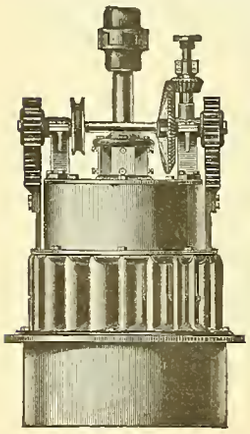

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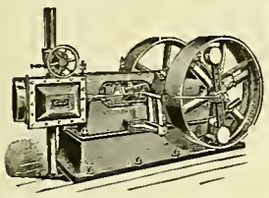

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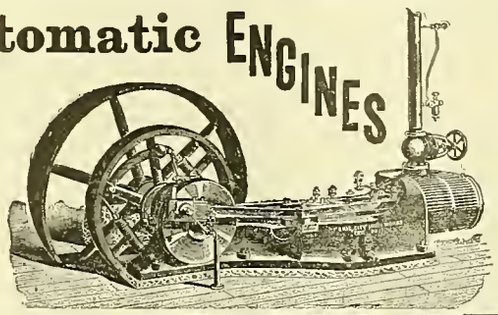

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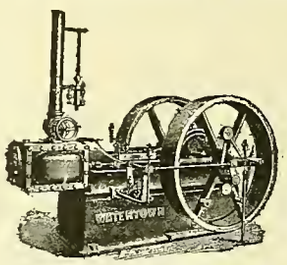

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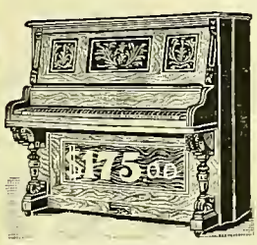

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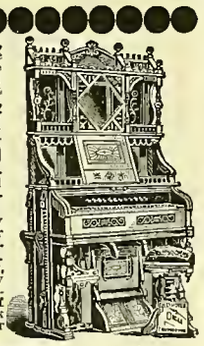

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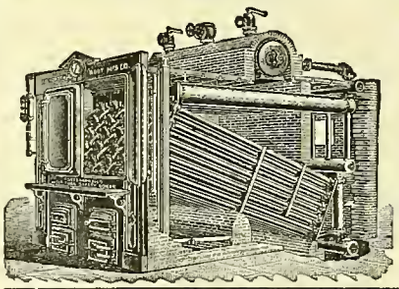

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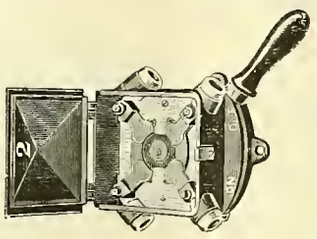

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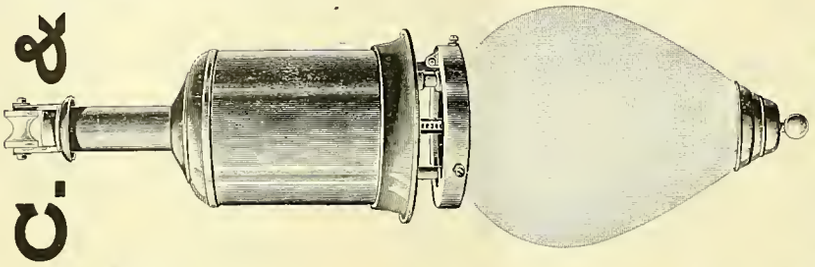

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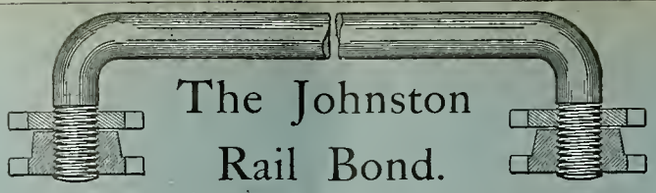

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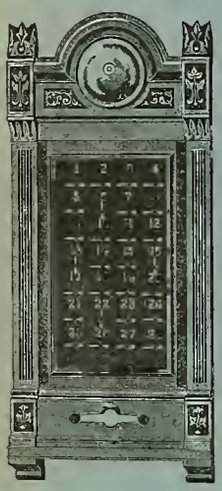

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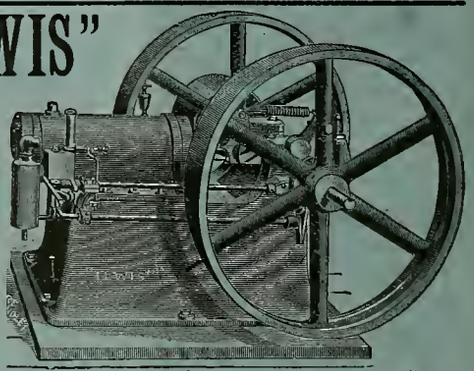

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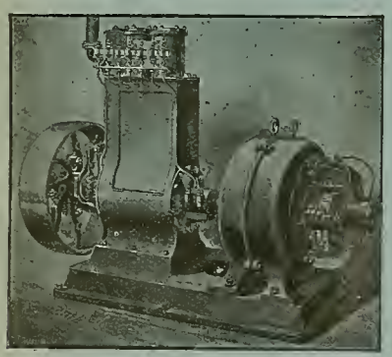

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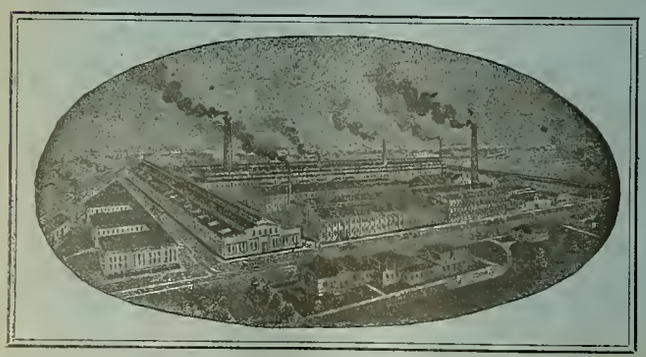

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Vol. XVI. CHICAGO, JANUARY 20, 1895 No. 4



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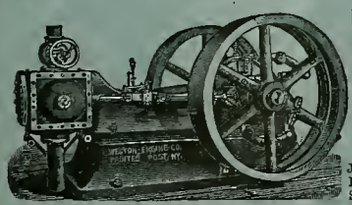

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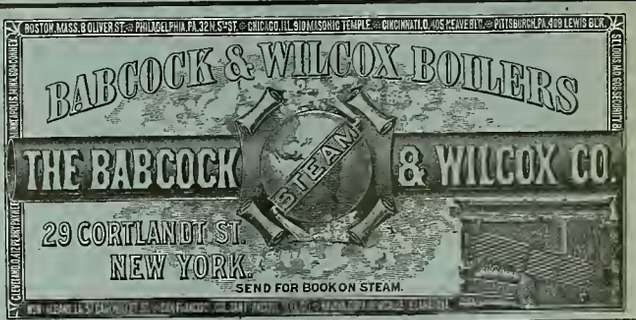


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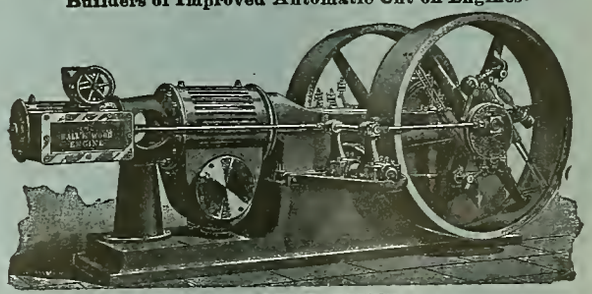

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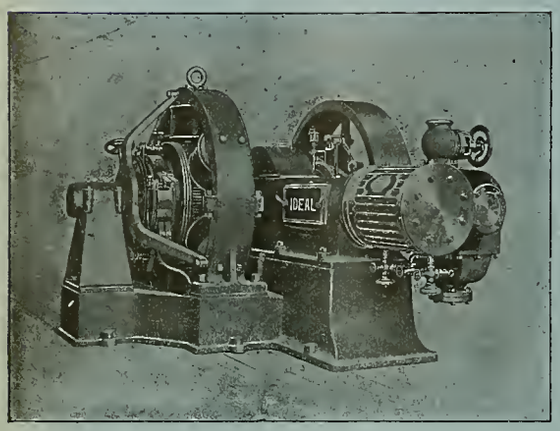


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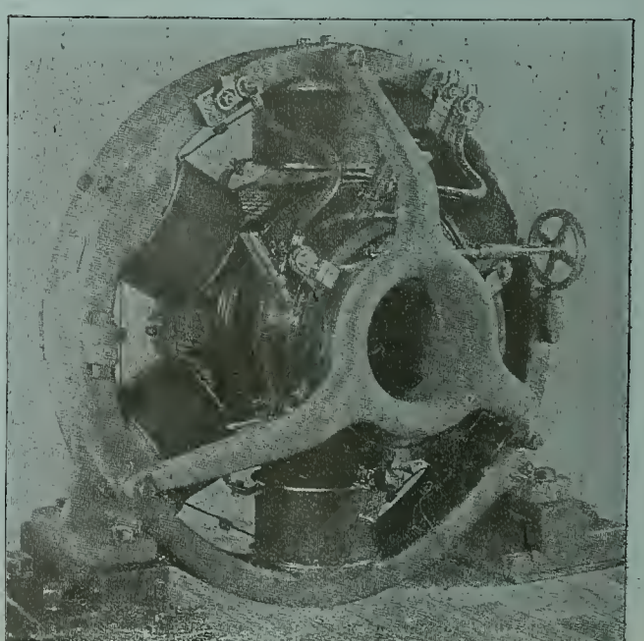

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Kartavert Mfg. Co.
Standard Paint Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Butler Hard Rubber Co.
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Lee & Collins.

**Gas Lighting, Electric.**
Holtzer-Cabot Electric Co.
Lee & Collins.
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Grant, Geo. B.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Audrae, J. & Sons' Co.
Besly & Co., Chas. H.
Bryant Electric Co.
Bunnell & Co., J. H.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
General Electric Co.
High & Co., J. Grant.
Holtzer-Cabot Electric Co.
Interior Conduit & Ins. Co.
Lee & Collins.
Little, F. P. Elec. C. & S. Co.
Nashold Cleat Co.
Nowotny Electric Co.
Palmer Bros.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Proctor-Raymond Elec. Co.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Technic Electrical Wks.
Washington Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Gleason, E. P. Mfg. Co.
Jaeger Mfg. Co., The.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.

**Induction Coils.**
Splitdorf, C. F.

**Insulators and Insulating Materials.**
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Andrae, J. & Sons' Co.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Holtzer-Cabot Electric Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
Lee & Collins.
Little, F. P. Elec. C. & S. Co.
Munsell & Co.. Eugene.
Nashold Cleat Co.
National India Rubber Co.
Nowotny Electric Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Paragon Insulating Co.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.
Technic Electrical Wks.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co., J. H.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Lee & Collins.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Am. Electrical Mfg. Co.
Andrae, Julius & Sons' Co.
Beacon Vac Pump & Elec.Co.
Bernstein Electric Co.
Buckeye Electric Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Jaeger Mfg. Co., The.
New York & Onio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg.Co.

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Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

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Bliss Co., E. W.
Hine & Robertson Co.
Lukens Iron & Steel Co.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.

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Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
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C & C Electric Co.
Colburn Electric Mfg. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec, Mfg, Co.
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Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Palmer Bros.
Royal Electric Co.
Roth & Eck.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co

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Garlock Packing Co.

**Paints.**
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Paragon Insulating Co.
Standard Paint Co.

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**Platinum.**
Baker & Co.

**Poles.**
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Whitney Elec. Instrument Co.

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**Steam Pumps.**
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Bradbury-Stone Elec. S Co.
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Electric-Power Storage Co.
Electric Storage Battery Co.
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**Street Cars.**
Brill, J. G. Co.

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Electric Appliance Co.
Lee & Collins.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
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Standard Paint Co.

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Partrick & Carter Co.
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National Telep. Mfg. Co.
Nowotny Electric Co.
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Besly & Co., Chas. H.
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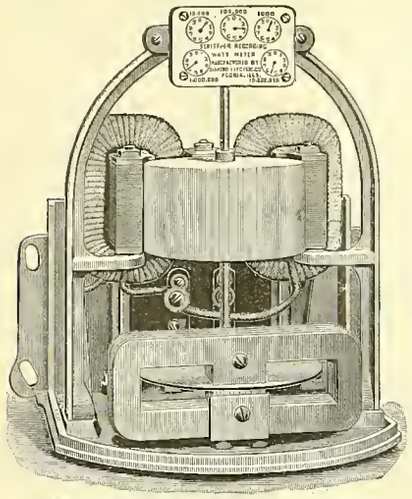
Brixey, W. R.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co
Roebling's Sons Co., J.
Standard Underground C.Co.



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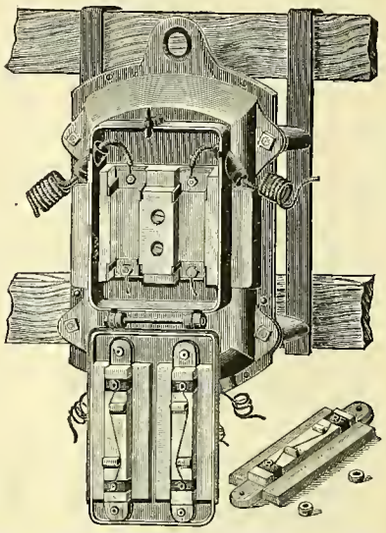
For Alternating Circuits. No Commutator. No Brushes.

Registers Direct Actual Power Consumed.

EASILY ADJUSTED. ABSOLUTELY RELIABLE.



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Simplest, Safest and Best.

FOR ANY VOLTAGE. FOR ALL SYSTEMS.

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# Low Potential Arc Lamps.

*Alternating-Helios, Old Type.*
*Spencer, New Type.*

*Direct Current-Helios, Old Type.*
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**FOR STREET, PAVEMENT AND INSIDE LIGHTING.**

Our Alternating Lamps have reflector plates. Our new Direct Current Lamps do not see-saw when running in series.

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## Alternating Current ARC LAMPS.

# The Kester '95

**IS THE LAMP YOU HAVE HOPED FOR.**

It is the only perfected Arc Lamp for the alternator, either high or low frequency.

It comprises all that is desired in an Arc Lamp.

Write for pamphlet and prices to

## THE F. P. LITTLE Electrical Construction & Supply Company,

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# HELIOS CORED CARBONS For Alternating and Direct Currents.

Attempts have been made in this country to produce a satisfactory cored carbon, but failure resulted in every case. We can now assure the Electric Light Companies that our "HELIOS" CARBON is made of the same ingredients, in precisely the same way,

**By the man who made them in Germany.**

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***NOTE THIS OFFER:—Let us know by telegraph the price you are now paying, stating yearly consumption, and we will guarantee to beat it from 50 cents to $2.00 per thousand.***

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**Philadelphia, Penn'a.**

SOLE MANUFACTURERS —of— Chloride Accumulator

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THE THOMSON-HOUSTON ELECTRIC COMPANY,
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THE ACCUMULATOR COMPANY,
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*Catalogues giving Capacities, Dimensions, Weights, Prices, Etc., on Application.*

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The only complete and perfected system by which light and power can be supplied from the same generator and circuit.

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**Power Generators for Lighting and Railway Purposes.**
**Complete Station Equipments.**

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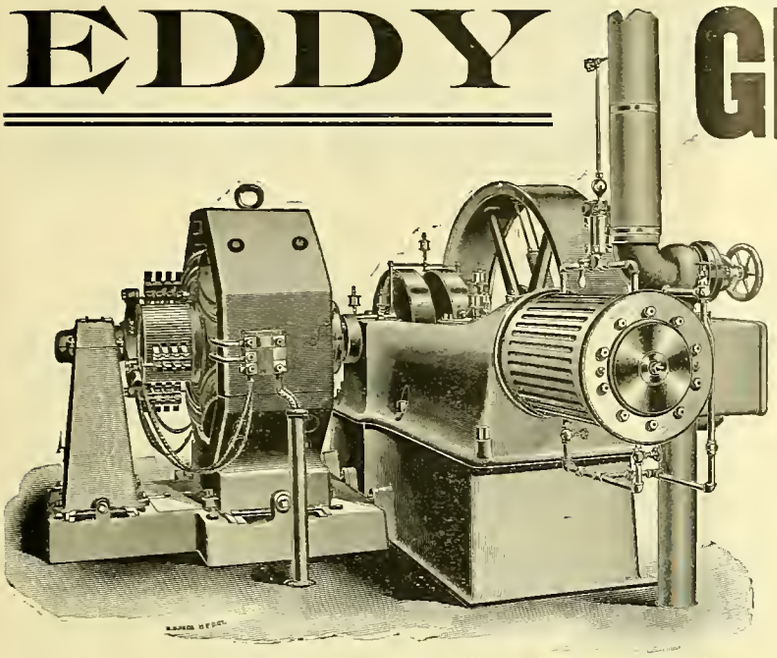

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

**EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.**

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*

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All Our Apparatus Guaranteed as Represented.

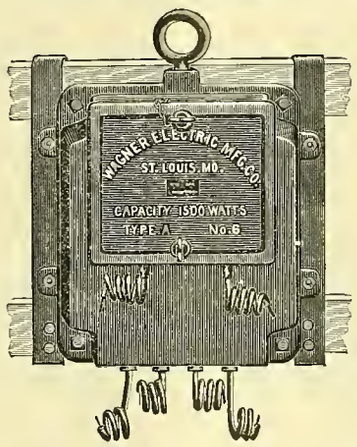
# ALTERNATING CURRENT TRANSFORMERS

Highest Efficiency Ever Obtained.

**TRANSFORMERS**

To order for any purpose, voltage or capacity.

**ALTERNATING CURRENT MOTORS.**




Standard Sizes, 5 Lights to 2,000 Lights.

**HIGH POTENTIAL SWITCHES,**

Complete Switch Boards

For Central Stations and Isolated Plants.

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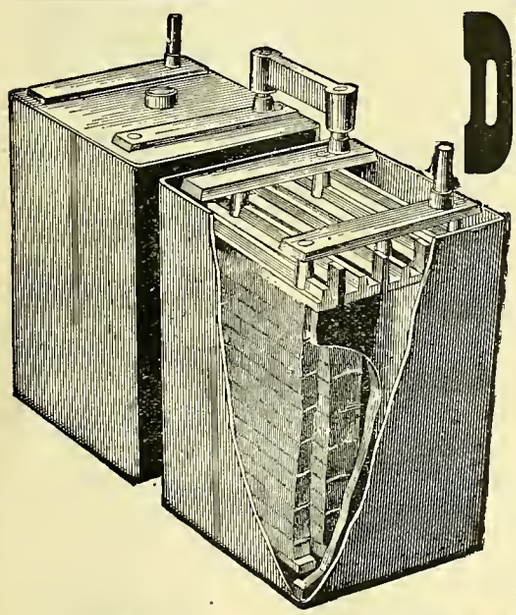

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By all who have used

**STANDARD PLANTÉ BATTERIES.**

Will not **Sulphate** nor **Disintegrate,** and cannot **Buckle.**

**HIGHEST EFFICIENCY, LARGEST DELIVERY, LEAST INTERNAL RESISTANCE.**

**Cells from 10 to 10,000 Ampere-Hour Capacity.**

**CENTRAL STATION INSTALLATIONS.**

Batteries for **Electric Launches,** for **Dental, Surgical** and **Medical Work,** and for all purposes for which electricity is required.

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Complete Lighting and Power Plants installed as reasonably as consistent with first-class material and workmanship.

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Direct Driven or Belted, in sizes up to 250 H. P. Up to 100 H. P.

Electric Motors, Automatic or Hand Controlled.
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Isolated lighting plants, Central Station Apparatus.

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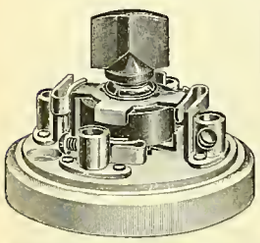
# HART SNAP SWITCHES!

STANDARD SWITCHES, 5 and 10 ampere S. P.
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



## FLUSH SWITCHES

Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

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# ARC LAMPS FOR INCANDESCENT CIRCUITS,

Both Alternating and Direct.

Standard "Ward" Lamps, - $10 Each

TWO IN SERIES ON 110 VOLTS. Globe and Resistance, $2 extra per lamp.

A COMPLETE LINE of ENTIRELY NEW Arc Lamps.

SIMPLEST. STRONGEST. SUREST FEED.

Easiest and Cheapest to Maintain.

SPECIAL LAMPS OF ALL KINDS.

Write us for Circulars.

We carry a stock of FIDELITY carbons and IMPORTED CORED carbons, which we are selling at reduced prices.

Users of Arc Lamps should Write us for Prices.

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(Established 1881.)

Wallace Electric Co., Agents, 307 Dearborn Street, Chicago, Ill.

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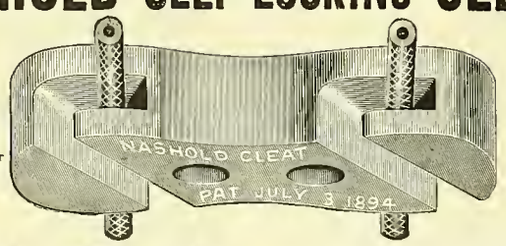
Patented in U. S., Canada, England, France, And Applied for In Germany.




FOR SALE BY ALL ELECTRICAL SUPPLY HOUSES.

It is the most practical Cleat made.
It is made of finest glazed porcelain.
It is in one piece.
It has the strength.
It will lock the wire firmly.
It will NOT break in putting up.
It will NOT hold moisture.
It will NOT hurt the insulation.

The wire can easily be put in place or removed without loosening the Cleat. It is a great saver in Time and Labor over any other Cleat in use for putting up Electric Light or other Wires.

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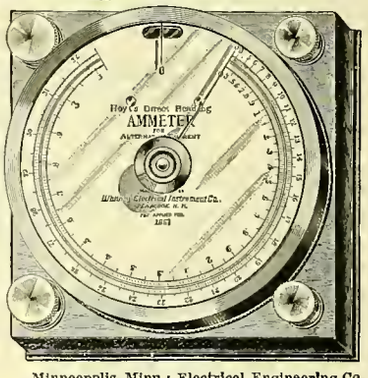
# Something New.

The **Hoyt Standard Ammeters** and **Voltmeters** for **Lamp** and **Meter** measurement on **Alternating Currents** are now ready for the market.

Send for our **1894 Catalogue** which contains the above and other new instruments of our manufacture.

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New York City: Geo. L. Colgate, 136 Liberty St.
San Francisco, Cal.: California Electrical Works.
St. Louis, Mo.: St. Louis, Electrical Supply Co.
Little Rock, Ark.: The Brown Elec. & Mach'ry Co.
Minneapolis, Minn.: Electrical Engineering Co.
Denver, Col.: Russell & Officer Elec. Constr. Co.
Omaha, Neb.: Western Electrical Supply Co.
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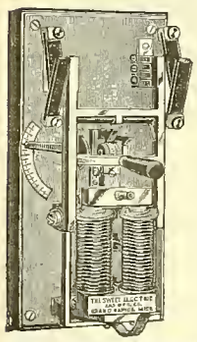
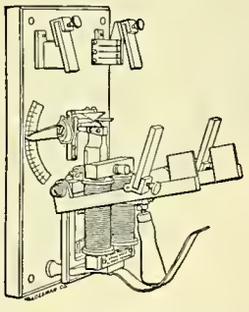
# Hot Stuff.



No! we make the final break off from carbons so that it is impossible to get heat enough to fuse points of your copper contact plates; no filing off of rough points, no hanging on after you have had a short circuit or over load, bound to work as easily after opening 1,000 times as it does when opened the first time.

**WE KNOW YOU NEED OUR CIRCUIT BREAKER**, and do not see why you should delay writing us any longer. One burn out will pay for a dozen of our instruments. **To be used on the Alternating or Direct Current Systems.**



WRITE US AT ONCE.

## SWEET ELECTRIC & MFG. CO.,

GRAND RAPIDS, MICH.

WHY PAY RENT?

# THE COLUMBIA

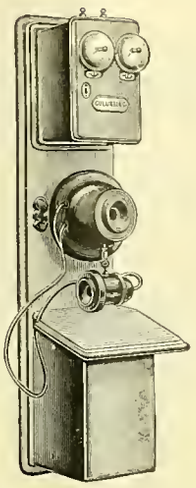
THE LATEST AND BEST.

PATENTS FUNDAMENTAL—NON-INFRINGING.

## Why Not Own Your Telephone?

**LONG DISTANCE BATTERY TRANSMITTERS**

of the latest and newest designs sold outright. No adjustment. Nothing to get out of order. Nothing demanding repair. Will convey articulate speech 1,000 miles. Constructed of the best material.



**A TELEPHONE RECEIVER**

of the newest and best pattern. Unique in design. Perfect in action. Moderate in cost. Small instruments made of the finest rubber. All wires and connections within the case. No unsightly thumbscrews.

This Company owns the patent for the improved Switch for changing the circuit of the Telephone on battery transmitters. Also for perfected system of telephone exchanges. The best DRY BATTERY manufactured. Send for Circular.

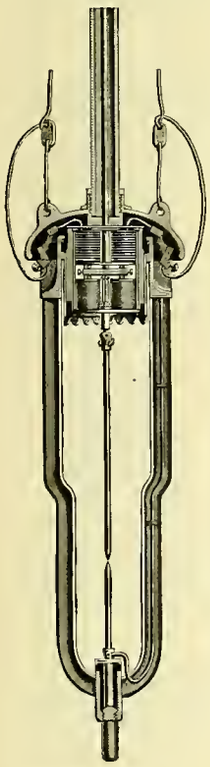
## THE COLUMBIA TELEPHONE MANUFACTURING CO.,

**136, 138, 140 Front St., New York City.**

# The "Waterhouse" Incandescent Arc Lamp.

**THE HIGHEST TYPE OF EXCELLENCE.**

Investigate its Merits Before Buying.



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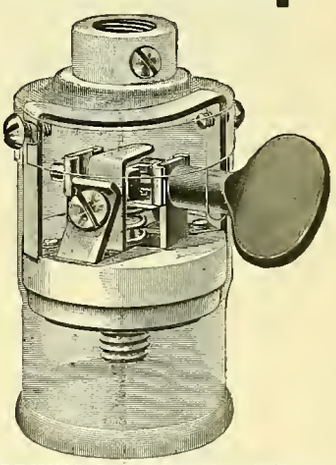

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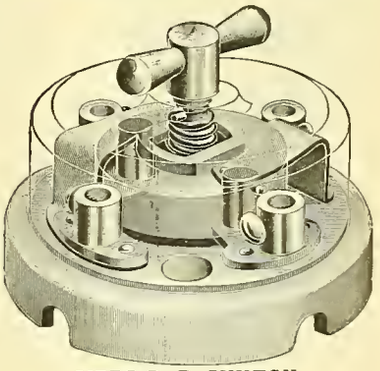

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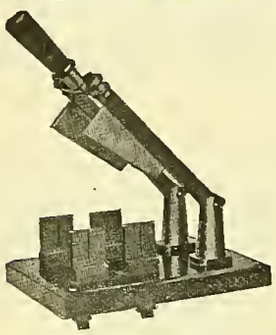

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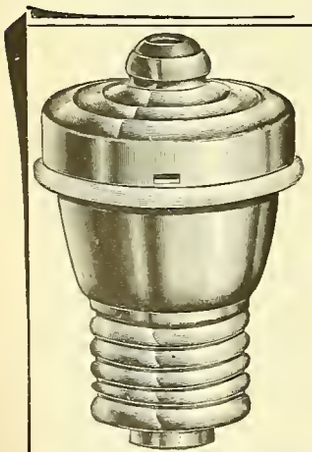

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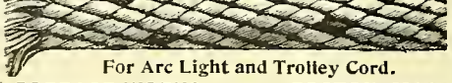

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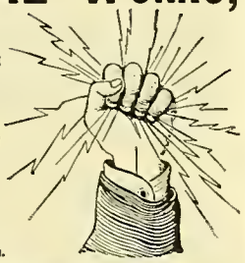

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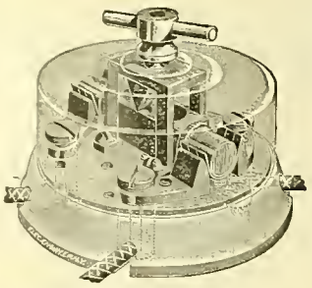

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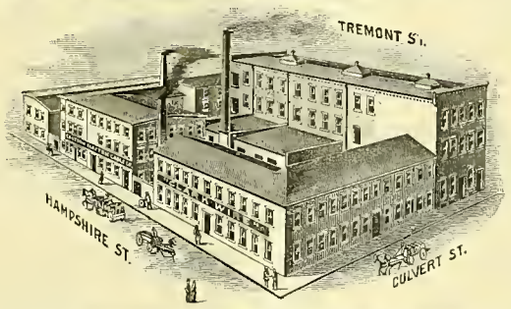


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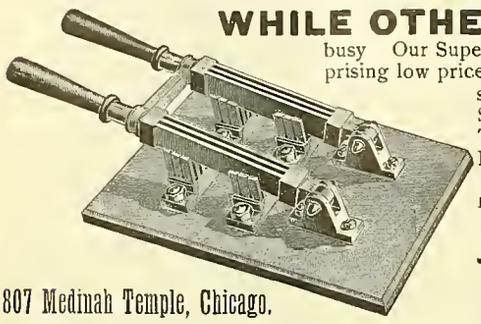

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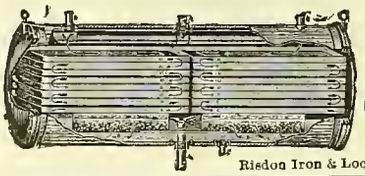

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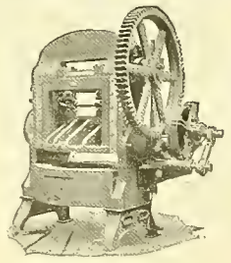

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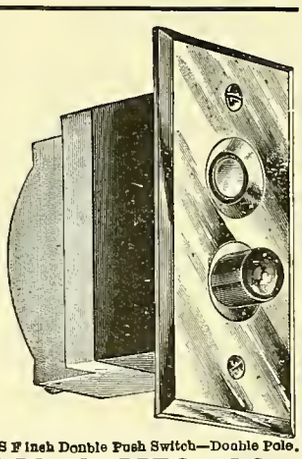

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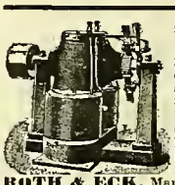

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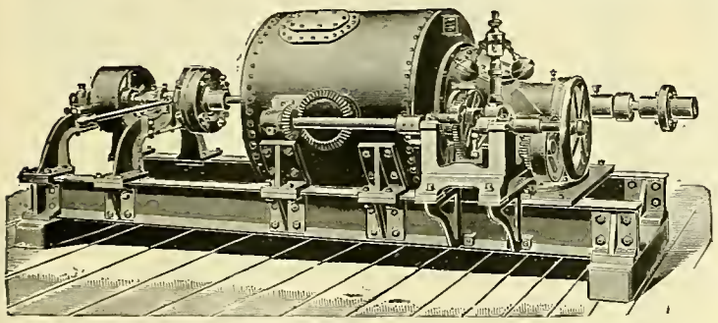

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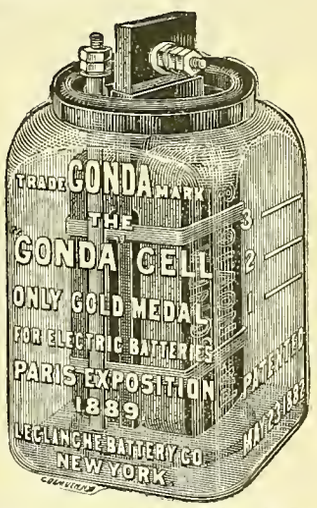


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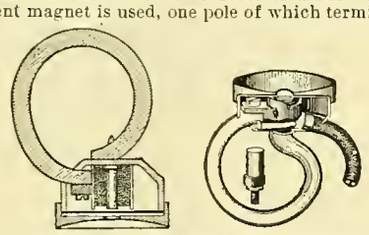
ductor. In the D'Arsonval receiver a curved permanent magnet is used, one pole of which terminates



FIGS. 27 AND 28. D'ARSONVAL RECEIVER.

in a soft iron polepiece that serves as the core of the coil, and the other in an iron box, or cylinder, that

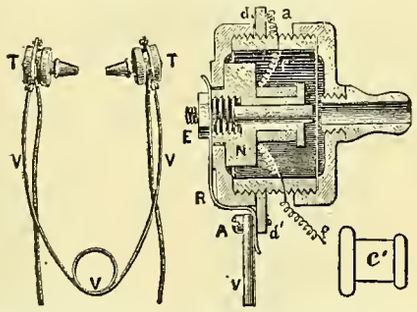



FIG. 29. MERCADIER'S BI-TELEPHONE. *T T* RECEIVERS, *V* SPRING, *N* MAGNET, *E* NUT, *R* STEEL STRIP, *A* SCREW CLAMPING *R* TO *V*, *d d'* METAL COLLAR CLAMPING *V* TO RECEIVER CASE, *f f* TERMINALS OF COIL *a* CONNECTING SCREW, *c'* SOFT RUBBER NIPPLE FOR EARPIECE.

completely encloses the coil. The two poles are magnetically insulated from each other by the wooden case, to the upper part of which the diaphragm is

48 TELEPHONE HAND BOOK.

appeared on the scene with an application for a patent on a microphonic transmitter, and according to the rules of the Patent Office no patent could be issued to any of the three until it was determined whether the Drawbaugh claim was valid or not. This was finally decided against Drawbaugh, as it was proved that the Edison carbon transmitter had been in public use for more than two years before Drawbaugh made his application for a patent, and his application was thrown out. A patent was then issued to Berliner on the broad

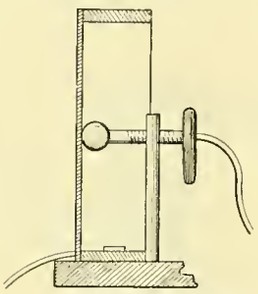


FIG. 44. BERLINER'S FIRST TRANSMITTER.

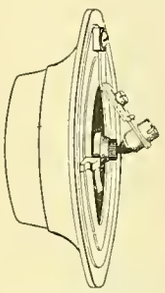


FIG. 45. BERLINER CARBON TRANSMITTER.

principle of the microphone transmitter in November, 1891. In May of the following year a patent was issued to Edison, so that both sides of the interference eventually got their patents—more than fourteen years after the filing of the original applications.

78. Both Berliner and Edison obtained in 1878 patents on special forms of transmitters designed in accordance with the principles laid down in their applications for the broad principle of battery telephones, and the Berliner transmitter especially has been modified out of all semblance to its original form. The broad claim in the Berliner patent is as follows: "The method of producing in a circuit electrical undulations similar in form to sound waves by caus-

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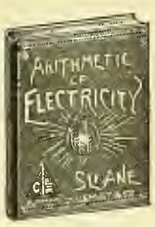


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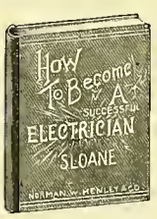


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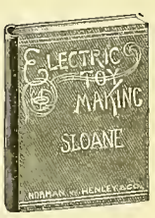


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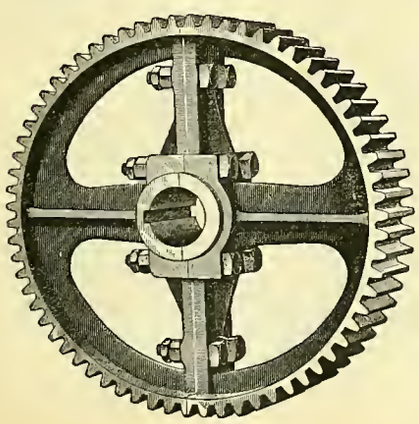

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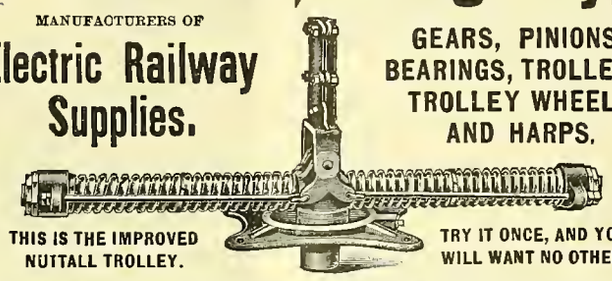

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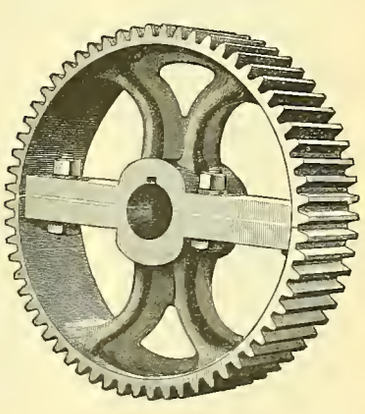

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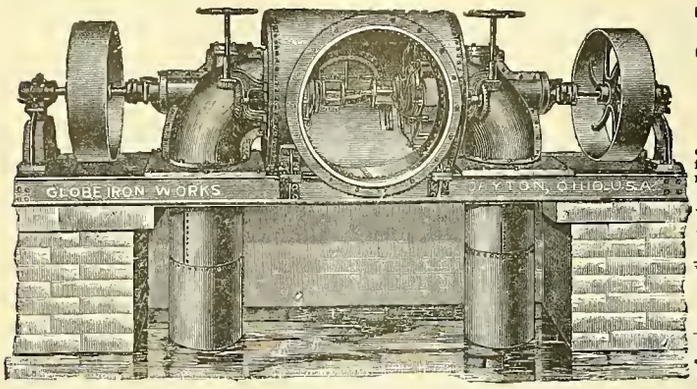


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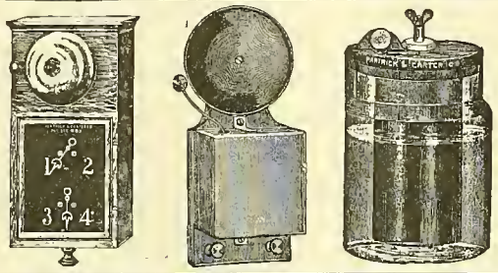

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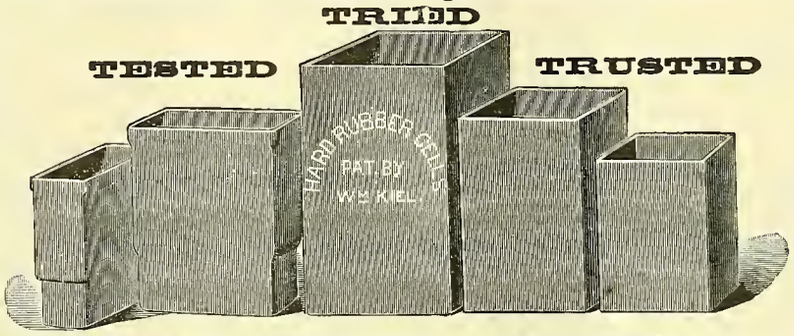


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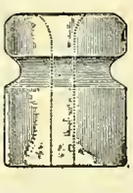

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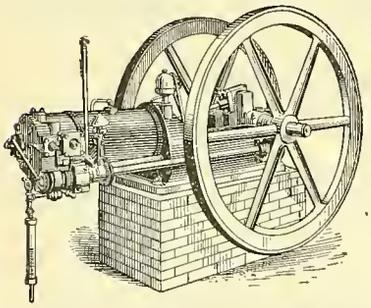

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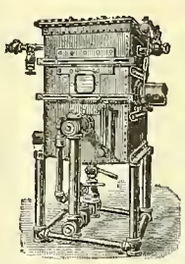

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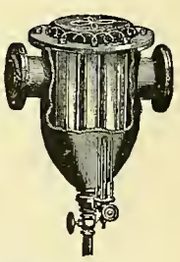

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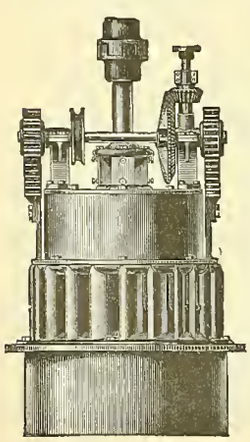

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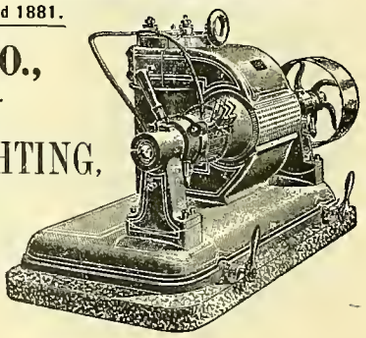

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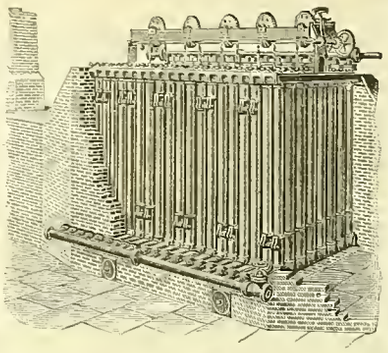

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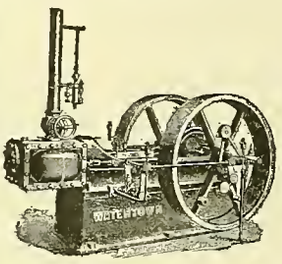

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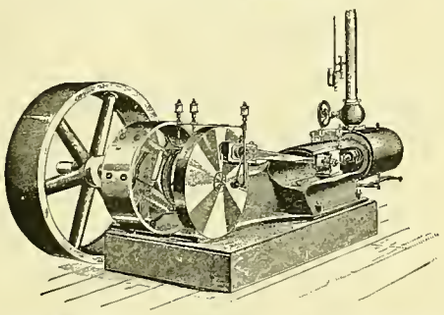

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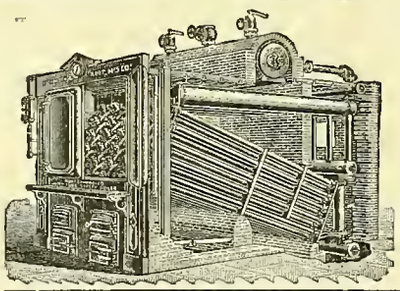

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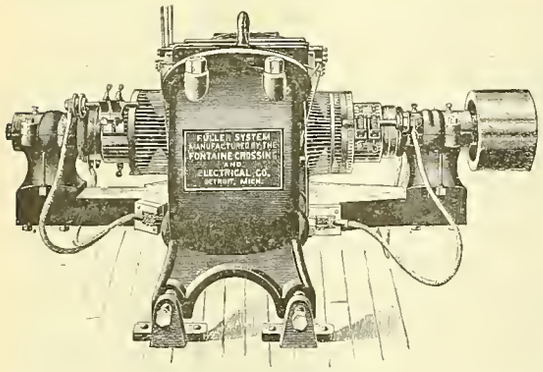


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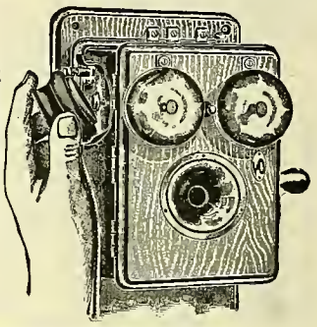

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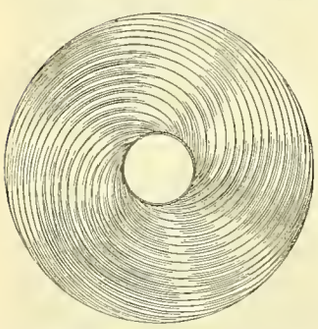

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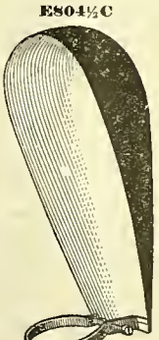

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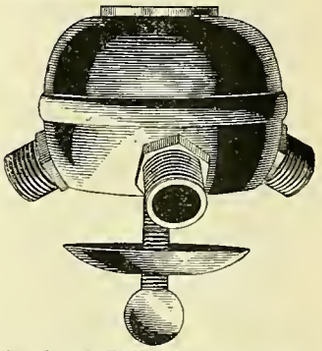

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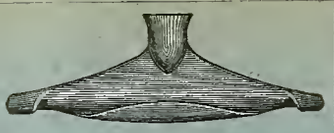

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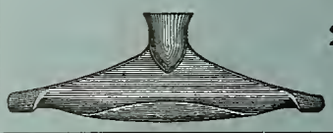

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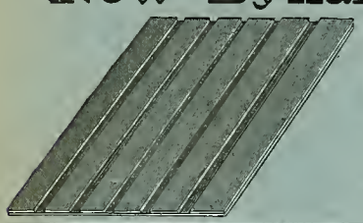

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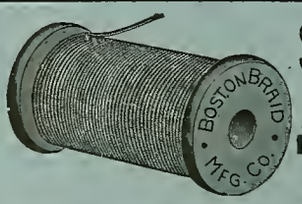


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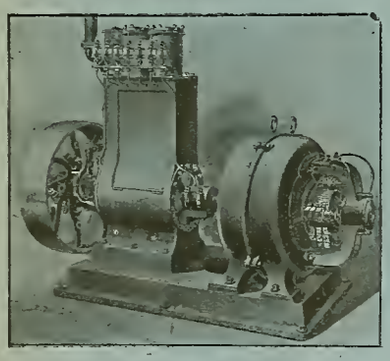

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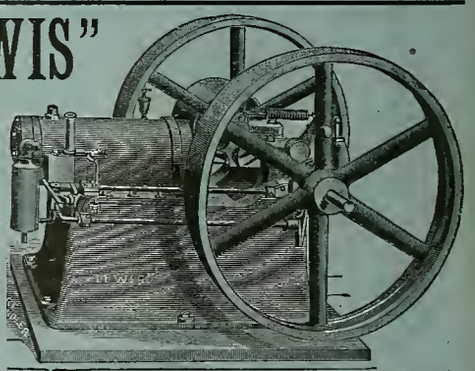

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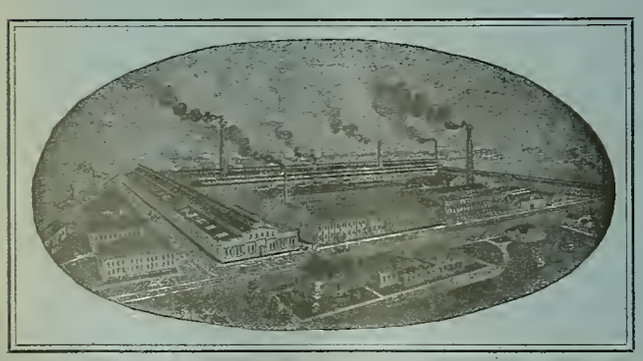

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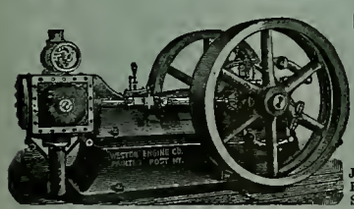

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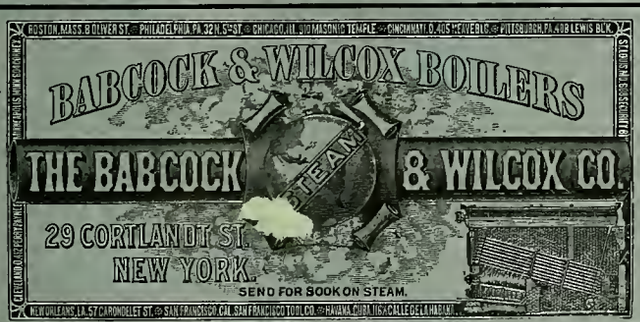


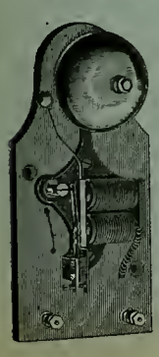

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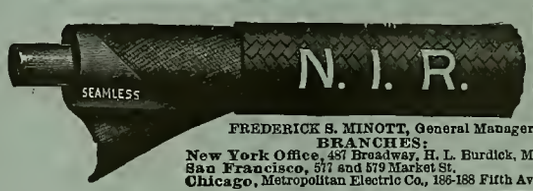


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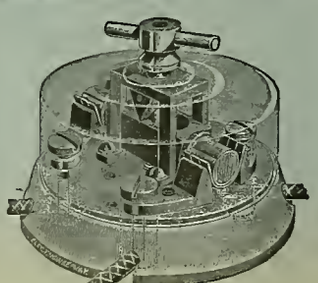

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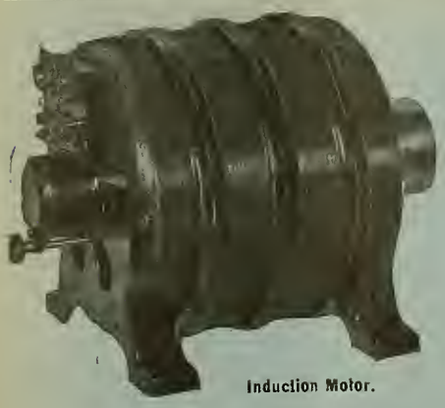

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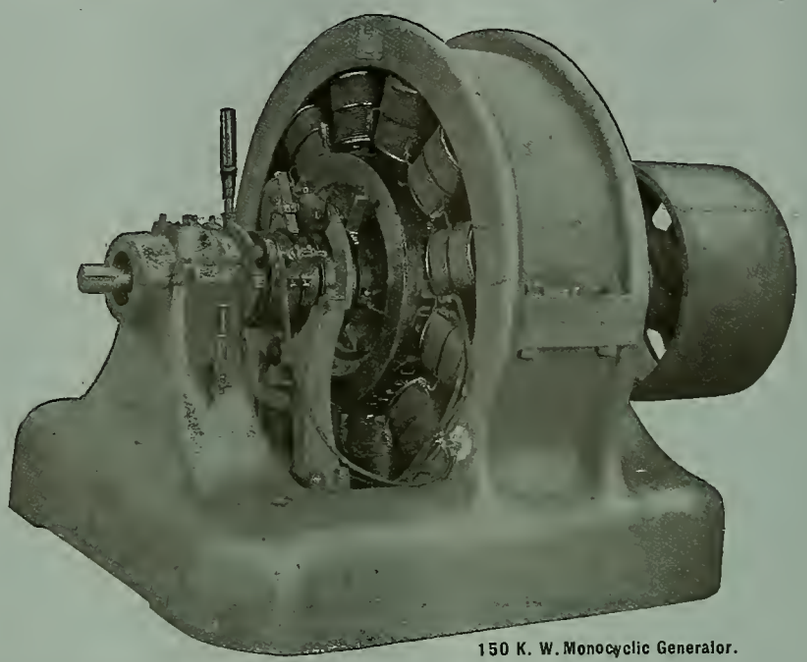

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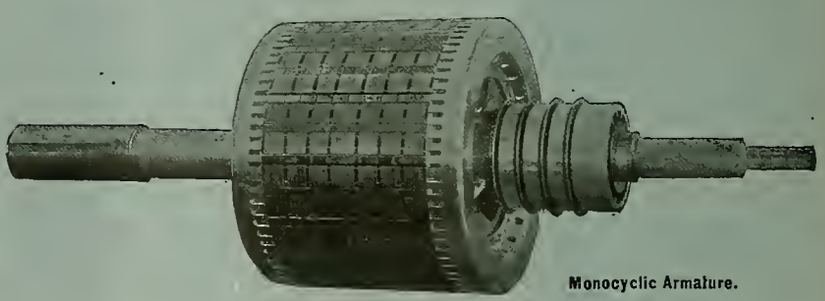

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## CLASSIFIED LIST.


**Accumulators.**
Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Haschke & Creelman.
Porter & Buerdorf.

**Annunciators.**
Dearborn Electric Co.
Electric Appliance Co.
Nowotny Electric Co.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Washington Electric Co.
Western Elec. Supply Co.

**Arc Lamps.**
Auerbach-Woolverton El.Co.
C & C Electric Co.
Clark Electric Co.
Crocker-Wheeler Elec. Co,
Electric Cons. & Supply Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
General Ins'd'cent Arc Lt. Co.
Helios Electric Co.
La Roche Electric Wks.
Little, F. P. Elec. C. & S. Co.
Mather Electric Co.
Perkins El. Switch Mfg. Co.
Washington Electric Co.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Haschke & Creelman.
Law Battery Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Nowotny Electric Co.
Partrick & Carter Co.
Phœnix Carbon Mfg. Co.
Wallace Electric Co.
Western Electric Co.

**Bells.**
Dearborn Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Electric Co.

**Belting.**
Shultz Belting Co.
Phœnix Carbon Mfg. Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Brownell & Co., The.
Clonbrock Steam Boiler Wks.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co., Ltd.

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Partridge Carbon Co.
Phœnix Carbon Mfg. Co.

**Burglar Alarms.**
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Washington Electric Co.
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**Cables** (See Insulated Wires.)
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Bishop Gutta Percha Co.
Brixey, W. R.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Carbons, Points & Plates.**
General Electric Co.
Partridge Carbon Co.
Phœnix Carbon Mfg. Co.
Reisinger, Hugo.
Washington Carbon Co.
Western Electric Co.

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Self-Winding Clock Co.

**Conduits.**
Interior Conduit & Ins Co.
National Conduit Mfg. Co.

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Allen-Hussey Co.
Amstutz, N. S.
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Ft. Wayne Elec. Corporation.
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Arnold, B. J.
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Bryan, Wm. H.
C & C Electric Co.
Clark Electric Co.
Comstock Co., The Louis K.
Consolidated Engineering Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Goltz & Sinclair.
Interior Conduit & Ins. Co.
La Roche Electric Wks.
Mather Electric Co.
Siemens & Halske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.
Law Battery Co.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co., J. H.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

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Anderson, Albert & J. M.
Brownlee & Co.
Electric Appliance Co.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Bryant Electric Co.
Bunnell & Co., J. H.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Nuttall Co., R. D.
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Brush Electric Co.
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Crocker-Wheeler Elec. Co.
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Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
La Roche Electric Wks.
Mather Electric Co.
Palmer Bros.
Roth & Eck.
Royal Electric Co.
Siemens & Halske Elec. Co.
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Westinghouse Elec. & Mfg.Co.

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Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.
Washington Electric Co.
Whitney Elec. Instrument Co.

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Nashold Cleat Co.
Proctor-Raymond Elec. Co.

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Gleason, E. P. Mfg. Co.

**Electro-Plating Mach'y.**
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Colburn Electric Mfg. Co.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.
Webster Mfg. Co.

**Engines, Steam.**
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Brownell & Co., The.
Erie City Iron Wks.
Freeman & Sons Mfg. Co.
Racine Hardware Co.
Sioux City Eng & Iron Wks.
Watertown Steam Engine Co.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Diehl & Co.
Interior Conduit & Ins. Co.

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Goubert Mfg. Co.
Webster & Co., Warren.

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Butler Hsrd Rubber Co.
Kartavert Mfg. Co.
Standard Paint Co.
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Western Electric Co.

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Brixey, W. R.
Chicago Ins. Wire Co.
Electric Appliance Co.
General Electric Co.
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**Gas Lighting, Electric.**
Holtzer-Cabot Electric Co.
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Grant, Geo. B.
Nuttall Co., R. D.

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Anderson, Albert & J. M.
Besly & Co., Chas. H.
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Bunnell & Co., J. H.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
General Electric Co.
High & Co., J. Grant.
Holtzer-Cabot Electric Co.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Nashold Cleat Co.
Nowotny Electric Co.
Palmer Bros.
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Perkins El. Switch Mfg. Co.
Platt, O. S.
Proctor-Raymond Elec. Co.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Technic Electrical Wks.
Washington Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Glesson, E. P. Mfg. Co.
Jaeger Mfg. Co., The.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.

**Induction Coils.**
Splitdorf, C. F.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Holtzer-Cabot Electric Co.
Interior Conduit & Ins. Co.
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Kartavert Mfg. Co.
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Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Nowotny Electric Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Paragon Insulating Co.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.
Technic Electrical Wks.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co. J. H.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
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Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Am. Electrical Mfg. Co.
Beacon Vac Pump & Elec.Co.
Bernstein Electric Co.
Buckeye Electric Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Jaeger Mfg. Co., The.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg.Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Bliss Co., E. W.
Hine & Robertson Co.
Lukens Iron & Steel Co.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Brush Electric Co.
C & C Electric Co.
Colburn Electric Mfg. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Palmer Bros.
Royal Electric Co.
Roth & Eck.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Paragon Insulating Co.
Standard Paint Co.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm.Co. Ltd

**Pianos and Organs.**
Beethoven Piano & Organ Co.

**Platinum.**
Baker & Co.

**Poles.**
Brownlee & Co.
Morris, Tasker & Co.
Nuttall Co., R. D.

**Porcelain.**
Empire China Works.
General Electric Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Electric Appliance Co
Partrick & Carter Co.

**Rheostats.**
General Electric Co.

**Sal Ammoniac.**
Klipstein, A. & Co.
Law Battery Co.

**Separators.**
Goubert Mfg. Co.
Hine & Robertson Co.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co

**Speed Indicators**
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Colgate Co., Geo. L.
Diamond Electric Co.
Whitney Elec. Instrument Co.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Steam Pumps.**
Worthington, Henry R.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Haschke & Creelman.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works
Brixey, W. R.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.

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Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones**
Columbia Tel. Mfg. Co.
National Telep. Mfg. Co.
Nowotny Electric Co.
Palmer Bros.
Partrick & Carter Co.
Western Electric Co.
Western Tel. Const. Co.

**Transformers.**
Diamond Electric Co.
General Electric Co.
Hornberger Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
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**Trolley Cord.**
Samson Cordage Wks

**Trucks, Electric Car.**
General Electric Co.
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Dayton Globe Iron Works Co
Smith, S. Morgan.
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**Universities.**
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**Varnishes.**
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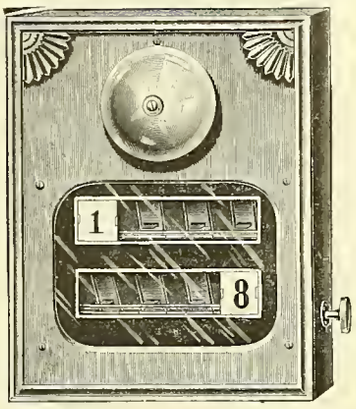
**Water Wheels.**
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C.Co.

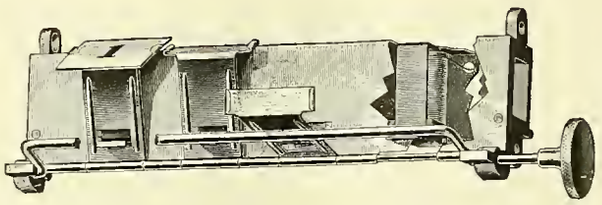



"A" STYLE.

Made in Sizes from 3 to 20 Drops.

# ANNUNCIATORS

That never fail to Annunciate.



This illustrates the inside construction of our Gravity Drop Annunciator as applied to the Eclipse Case.

No Springs. No Screws. Nothing to get out of adjustment. Simplicity itself.

*Our other Specialties:*

**REX** Wood-box Bells.

**ECLIPSE** Iron-box Bell.

## PROCTOR-RAYMOND ELECTRIC CO.,

Rochester, N. Y.

# Low Potential Arc Lamps.

*Alternating-Helios, Old Type.*
*Spencer, New Type.*

*Direct Current-Helios, Old Type.*
*Spencer, New Type.*

**FOR STREET, PAVEMENT AND INSIDE LIGHTING.**

Our Alternating Lamps have reflector plates. Our new Direct Current Lamps do not see-saw when running in series.

Our Focusing Lamps, both direct and alternating, are adapted for stereopticon and photo-engraving work.

We also make direct current lamps to be used on street railway circuits.

## HELIOS ELECTRIC COMPANY,

1310 Filbert St., PHILADELPHIA, PA.

**AGENTS:**

Eastern Agents: STANLEY ELECTRIC MFG. CO., Pittsfield, Mass.
Western Agents: CENTRAL ELECTRIC CO., Chicago, Ill.
Southwestern Agents: ST. LOUIS ELECTRICAL SUPPLY CO., St. Louis, Mo.
New York City Agents: GLOBE ELECTRICAL SUPPLY & CONSTRUCTION CO., Vandam and Greenwich Streets.
MOUNTAIN ELECTRIC CO., Denver, Col., Agents for Colorado, Utah, Wyoming and New Mexico.
MACHINERY SUPPLY CO., Los Angeles, Cal., Agents for Lower Californie and Arizona.
CANADIAN GENERAL ELECTRIC CO., Toronto, Canada, Agents for Canada.
Agent for Texas: W. T. M. MOTTRAM, Dallas, Texas.

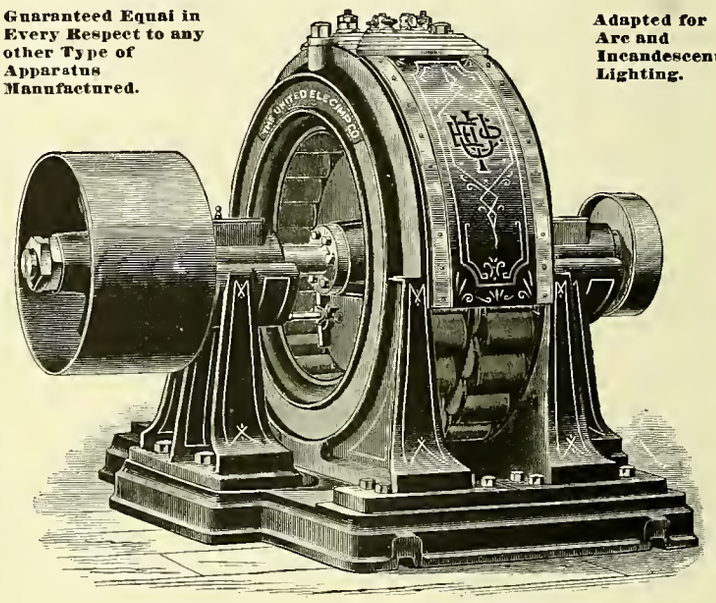
**SINGLE OR MULTIPHASE,**

# Alternating Current Generators,

**For Central Station Equipment.**

**Guaranteed Equal in Every Respect to any other Type of Apparatus Manufactured.**

**Adapted for Arc and Incandescent Lighting.**




Slow Speed and Close Regulation.

Standard of Simplicity and Durability.

**ALSO**

Direct Current Apparatus for Lighting Factories, Public Buildings and Isolated Plants.

Improved Long Distance Series Incandescent Apparatus for Street and Commercial Illumination.

Incandescent Lamps and Sockets for use on Arc Light Circuits.

**Correspondence Solicited.**

## THE UNITED ELECTRIC IMPROVEMENT CO.,

**19th St. and Alleghany Ave., Philadelphia, Pa.**

# HELIOS CORED CARBONS For Alternating and Direct Currents.

Attempts have been made in this country to produce a satisfactory cored carbon, but failure resulted in every case. We can now assure the Electric Light Companies that our "HELIOS" CARBON is made of the same ingredients, in precisely the same way,

**By the man who made them in Germany.**

We shall be glad to hear from the Electric Light interests of the country in relation to carbons for both alternating and Direct Currents. A memorandum book, with tables showing the relation between millimeters and inches, with a list of ordinary sizes of "HELIOS" CARBONS of our manufacture will be sent on application. **Reduced Prices on Solid Carbons for Series Arc Lighting.**

## A · Departure · In · Business · Methods!

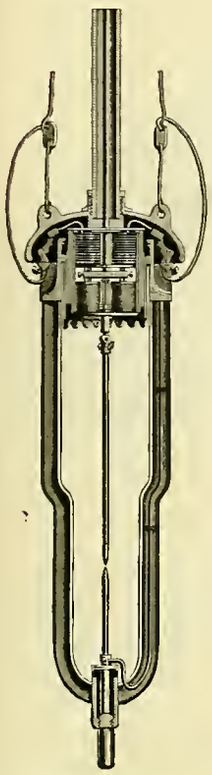
*NOTE THIS OFFER:—Let us know by telegraph the price you are now paying, stating yearly consumption, and we will guarantee to beat it from 50 cents to $2.00 per thousand.*

## THE WASHINGTON CARBON COMPANY, - PITTSBURG, PA.

# The "Waterhouse" Incandescent Arc Lamp.

**THE HIGHEST TYPE OF EXCELLENCE.**

Investigate its Merits Before Buying.



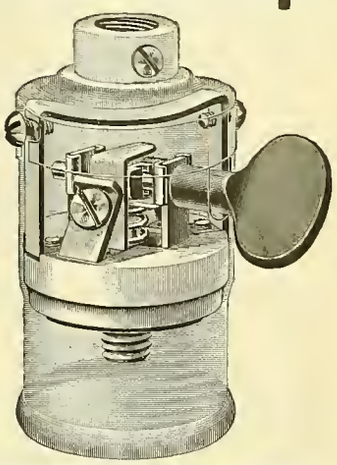
The "Waterhouse" Inc. Arc Lamps for DIRECT Inc. Circuits.

**WE ALSO MANUFACTURE**

**GIBBS SWITCHES,** Single and Double Pole—All Sizes.
**PERKINS SOCKETS**—All Bases.
**DOVETAIL CEILING CUT-OUTS**—Cleat and Concealed.

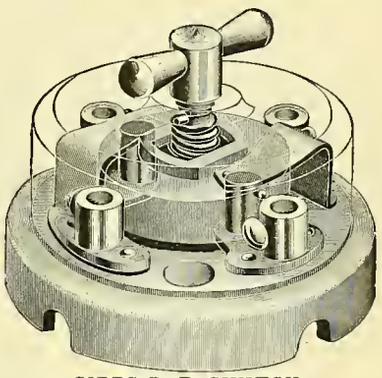
These goods sold by SUPPLY HOUSES.

Write for Catalogue and Prices.



PERKINS SOCKET—For all Bases.

**FULL STOCK CARRIED IN CHICAGO.**



GIBBS D. P. SWITCH.

## The Perkins Electric Switch Mfg. Co.,

**CHICAGO OFFICE:**
**1536 Monadnock Block,**
**C. W. CONOVER, Mgr.**

**FACTORY:**
**Hartford, Conn.**

**BOSTON OFFICE: 182 Summer St. F. B. SMITH, Mgr.**

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WHY PAY RENT?

# THE COLUMBIA

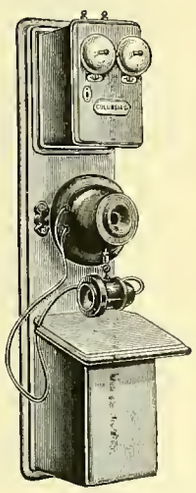
THE LATEST AND BEST.

**PATENTS FUNDAMENTAL—NON-INFRINGING.**

## Why Not Own Your Telephone?

**LONG DISTANCE BATTERY TRANSMITTERS**

of the latest and newest designs sold outright. No adjustment. Nothing to get out of order. Nothing demanding repair. Will convey articulate speech 1,000 miles. Constructed of the best material.



**A TELEPHONE RECEIVER**

of the newest and best pattern. Unique in design. Perfect in action. Moderate in cost. Small instruments made of the finest rubber. All wires and connections within the case. No unsightly thumbscrews.

This Company owns the patent for the improved Switch for changing the circuit of the Telephone on battery transmitters. Also for perfected system of telephone exchanges. The best DRY BATTERY manufactured. Send for Circular.

## THE COLUMBIA TELEPHONE MANUFACTURING CO.,

**136, 138, 140 Front St., New York City.**

# Now Ready!

WESTERN ELECTRICIAN'S

# MOONLIGHT SCHEDULE

*FOR 1895.*

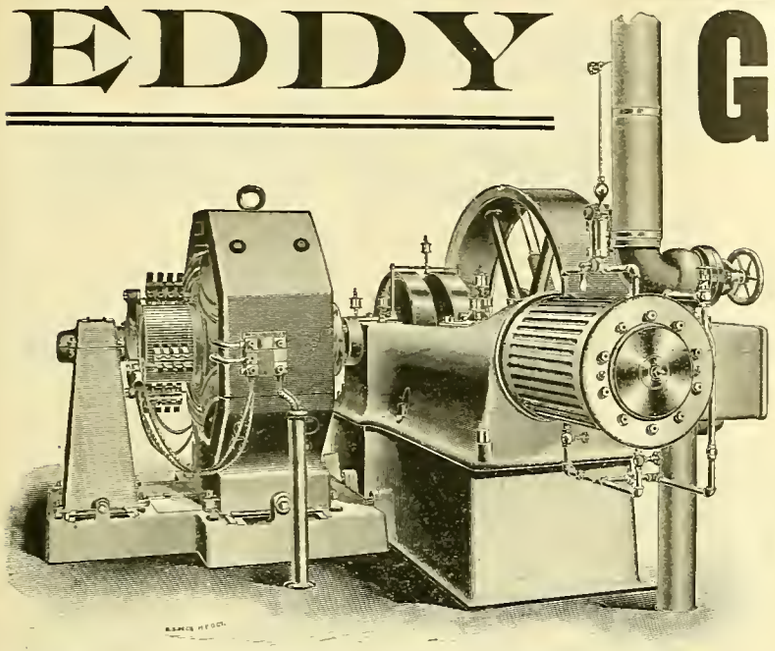
**Every Station Needs It.**

*SEND 10 CENTS FOR A COPY.*

**Electrician Publishing Company,**

6 Lakeside Building, Chicago.

# EDDY GENERATORS



Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*

**The Eddy Electric Mfg. Co.,** Windsor, Conn.

NEW YORK OFFICE, HAVEMEYER BLDG.

*REPRESENTED BY:*

Walter C. McIntire & Co., 506 Commerce St., Philadelphia, Pa.
Western Electrical Supply Company, St. Louis, Mo.
F. P. Little Electrical Construction & Supply Co., Buffalo, N. Y.
W. T. Usborn, Kansas City, Mo.

All Our Apparatus Guaranteed as Represented.

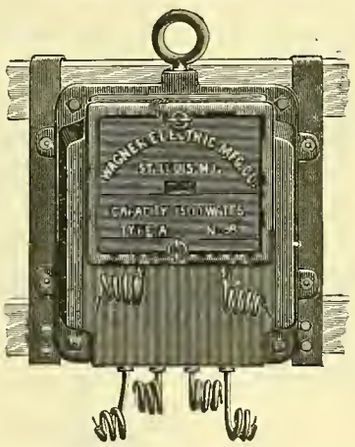
# ALTERNATING CURRENT TRANSFORMERS

Highest Efficiency Ever Obtained.

## TRANSFORMERS

To order for any purpose, voltage or capacity.

**ALTERNATING CURRENT MOTORS.**




Standard Sizes, 5 Lights to 2,000 Lights.

**HIGH POTENTIAL SWITCHES,**

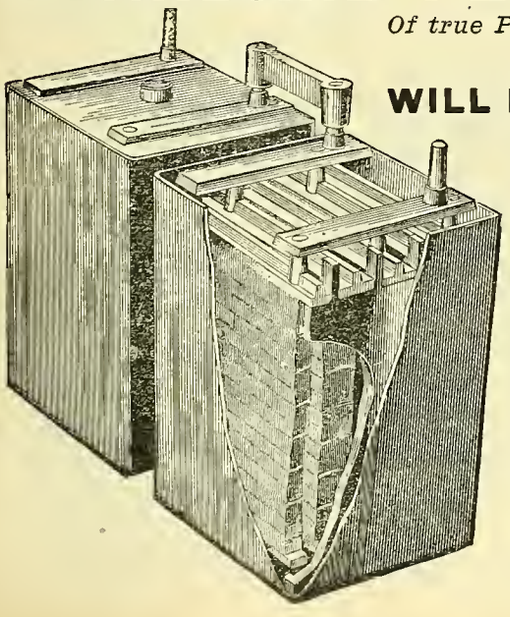
Complete Switch Boards

For Central Stations and Isolated Plants.

# WAGNER ELECTRIC MFG. CO., ST. LOUIS, MO.

CHICAGO OFFICE, Wells Goodhue, 1564 Monadnock Block. PHILADELPHIA OFFICE, John Mustard, 1000 Betz Bldg.

# STANDARD PLANTE STORAGE BATTERIES



*Of true PLANTE Type and CRYSTALLINE FORMATION.*

Will give or receive without injury, currents that would destroy other batteries.

**WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.**

Contain no asbestos or other separating material to increase their internal resistance.

## ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

## Highest efficiency, largest delivery, lowest internal resistance.

For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

## Cannot be damaged by excessive charge or discharge currents.

A 400 ampere current has been taken from a 120 ampere hour cell.

☞ CHALLENGE: We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

## ELECTRIC POWER STORAGE COMPANY,

Room 1210 Havemeyer Building, 26 Cortlandt Street, New York.

# THE C & C ELECTRIC COMPANY

MANUFACTURERS OF

## MULTIPOLAR DYNAMOS,

Direct Driven or Belted, in sizes up to 250 H. P.

## BIPOLAR DYNAMOS,

Up to 100 H. P.

Electric Motors, Automatic or Hand Controlled.
Complete Plants for Power Transmission.
Isolated lighting plants, Central Station Apparatus.

General Office:
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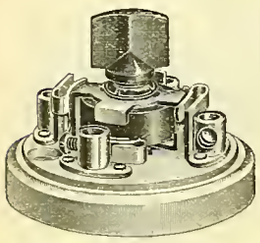
Works: GARWOOD, N. J.
on CENTRAL R. R. of N. J.

BRANCH OFFICES: CHICAGO, 1020 and 1021 Monadnock Building. BOSTON, 63 Oliver St. CLEVELAND, Cuyahoga Building. PHILADELPHIA, 633 Arch St.

# HART SNAP SWITCHES!

STANDARD SWITCHES, 5 and 10 ampere S. P.
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



## FLUSH SWITCHES

Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

SEND FOR CATALOGUE.

## THE HART & HEGEMAN MFG. COMPANY,

Hartford, Conn.

# TESTING

## OF INSULATED WIRES AND CABLES.

BY HERBERT LAWS WEBB.

A New Book Just Published.

A Practical Guide to the Testing of Electric Light, Electric Railway, Telephone and Telegraph Wires.

PRICE, POSTAGE PREPAID, $1.00.
SEND IN YOUR ORDER NOW.

## ELECTRICIAN PUBLISHING COMPANY,

6 Lakeside Building, CHICAGO.

# ARC LAMPS FOR INCANDESCENT CIRCUITS,

Both Alternating and Direct.

Standard "Ward" Lamps, - $10 Each

TWO IN SERIES ON 110 VOLTS. Globe and Resistance, $2 extra per lamp.

A COMPLETE LINE of ENTIRELY NEW Arc Lamps.

SIMPLEST. STRONGEST. SUREST FEED.

Easiest and Cheapest to Maintain.

SPECIAL LAMPS OF ALL KINDS.

Write us for Circulars.

We carry a stock of FIDELITY carbons and IMPORTED CORED carbons, which we are selling at reduced prices.

Users of Arc Lamps should Write us for Prices.

## Electric Construction & Supply Co.,

18 Cortlandt Street, New York.

(Established 1881.)

Wallace Electric Co., Agents, 307 Dearborn Street, Chicago, Ill.

# Something New.

The **Hoyt Standard Ammeters** and **Voltmeters** for **Lamp** and **Meter** measurement on **Alternating Currents** are now ready for the market.

Send for our **1894 Catalogue** which contains the above and other new instruments of our manufacture.

## Whitney Electrical Instrument Co.,

PENACOOK, N. H.

Factories: Penacook, N. H.; Sherbrooke, P. Q., Can.

AGENTS:

HENRY F. KELLOGG, General Selling Agent.

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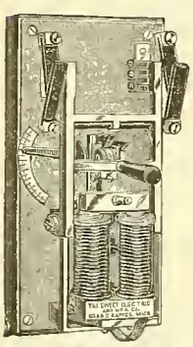
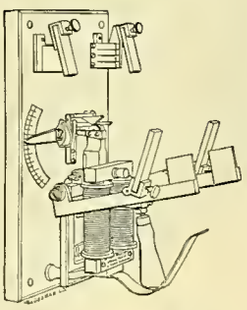
Boston, Mass.: Warren S. Hill.
Boston, Mass. (New England): W. B. Southgate & Co., 146 Franklin St.
Chicago, Ill: Electric Appliance Co.
Cincinnati, O: Nowotny Electric Co.
Halifax, N. S.: John Starr, Son & Co., Ltd.
San Francisco, Cal.: California Electrical Works.
New York: J. A. Machado, 203 Broadway.
Philadelphia: Vallee, Bros. & Co.
St. Louis, Mo.: St. Louis, Electrical Supply Co.
Little Rock, Ark.: The Brown Elec. & Mech'ry Co.
Minneapolis, Minn.: Electrical Engineering Co.
Denver, Col.: Russell & Officer Elec. Constr Co.
Omaha, Neb.: Western Electrical Supply Co.
Seattle, Wash.: Northwest Fixture Co.

# Hot Stuff.



No! we make the final break off from carbons so that it is impossible to get heat enough to fuse points of your copper contact plates; no filing off of rough points, no hanging on after you have had a short circuit or over load, bound to work as easily after opening 1,000 times as it does when opened the first time.

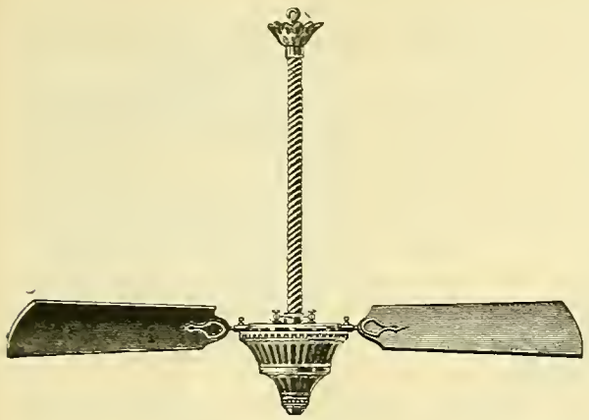
**WE KNOW YOU NEED OUR CIRCUIT BREAKER,** and do not see why you should delay writing us any longer. One burn out will pay for a dozen of our instruments. **To be used on the Alternating or Direct Current Systems.**



WRITE US AT ONCE.

## SWEET ELECTRIC & MFG. CO.,

GRAND RAPIDS, MICH.



**AN EMPHATIC SUCCESS!**
**THE DIEHL ELECTRIC FANS WIRED IN A SERIES OF TWO OR MORE ON A STREET RAILWAY CURRENT.**

**DIEHL & COMPANY, 385 BROADWAY, NEW YORK.**

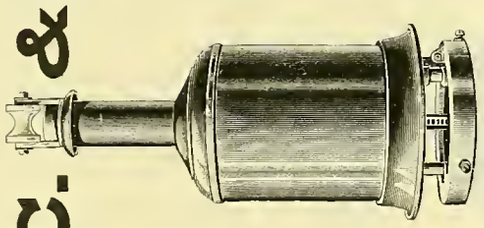
# WALLACE ELECTRIC CO.

## A Few of our Specialties:

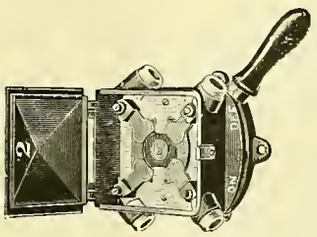
### THE E. C. & S. CO.'S ARC LAMP.

Alternating and Direct.

Made for all Circuits



### WRIGHT'S Series Circuit Arc Cut-Out.



Approved by Every Board of Fire Underwriters

### HABIRSHAW WIRES CABLES AND CORES.

The Highest Grade of Rubber Insulation.

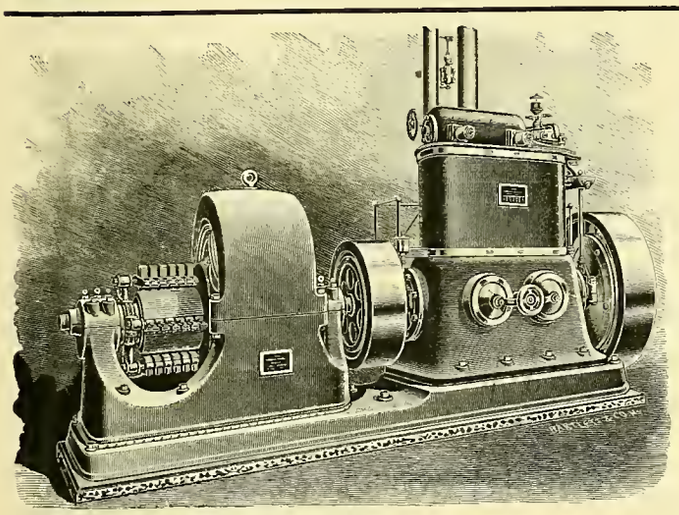
*RED CORE.*
*WHITE CORE.*

### THE WIRT DYNAMO BRUSH.

PATENTED SEPTEMBER 23, 1890.

Superior to all Copper, Carbon and Woven Wire Brushes.
Prevents Sparking and Cutting of Commutator.

## 307 DEARBORN ST., CHICAGO.



*Despite the "HARD TIMES"*

# WESTINGHOUSE ENGINE

Sales for 1894 foot up a total of 270 Engines, aggregating 37,915 H. P. No endorsement of the continued popularity and success of

## WESTINGHOUSE ENGINES

could be more emphatic! Three types covering every grade of service.

**COMPOUND.**
5 to 1000 H. P. For electric lighting, electric railways and high grade service generally.

**STANDARD.**
5 to 250 H. P. A high class steam engine for all purposes.

**JUNIOR.**
5 to 75 H. P. Low in price and thoroughly reliable.

**CATALOGUE ON APPLICATION.**

## THE WESTINGHOUSE MACHINE COMPANY

**PITTSBURG, PA., U. S. A.**

There appears to be a decided difference of opinion as to the propriety of the exhibition of

# LIVING PICTURES.

This difference does not exist, however, in regard to the propriety and advisability of sending all of your orders for

# ELECTRICAL SUPPLIES

To the only electrical supply house in the West that gives to every order careful personal attention and intelligent execution born of a perfect familiarity with the electrical supply business.

**PROMPTNESS** in the filling of orders, which means so much to every purchaser of electrical supplies, is one of our strong points.

**LOW PRICES,** which have so much to do with the appearance of your dividend account at the end of the year, is another.

**We combine these and secure beautiful results.**

ELECTRIC APPLIANCE COMPANY,

242 MADISON STREET, CHICAGO.

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**Miamisburg Electric Co.,** - Miamisburg, Ohio.

## IMPERIAL DRY BATTERY.

Guaranteed the best Dry Battery ever made. Internal short circuiting or local action is eliminated. Will not deteriorate when not doing work. Will hold its first value over long periods of time. Internal resistance small; high and constant E. M. F. Will not run down or die on the shelf. No bursting of seals or oozing of salts from the top.

## Burnley Cartridge Battery.

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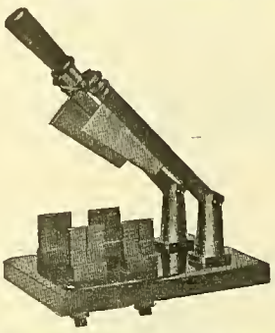

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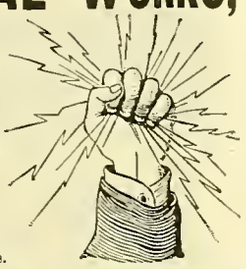

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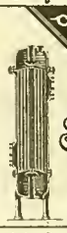

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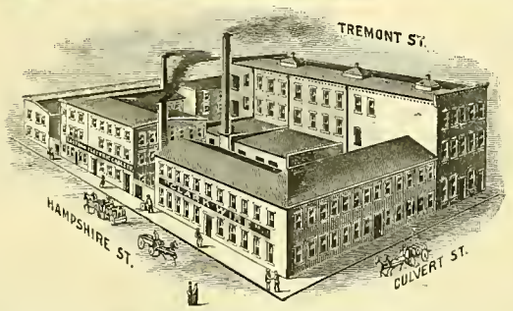


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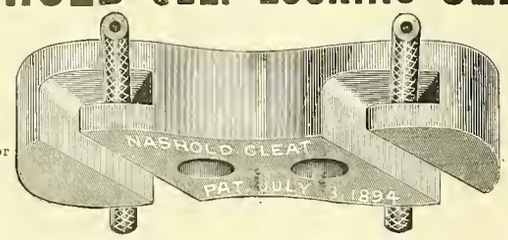


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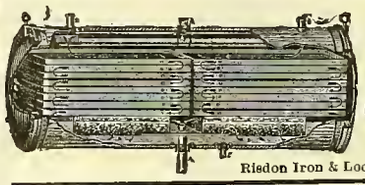

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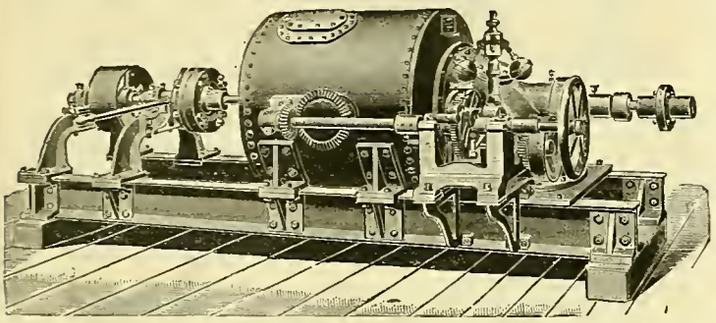

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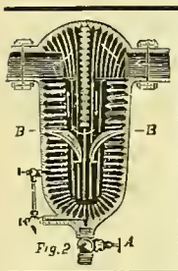


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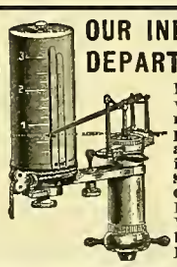

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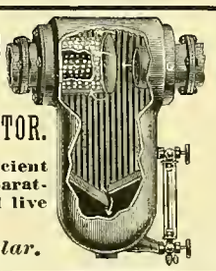

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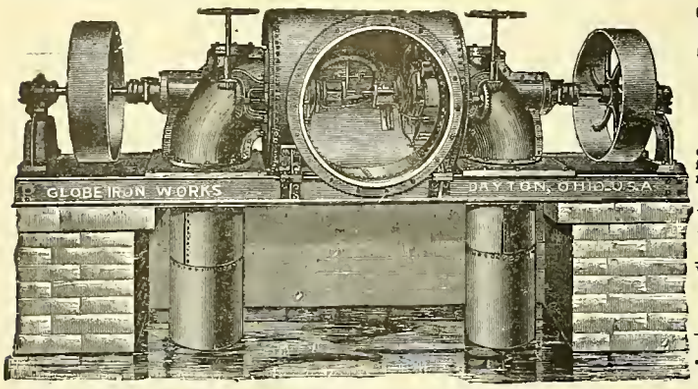


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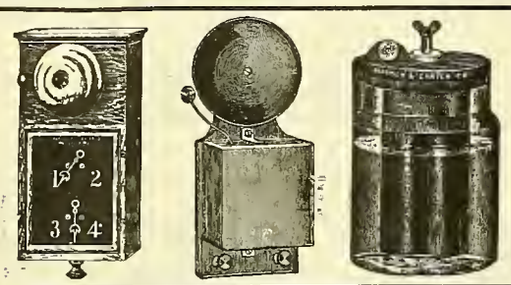

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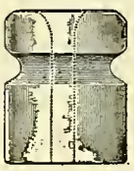

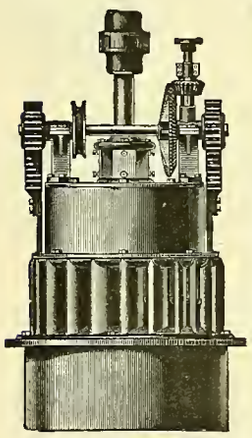

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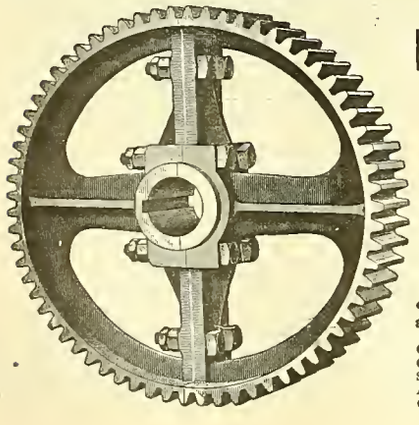

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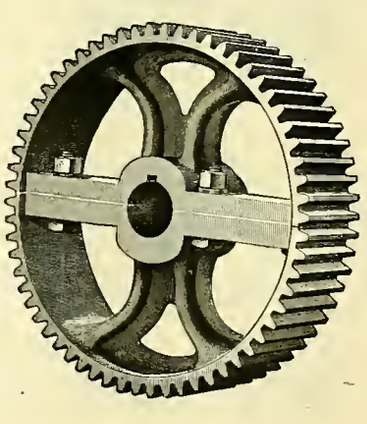

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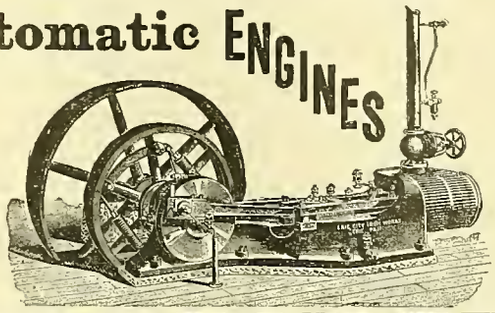

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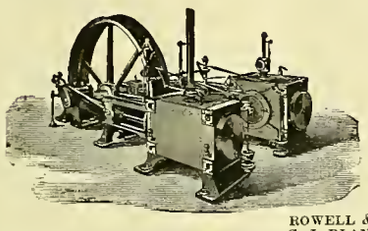

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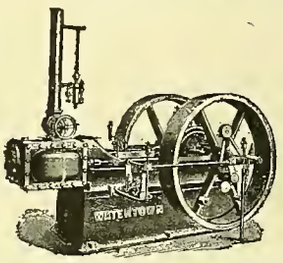

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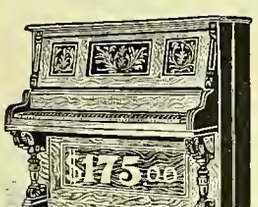

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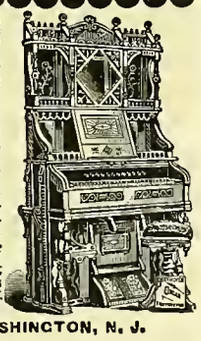

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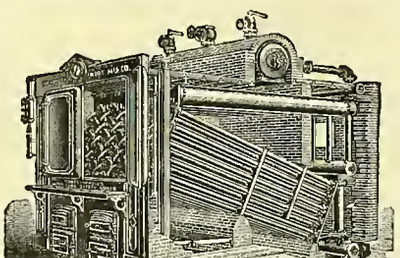

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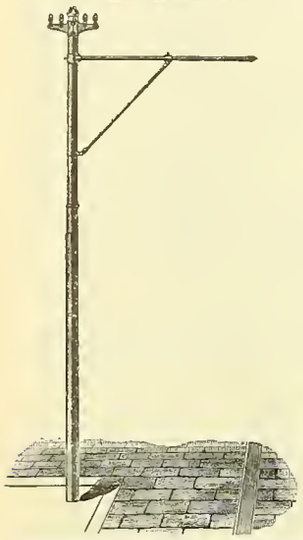

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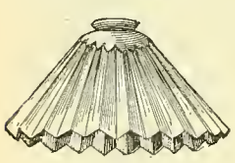

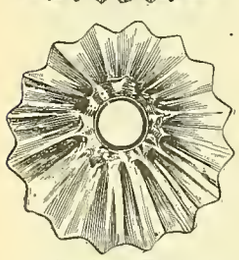

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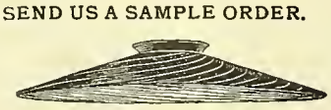

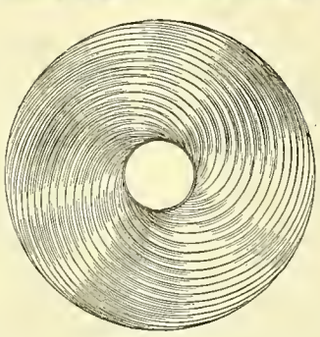

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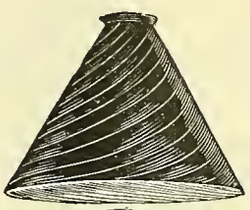

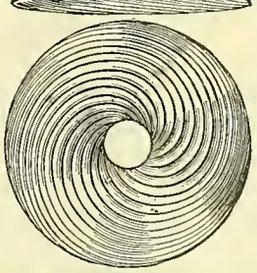

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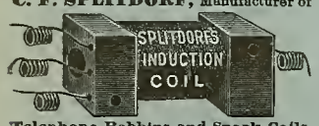


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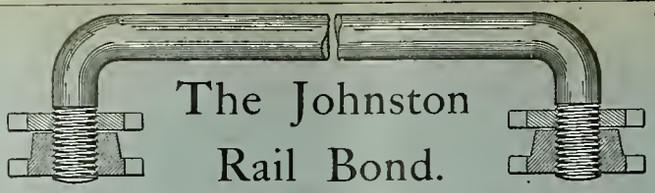

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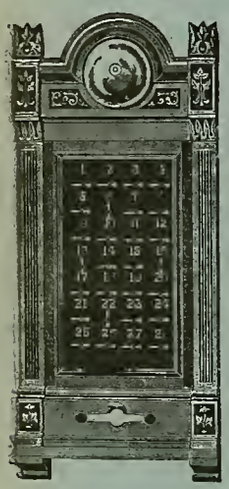

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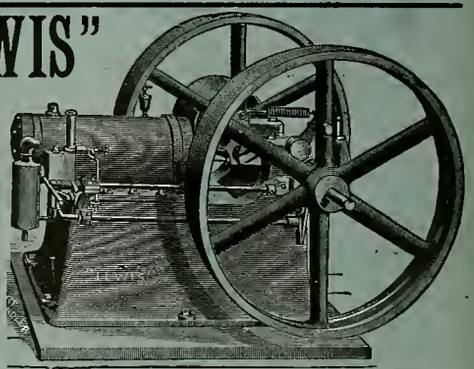

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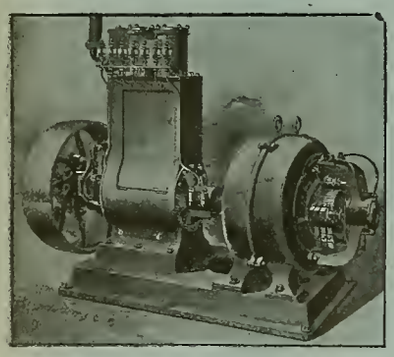

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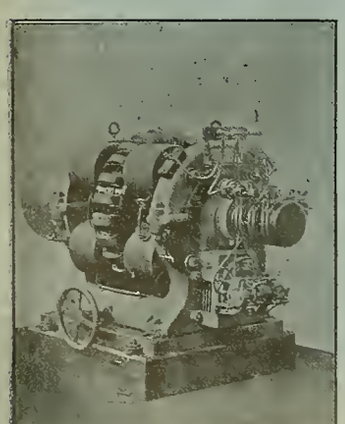

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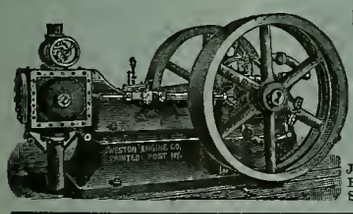

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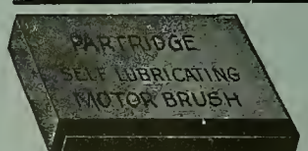
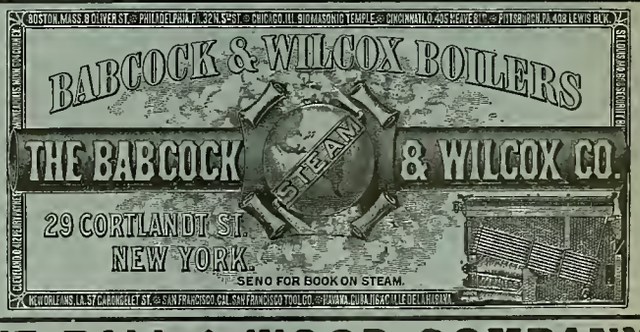


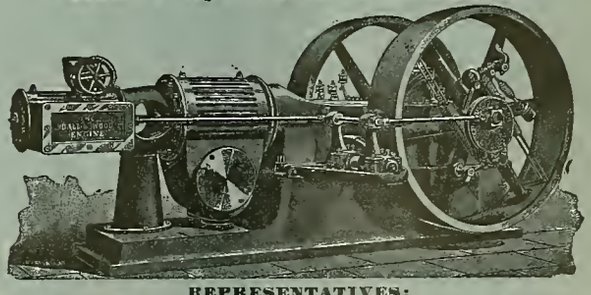

**PARTRIDGE** Send for Samples.

Sandusky, Ohio. **CARBON CO.**




**THE BALL & WOOD COMPANY,**

Builders of Improved Automatic Cut-off Engines.

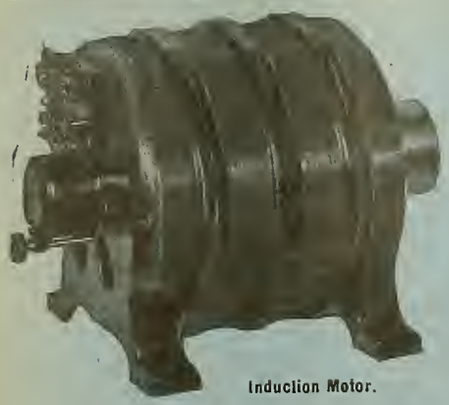


REPRESENTATIVES:

Stern & Silverman, 707 Arch St., Philadelphia, Pa.
George M. Kenyon, Endicott Arcade, St. Paul, Minn.
C. E. Sargent, Home Ins. Bldg., Chicago, Ill.
James & Company, Chattanooga, Tenn.

**WIRES and CABLES,**

Overhead and Underground.



Induction Motor.

A COMPLETE

# Light and Power

## Central Station

IN

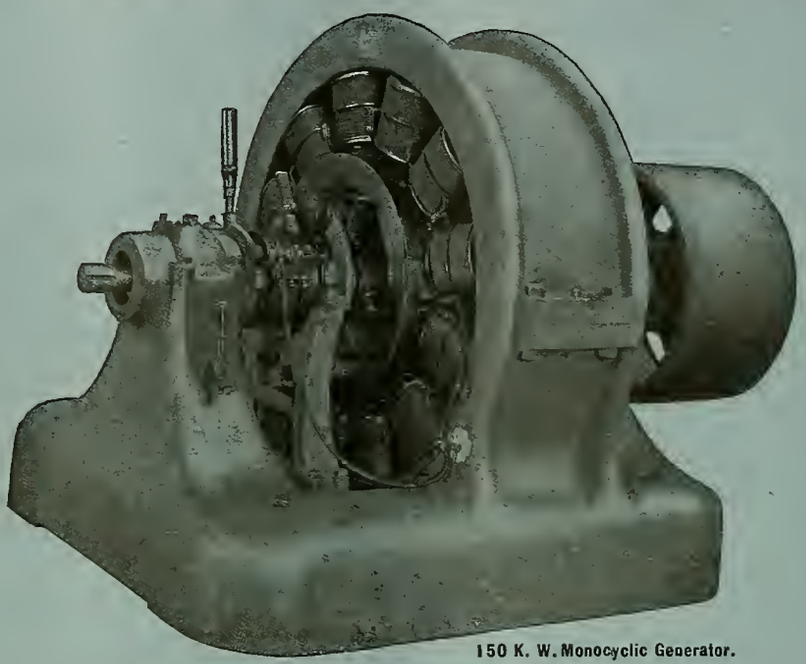
## A Single Alternating Generator,

**Rendered for the first time possible by our**

# MONOCYCLIC

Arc and Incandescent Lighting Circuits Operated on the Single Phase System as from the Ordinary Alternator.

Generators will carry full Load in Lights or Motors or any proportion in Lights and the rest in Motors. There can be no unbalancing.



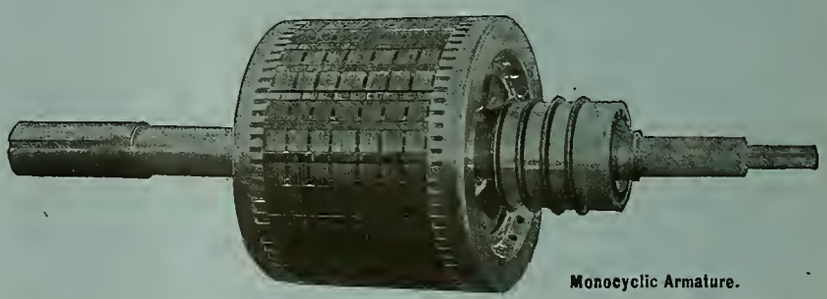
150 K. W. Monocyclic Generator.

Induction Motors Operated with Results Equal to those Obtained with the Best Direct Current Shunt Motors with the Same Efficiency and Better Speed Regulation.

May be Adapted to Systems of Secondary Mains Supplied from Large Transformers.

# SYSTEM OF

***For Power Purposes Equal to a Polyphase System. With all the Simplicity and Advantages of the Single Phase System.***



Monocyclic Armature.

# ELECTRICAL DISTRIBUTION.

CARPENTER ENAMEL RHEOSTATS.

# GENERAL ELECTRIC COMPANY,

**PRINCIPAL SALES OFFICES:**

## MAIN OFFICE, SCHENECTADY, N. Y.

Boston, Mass., 180 Summer Street.
New York, N. Y., 44 Broad Street.
Syracuse, N. Y., 244 West Fayette Street.
Buffalo, N. Y., Erie County Savings Bank Building.
Philadelphia, Pa., 509 Arch Street.
Pittsburg, Pa., 425 Wood Street.
Baltimore, Md., 227 East German Street,

Atlanta, Ga., Equitable Building.
Cincinnati, Ohio 264 West Fourth Street.
Columbus, Ohio, 12¼ North High Street.
Chicago, Ill., Monadnock Building.
Detroit, Mich., 13 Rowland Street.
Omaha, Neb., 309 South Street.
Kansas City, Mo., New York Life Building.

St. Louis, Mo., Wainwright Building.
Dallas, Tex., Corner Elm and Griffin Streets.
Denver, Colo., 505 Sixteenth Street.
San Francisco, Cal., 15 First Street.
Helena, Mont., Electric Building.
Seattle, Washington, Bailey Building.
Portland, Ore., Front and Ankeny Streets.

**For all business outside the United States and Canada—Foreign Department, Schenectady, N. Y., and 44 Broad Street, New York.**
**For Canada—Canadian General Electric Co., Ltd., Toronto, Canada.**

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Royal Electric Co..... —
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## CLASSIFIED LIST.


**Accumulators.**
Boswell & Co., D. E.,
Bradbnry-Stone Elec. S. Co
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Haschke & Creelman.
Porter & Buerdorf.

**Annunciators.**
Dearborn Electric Co.
Electric Appliance Co,
Nowotny Electric Co.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Elec. Snpply Co.

**Arc Lamps.**
Auerbach-Woolverton El.Co.
C & C Electric Co.
Clark Electric Co.
Crocker-Wheeler Elec. Co,
Electric Cons. & Supply Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
General Inc'd'cent Arc Lt. Co.
Hellos Electric Co.
La Roche Electric Wks.
Little, F. P. Elec. C. & S. Co.
Mather Electric Co.
Perkins El. Switch Mfg. Co.
Westinghonse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Haschke & Creelman.
Law Battery Co.
Leclanche Battery Co., The.
Miamisburg Electric Co
Nowntny Electric Co.
Partrick & Carter Co.
Phœnix Carbon Mfg. Co.
Wallace Electric Co.
Western Electric Co.

**Bells.**
Dearborn Electric Co.
Electric Appliance Cn.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Electric Co.

**Belting.**
Shultz Belting Co
Phœnix Carbon Mfg. Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Cn., The.
Brownell & Co., The.
Clonbrock Steam Boiler Wks.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co., Ltd.

**Brushes.**
Partridge Carbon Co.
Phœnix Carbon Mfg. Co.

**Burglar Alarms.**
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)
**Cables, Electric** . (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Bishop Gutta Percha Co.
Brixey, W. R.
Desrborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Cn.
Western Electric Co.

**Carbons, Points & Plates.**
General Electric Co.
Partridge Carbon Co.
Phœnix Carbon Mfg. Co.
Reisinger, Hugo.
Washington Carbon Co.
Western Electric Co.

**Clocks, Electric.**
Self-Winding Clock Co.

**Compound.**
Eureka Compound Co.

**Conduits.**
Interior Conduit & Ins Co.
National Conduit Mfg. Co.

**Construction & Repairs.**
Allen-Hussey Co.
Amstutz, N. S.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.

**Contractors and Electric Light Plants.**
Allen-Hussey Co.
Amstutz, N. S.
Armstrong, Chas. G.
Arnold, B. J.
Bain, Foree.
Ball, Wm. D.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Clark Electric Co.
Consolidated Engineering Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Goltz & Sinclair.
Interior Condnit & Ins. Co.
La Roche Electric Wks.
Mather Electric Co
Siemens & Halske Elec. Co.
Unlted Elec Improvement Co
Westinghonse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.
Law Battery Co.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Bishop Gutts Percha Co.
Brixey, W. R.
Bunnell & Co , J. H.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard U derground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brownlee & Co.
Electric Appliance Co.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Bryant Electric Co.
Bunnell & Co., J. H.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elliott-Lincoln Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Cn.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Cn.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Clark Electric Co.
Colburn Electric Mfg. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Cn.
La Roche Electric Wks.
Mather Electric Co.
Palmer Bros.
Roth & Eck.
Royal Electric Co.
Siemens & Halske Elec. Co.
Western Electric Co.
Westinghnuse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Allen-Bussey Co.
Amstutz, N. S.
Armstrong, Chas. G.
Arnold, B. J.
Ball, Wm. D.
Bain, Foree.
Bryan, Wm. H.
Consolidated Eng. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg, Co,
Goltz & Sinclair.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bunnell & Co., J. H.
Culgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Electrical Specialties.**
Clark El. Specialty Mfg, Co.
Holtzer-Cabot Electric Co.
Nashold Cleat Co.
Proctor-Raymond Elec. Co.

**Electroliers, etc.**
Edwards, W. S. Mfg. Co.
Gleason, E. P. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn Electric Mfg. Co.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.
Webster Mfg. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Brownell & Co., The.
Erie City Iron Wks.
Freeman & Sons Mfg. Co.
Racine Hardware Co.
Sioux City Eng. & Iron Wks.
Watertown Steam Engine Cn.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Diehl & Co.
Interior Condnit & Ins. Co.

**Feed Water Heaters.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Fibre.**
Butler Hard Rubber Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Butler Hard Rubber Co.
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Chicago Ins. Wire Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Holtzer-Cabot Electric Co.
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. B.
Grant, Geo. B.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bryant Electric Co.
Bunnell & Co., J. H.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Elliott-Lincoln Elec. Co.
General Electric Co.
High & Co., J. Grant.
Holtzer-Cabot Electric Co.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Nashold Cleat Co.
Nowotny Electric Co.
Palmer Bros.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Proctor-Raymond Elec. Co.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Gleason, E. P. Mfg. Co.
Jaeger Mfg. Co., The.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.

**Induction Coils.**
Splitdorf, C. F.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Holtzer-Cabot Electric Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
Little, F. P. Elec. C. & S. Co.
Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Nowotny Electric Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Paragon Insulating Co.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Bishop Gntta Percha Co.
Brixey, W. R.
Bunnell & Co., J. H.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Am. Electrical Mfg. Co.
Hescon Vac Pump & Elec.Co.
Bernstein Electric Co.
Buckeye Electric Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Cn.
Jaeger Mfg. Co., The.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg. Co.

**Lightning Arresters.**
Colgate Co , Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Bliss Co., E. W.
Hine & Robertson Co.
Lukens Iron & Steel Co.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Brush Electric Co.
C & C Electric Co.
Colburn Electric Mfg. Co
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Palmer Bros.
Royal Electric Co.
Roth & Eck.
Sioux City Brass Works
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Paragon Insulating Co.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm.Co. Ltd

**Pianos and Organs.**
Beethoven Piano & Organ Co.

**Platinum.**
Haker & Co.

**Poles.**
Brownlee & Co.
Morris, Tasker & Co.
Nuttall Co., R. D.

**Porcelain.**
Empire China Works.
General Electric Co.

**Publishers, Electrical**
Electrician Publishing Co

**Push Buttons.**
Electric Appliance Co
Partrick & Carter Co.

**Rheostats.**
General Electric Co.

**Sal Ammoniac.**
Klipstein, A. & Co.
Law Battery Co.

**Separators**
Goubert Mfg. Co.
Hine & Robertson Co.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.

**Steam Heating.**
Gnubert Mfg. Co.
Webster & Co., Warren.

**Steam Pumps.**
Worthington, Henry R.

**Storage Batteries.**
Boswell & Co., D. E.
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Electric Appliance Co.
Moore, Alfred F.
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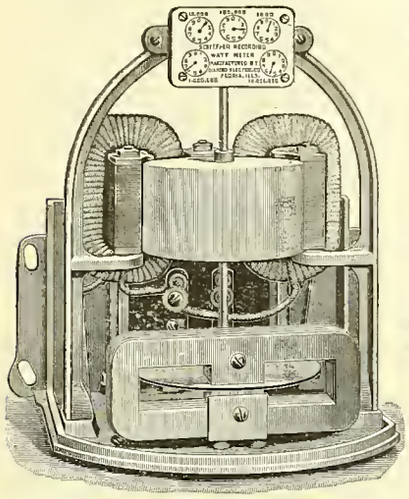

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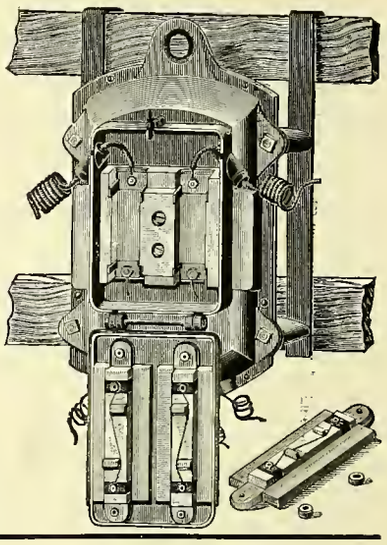

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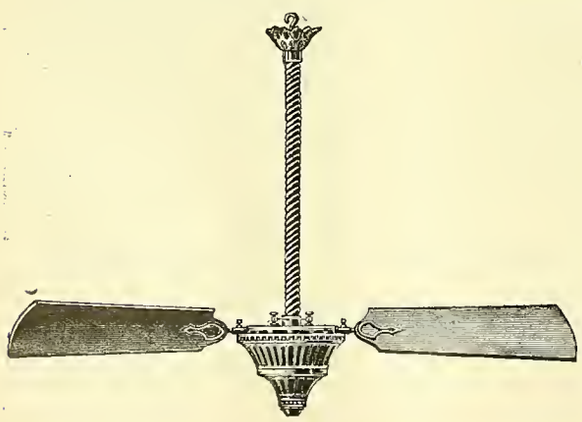

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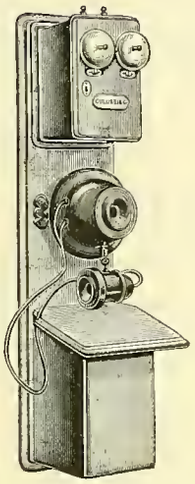

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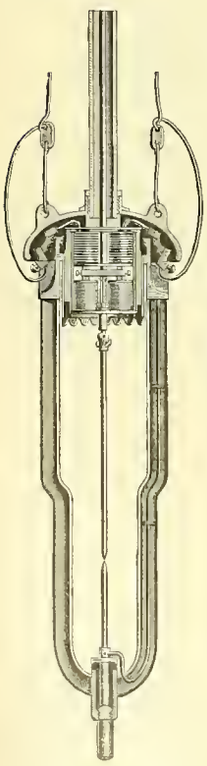

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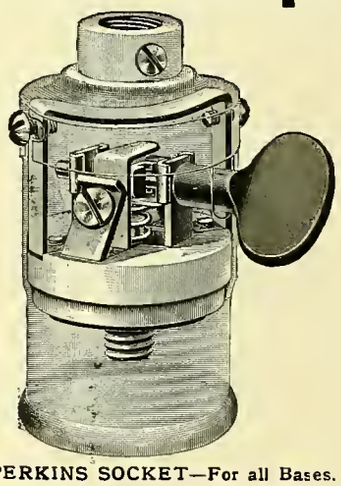

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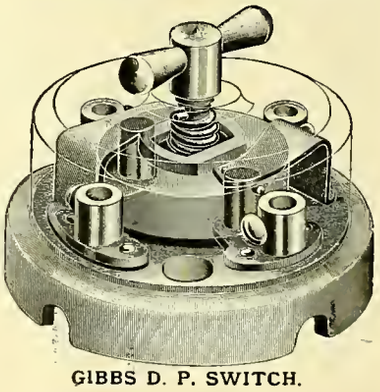

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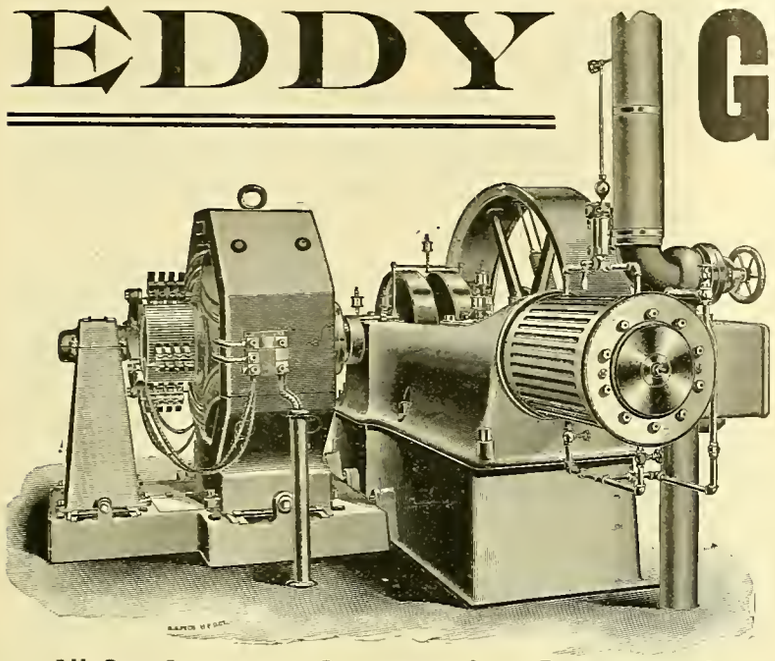

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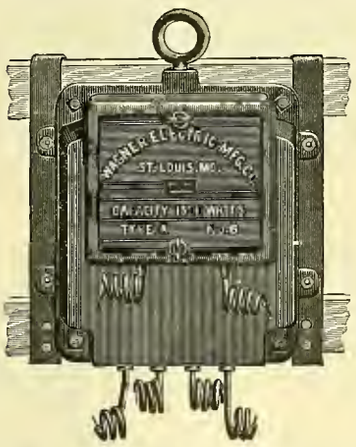


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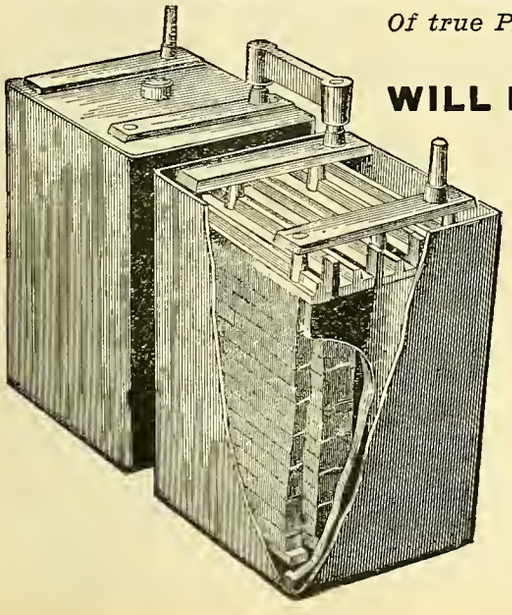
*Of true PLANTE Type and CRYSTALLINE FORMATION.*

Will give or receive without injury, currents that would destroy other batteries.



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Contain no asbestos or other separating material to increase their internal resistance.

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Absolutely free circulation of electrolyte preventing discharge of one plate into another.

## Highest efficiency, largest delivery, lowest internal resistance.

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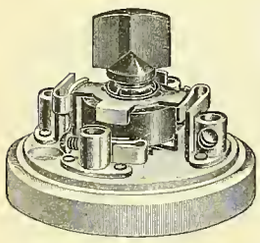

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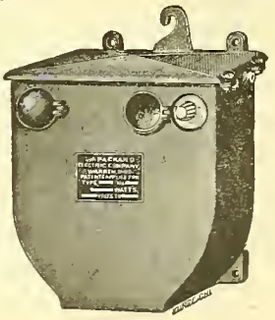

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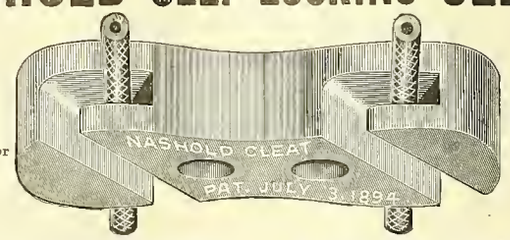


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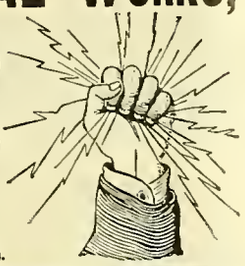

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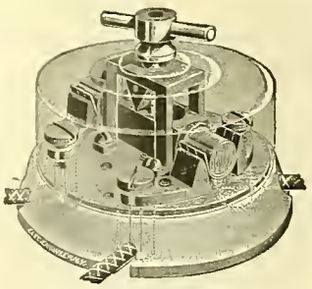

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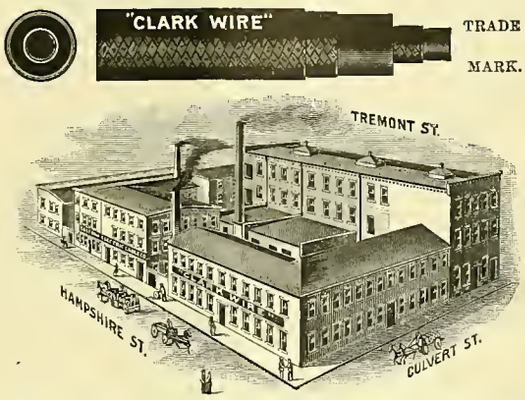


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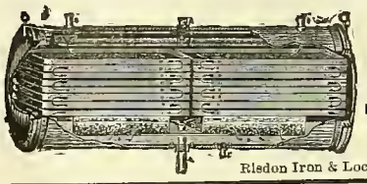

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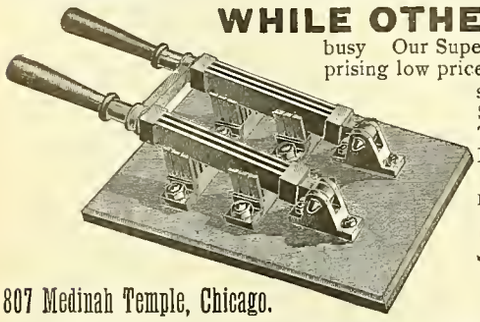

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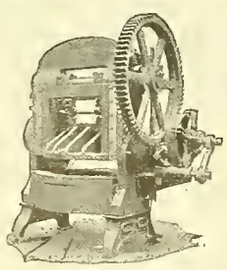

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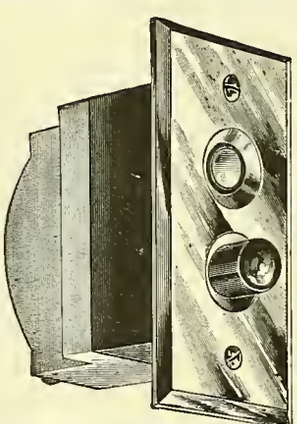

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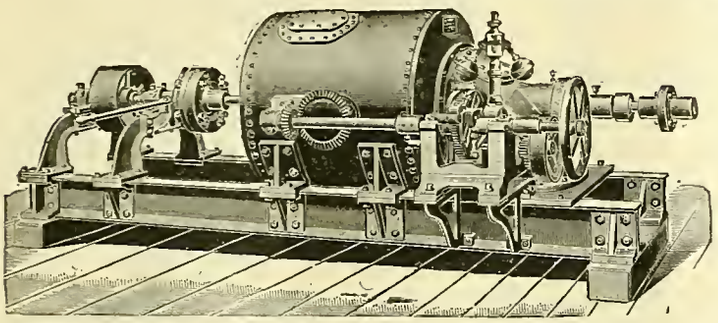

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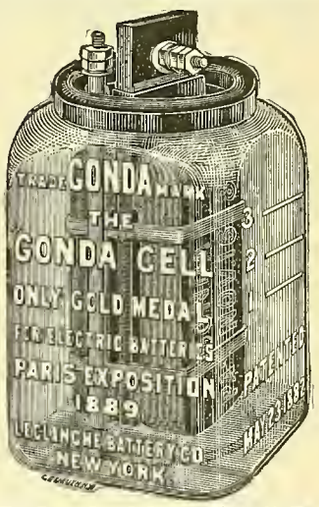


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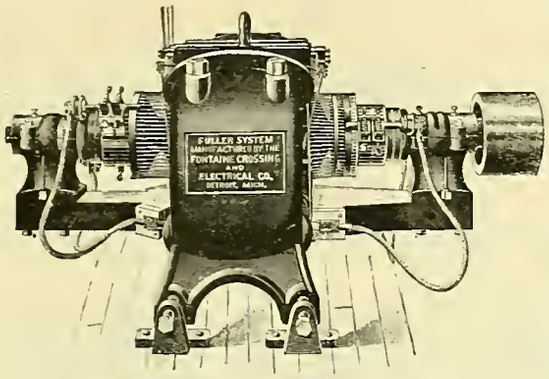

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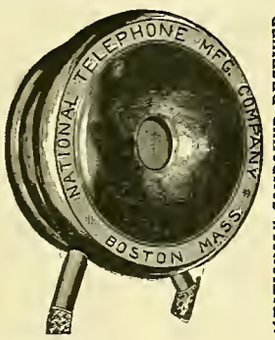


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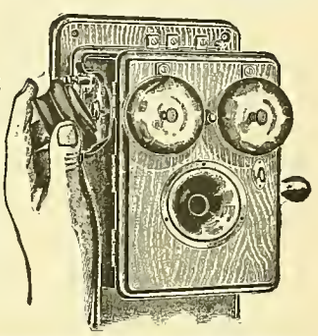

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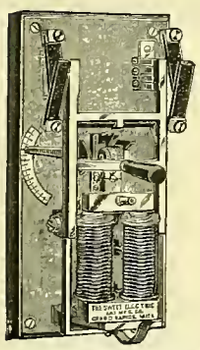

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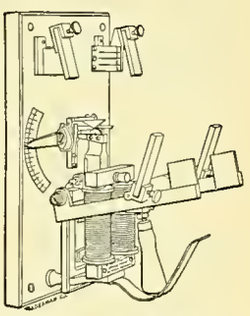

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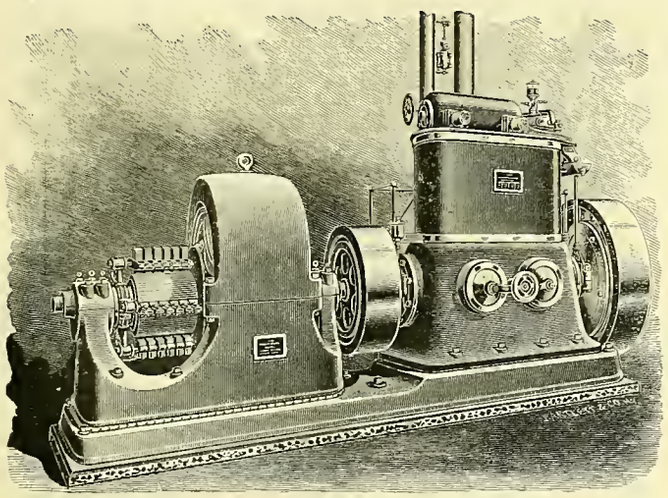

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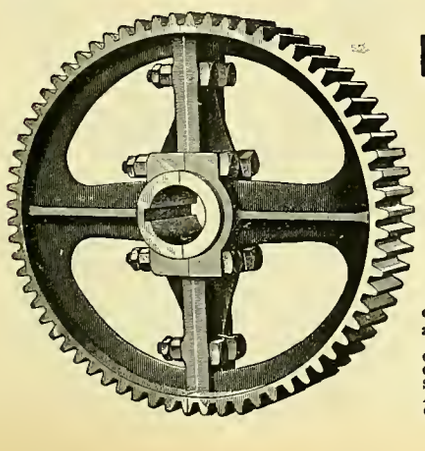

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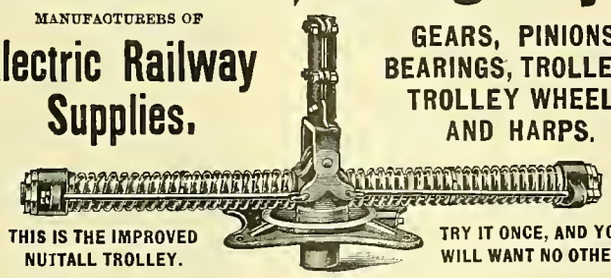

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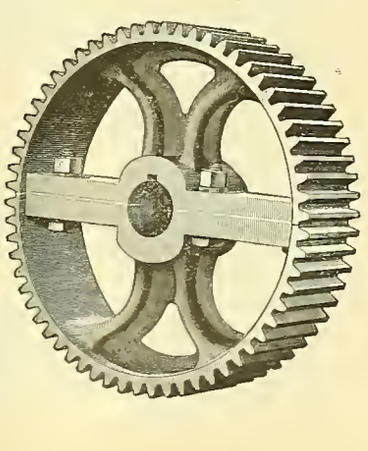

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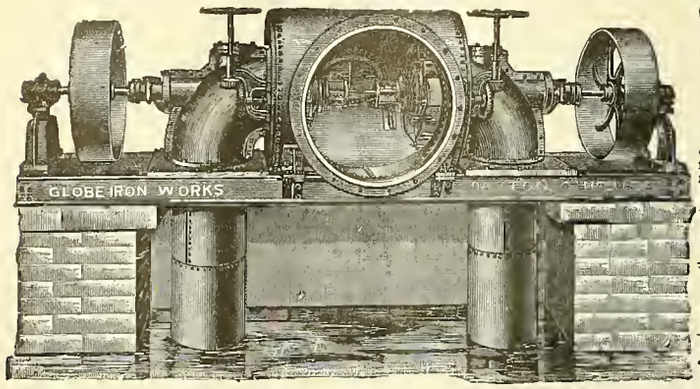


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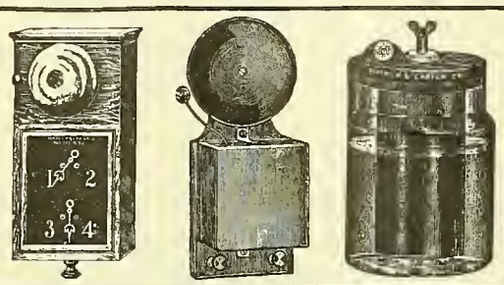

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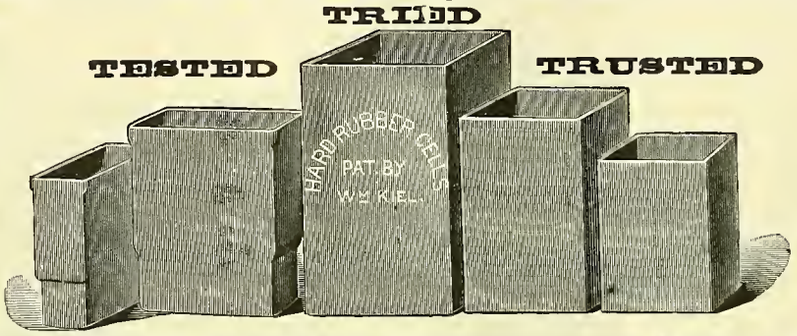


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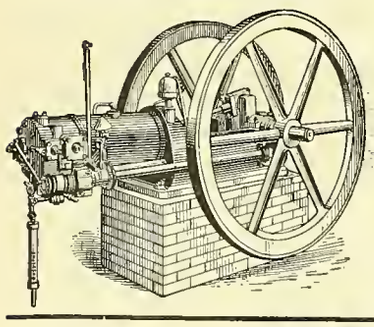

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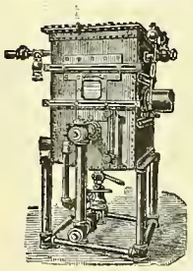

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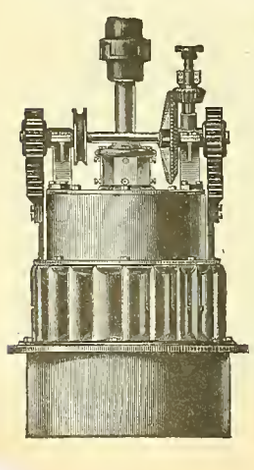

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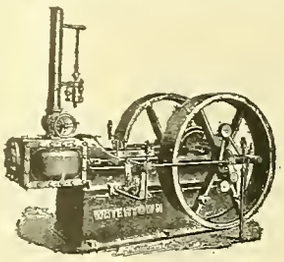

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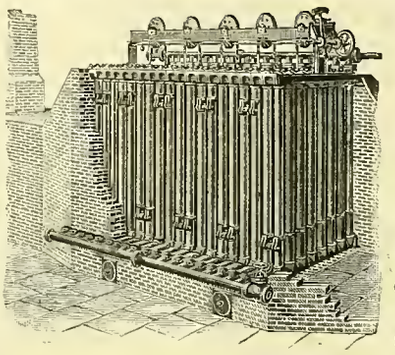

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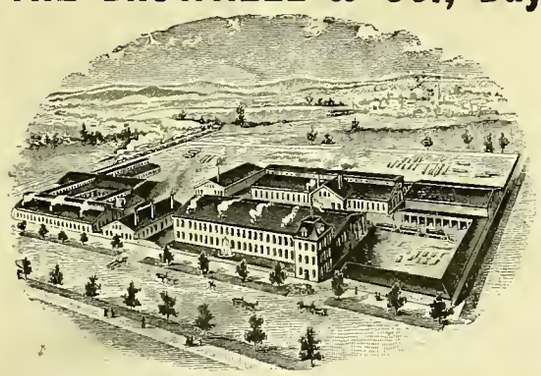

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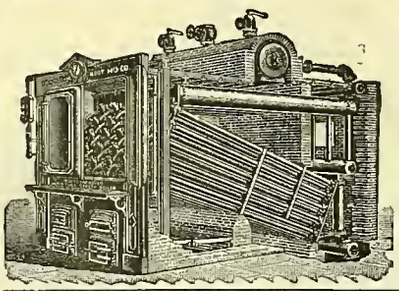

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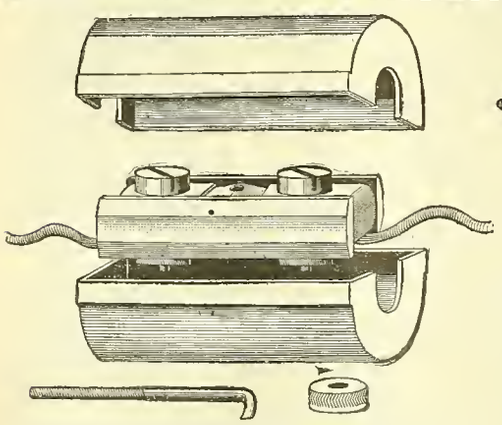
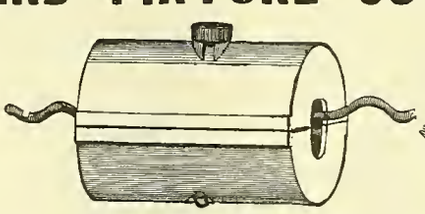


Enlarged cut showing construction of Gleason's Porcelain Lighting-Bug Cut-Out covered with porcelain.



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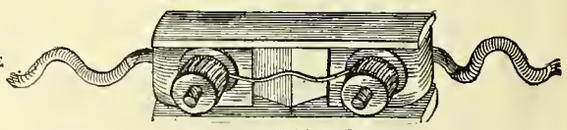

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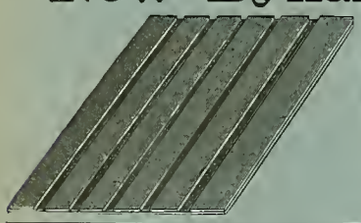

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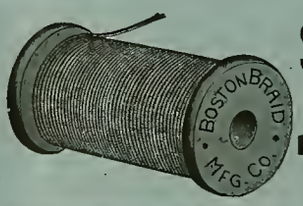


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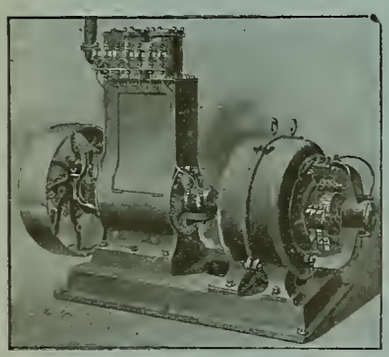

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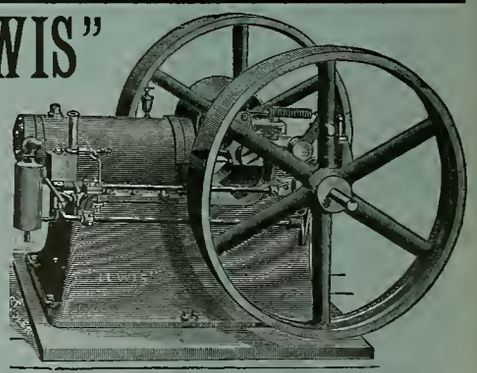

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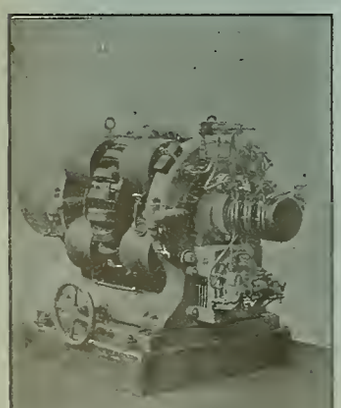

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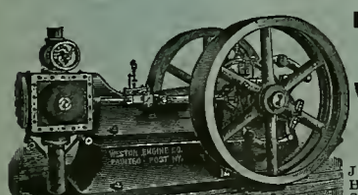

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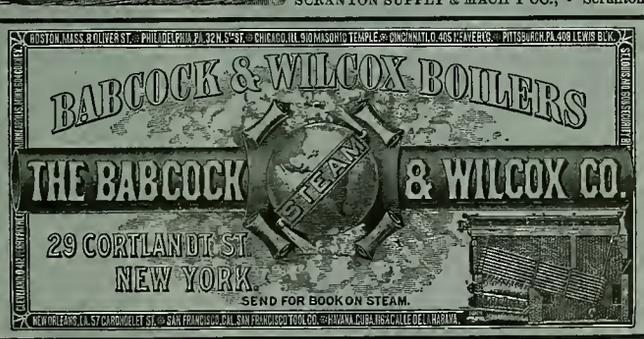


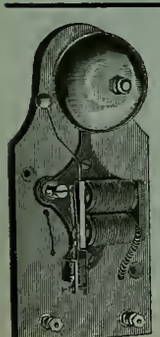

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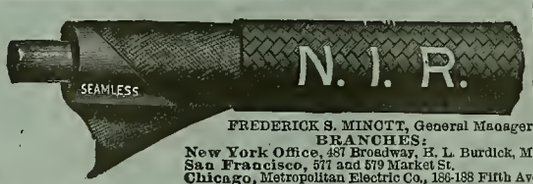


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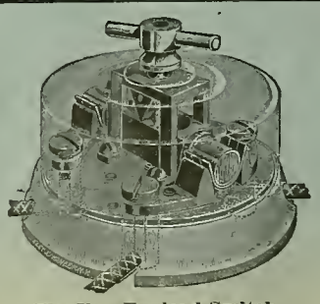

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## CLASSIFIED LIST.


**Accumulators.**
Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Haschke & Creelman.
Porter & Buerdorf.

**Annunciators.**
Dearborn Electric Co.
Electric Appliance Co.
Nowotny Electric Co.
Ostrander &Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Elec. Supply Co.

**Arc Lamps.**
Auerbach-Woolverton El.Co.
C & C Electric Co.
Clark Electric Co.
Crocker-Wheeler Elec. Co.
Electric Cons. & Supply Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
General Inc'd'cent Arc Lt. Co.
Helios Electric Co.
La Roche Electric Wks.
Little, F. P. Elec. C. & S. Co.
Mather Electric Co.
Perkins El. Switch Mfg. Co.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Haschke & Creelman.
Law Battery Co.
Leclanche Battery Co., The.
Miamisburg Electric Co
Nowotny Electric Co.
Partrick & Carter Co.
Phœnix Carbon Mfg. Co.
Wallace Electric Co.
Western Electric Co.

**Bells.**
Dearborn Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Electric Co.

**Belting.**
Shultz Belting Co.
Phœnix Carbon Mfg. Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Brownell & Co., The.
Clonbrock Steam Boiler Wks.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co., Ltd.

**Brushes.**
Partridge Carbon Co.
Phœnix Carbon Mfg. Co.

**Burglar Alarms.**
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric.** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Bishop Gutta Percha Co.
Brixey, W. R.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Carbons, Points & Plates.**
General Electric Co.
Partridge Carbon Co.
Phœnix Carbon Mfg. Co.
Reisinger, Hugo.
Washington Carbon Co.
Western Electric Co.

**Clocks, Electric.**
Self-Winding Clock Co.

**Compound.**
Eureka Compound Co

**Conduits.**
Interior Conduit & Ins Co.
National Conduit Mfg. Co.

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Allen-Hussey Co.
Amstutz, N. S.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Comp Elec. Const. Co.

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Amstutz, N. S.
Armstrong, Chas. G.
Arnold, B. J.
Bain, Force.
Ball, Wm. D.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Clark Electric Co.
Consolidated Engineering Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft Wayne Elec. Corporation.
General Electric Co.
Goltz & Sinclair.
Interior Conduit & Ins. Co.
La Roche Electric Wks.
Mather Electric Co
Siemens & Halske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. B.
Law Battery Co.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co., J. H.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard U derground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

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Anderson, Albert & J. M.
Brownlee & Co.
Electric Appliance Co.
Nuttall Co., R. D.
Partrick & Carter Co.

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Bunnell & Co., J. H.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elliott-Lincoln Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Clark Electric Co.
Colburn Electric Mfg.Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
La Roche Electric Wks.
Mather Electric Co.
Palmer Bros.
Roth & Eck.
Royal Electric Co.
Siemens & Halske Elec. Co.
Western Electric Co.
Westinghouse Elec. & Mfg.Co.

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General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

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Allen-Hussey Co.
Amstutz, N. S.
Armstrong, Chas. G.
Arnold, B. J.
Ball, Wm. D.
Bain, Force.
Bryan, Wm. H.
Consolidated Eng. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg, Co,
Field & Hinchman.
Ford, Owen.
Goltz & Sinclair.
Spencer, E. J.

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Anderson, Albert& J. M.
Bunnell & Co., J. H.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Queen & Co.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Electrical Specialties.**
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Interstate Comp. Elec. Const Co.
Holtzer-Cabot Electric Co.
Nashold Cleat Co
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Colburn Electric Mfg. Co.
General Electric Co.

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Otto Gas Engine Wks.
Webster Mfg. Co.

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Ball & Wood Co., The.
Brownell & Co., The.
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Freeman & Sons Mfg. Co.
Racine Hardware Co.
Sioux City Eng. & Iron Wks.
Watertown Steam Engine Co.
Westinghouse Machine Co.
Weston Engine Co.

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Interior Conduit & Ins. Co.

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Gonbert Mfg. Co.
Webster & Co., Warren.

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Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Butler Hard Rubber Co.
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Chicago Ins. Wire Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.

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Holtzer-Cabot Electric Co.
Partrick & Carter Co.

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Besly & Co., Chas. H.
Grant, Geo. B.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bryant Electric Co.
Bunnell & Co., J. H.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Elliott-Lincoln Elec. Co.
General Electric Co.
High & Co., J. Grant.
Holtzer-Caoot Electric Co.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Metropolitan Electric Co.
Nashold Cleat Co.
Nowotny Electric Co.
Palmer Bros.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Proctor-Raymond Elec. Co.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Gleason, E. P. Mfg. Co.
Jaeger Mfg. Co., The.

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Dixon Crucible Co., Jos.

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Splitdorf, C. F.

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Bunnell & Co., J. H.
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Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Holtzer-Cabot Electric Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
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Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Nowotny Electric Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Paragon Insulating Co.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co., J. H.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

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Am. Electrical Mfg. Co.
Beacon Vac Pump &Elec.Co.
Hernstein Electric Co.
Buckeye Electric Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Jaeger Mfg. Co., The.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec.&Mfg.Co.

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Colgate Co., Geo. L.
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Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Bliss Co., E. W.
Hine & Robertson Co.
Lukens Iron & Steel Co.

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General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

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C & C Electric Co.
Colburn Electric Mfg. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec, Mfg, Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Palmer Bros.
Royal Electric Co.
Roth & Eck.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

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Electrician Publishing Co.

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Electric Appliance Co
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Hine & Robertson Co.

**Silk Braid.**
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Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co

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Colgate Co., Geo. L.
Diamond Electric Co.

**Steam Heating.**
Gonbert Mfg. Co.
Webster & Co., Warren.

**Steam Pumps.**
Worthington, Henry R.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Haschke & Creelman.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
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Brixey, W. R.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.

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Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones**
Columbia Tel. Mfg. Co.
National Telep. Mfg. Co.
Nowotny Electric Co.
Partrick & Carter Co.
Western Electric Co.
Western Tel. Const. Co
Williams & Abbott Elec. Co.

**Transformers.**
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General Electric Co.
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Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
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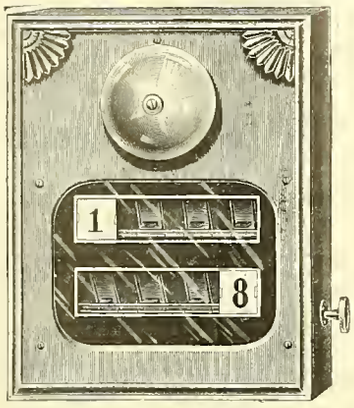
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A
Standard Underground C.Co.

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Made in Sizes from 3 to 20 Drops.

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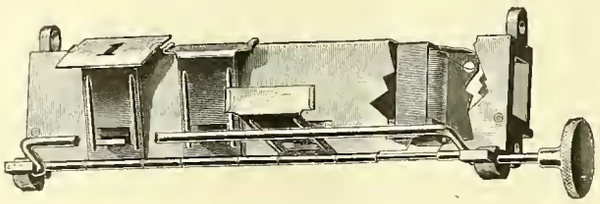

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# Alternating Current Generators,

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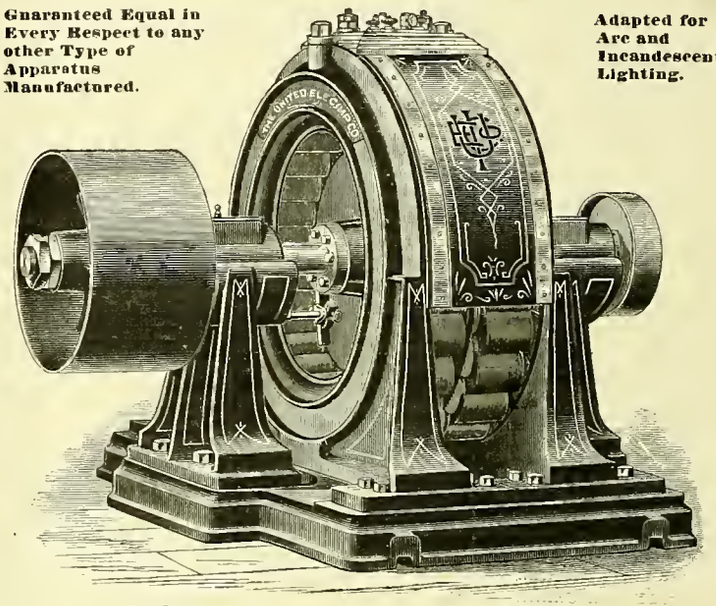
**Adapted for Arc and Incandescent Lighting.**



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Improved Long Distance Series Incandescent Apparatus for Street and Commercial Illumination.

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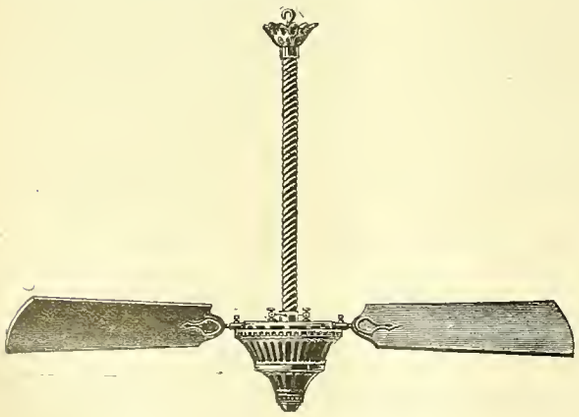

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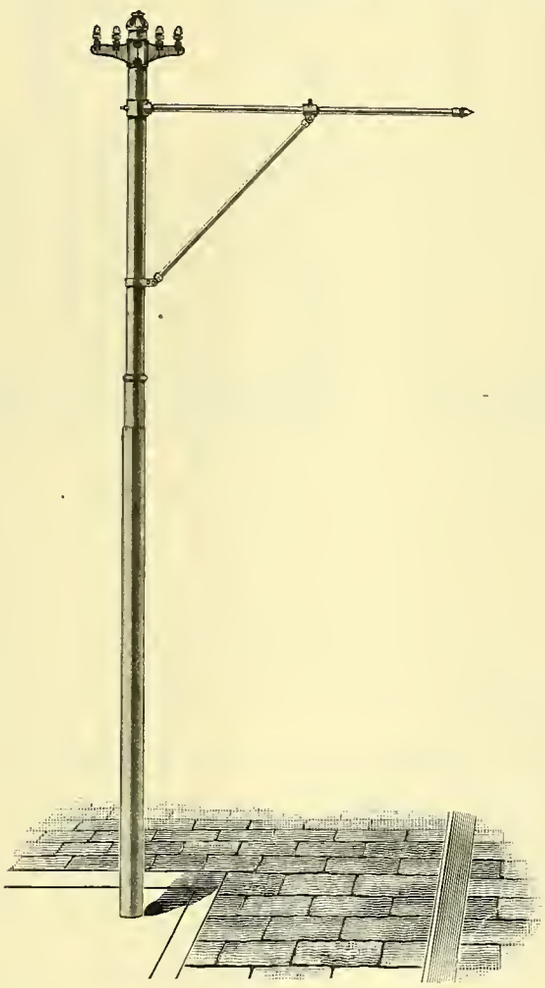

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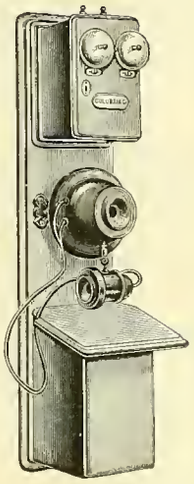

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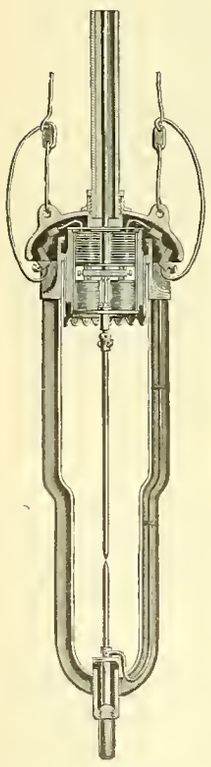

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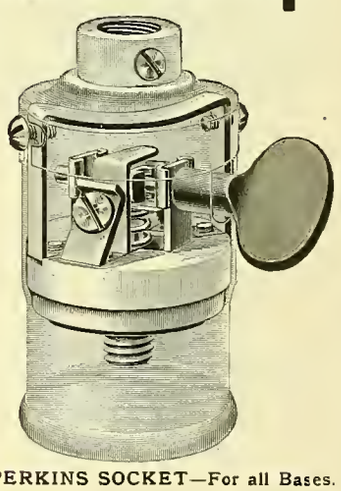

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**C. W. CONOVER, Mgr.**

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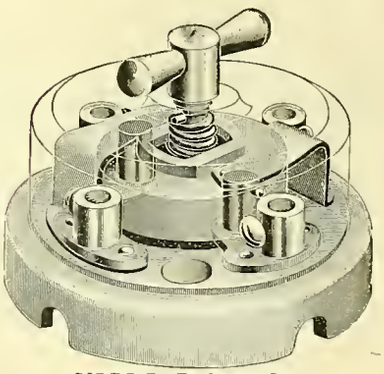
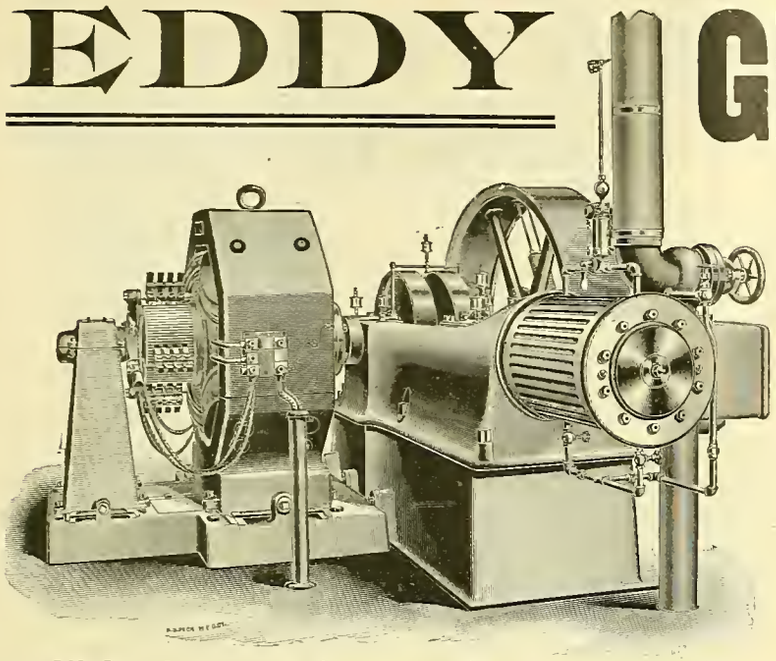


GIBBS D. P. SWITCH.

# EDDY GENERATORS



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*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*

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All Our Apparatus Guaranteed as Represented.

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## TO THE

# CONVENTION.

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A Special Rate of a Fare and a Third for the Round Trip on the Certificate Plan has been granted.

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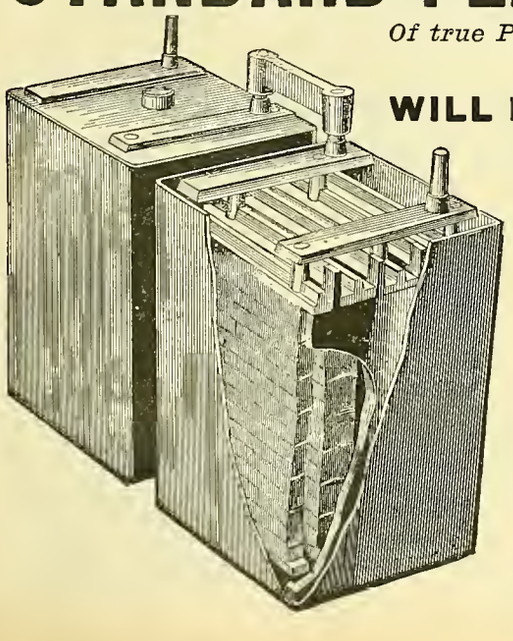
## SEE THAT YOUR TICKETS TO CLEVELAND READ VIA "LAKE SHORE."

# STANDARD PLANTE STORAGE BATTERIES

*Of true PLANTE Type and CRYSTALLINE FORMATION.*



Will give or receive without injury, currents that would destroy other batteries.

## WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.

Contain no asbestos or other separating material to increase their internal resistance.

## ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

## Highest efficiency, largest delivery, lowest internal resistance.

For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

## Cannot be damaged by excessive charge or discharge currents.

A 400 ampere current has been taken from a 120 ampere hour cell.

☞ CHALLENGE: We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

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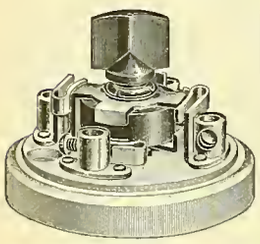
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



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*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

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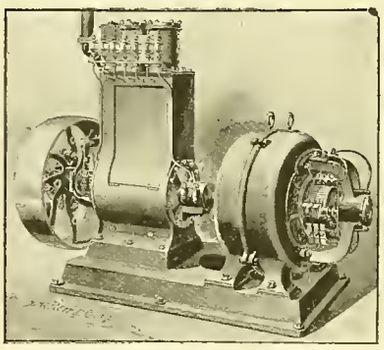

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Direct Current, Slow Speed, Iron Clad,

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By the man who made them in Germany.

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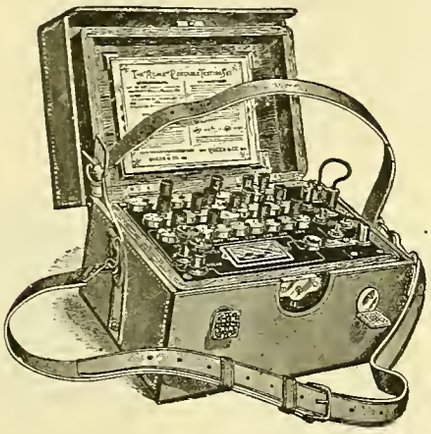

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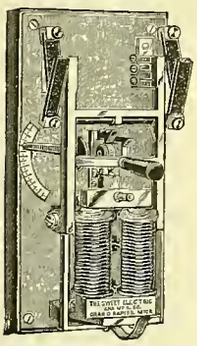

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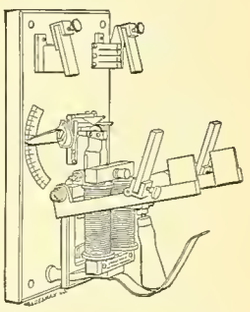

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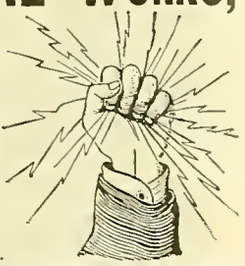

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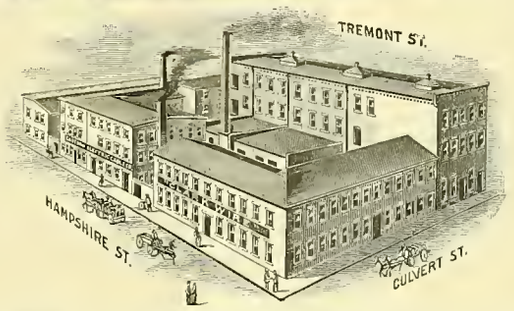


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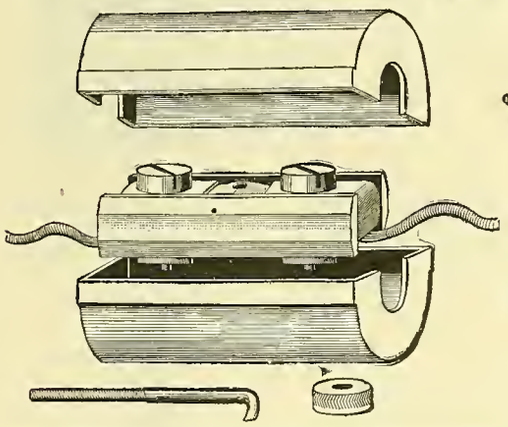
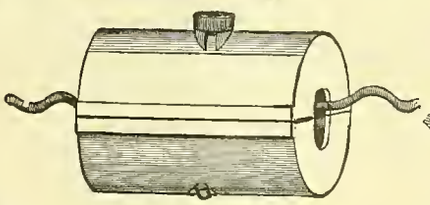


Enlarged cut showing construction of Gleason's Porcelain Lighting-Bug Cut-Out covered with porcelain.



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Smallest Covered Solid Porcelain Cut-Out on the Market.

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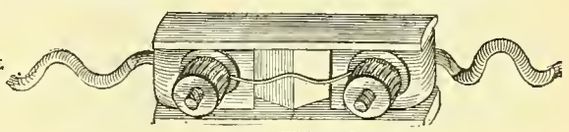

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Best and Smallest Cut-Out Made.

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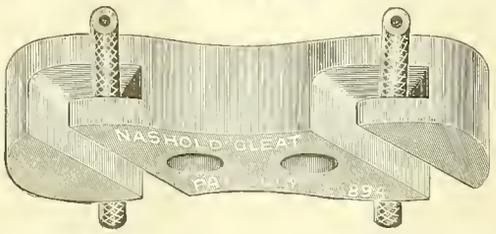
Patented In U. S., Canada, England, France, And Applied for In Germany.

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**It is in one piece.**
**It has the strength.**

**It will lock the wire firmly.**
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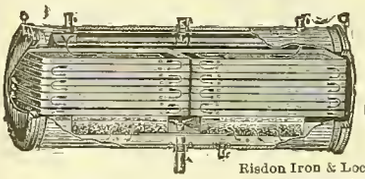

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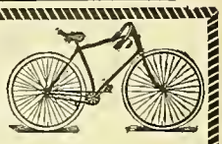

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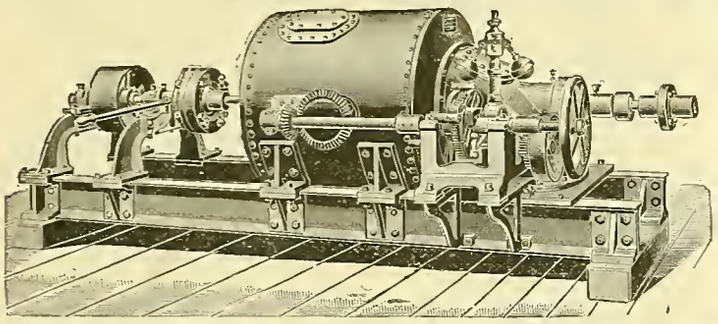

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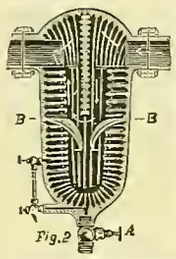


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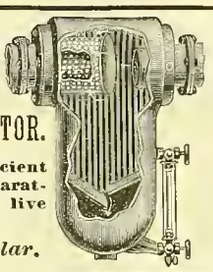

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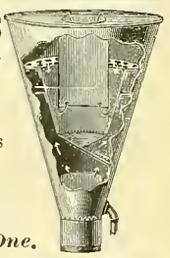

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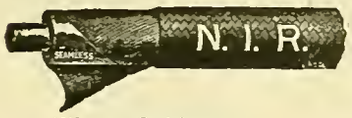


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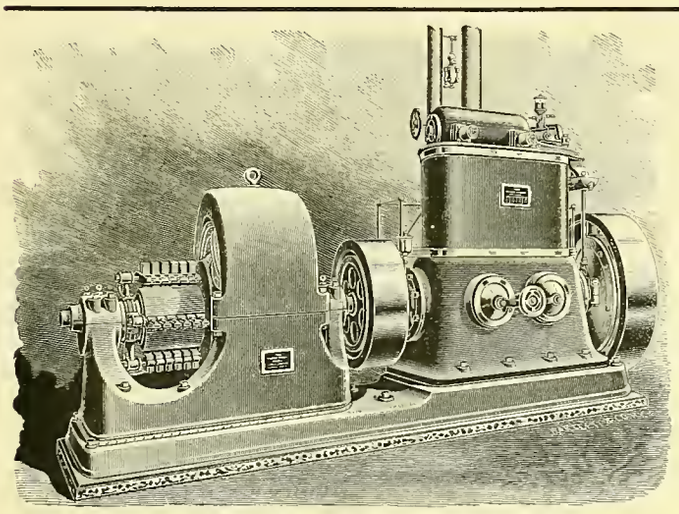

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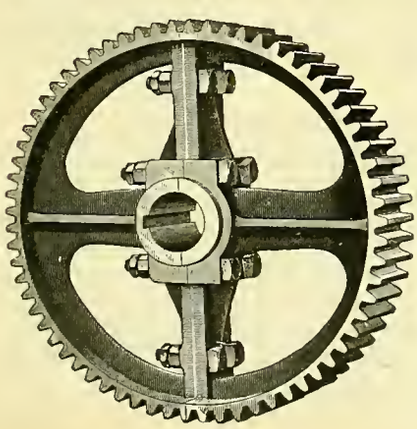

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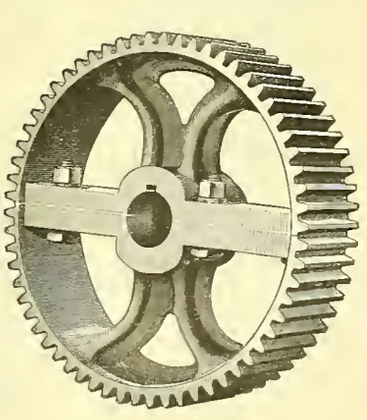

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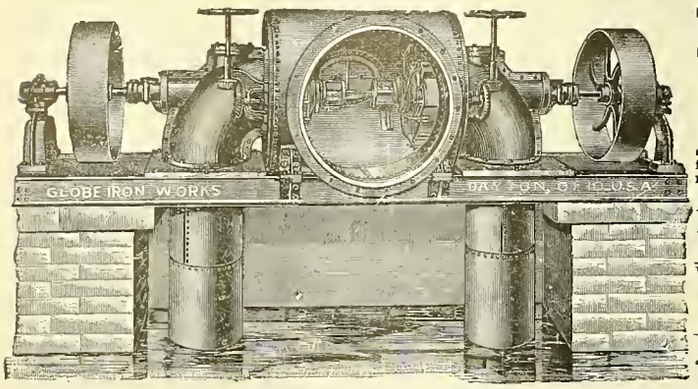


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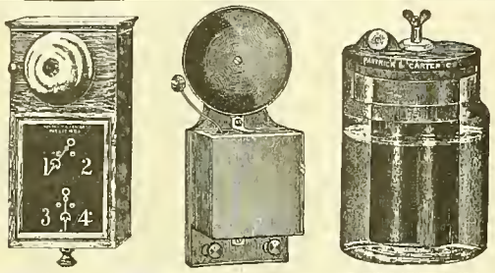

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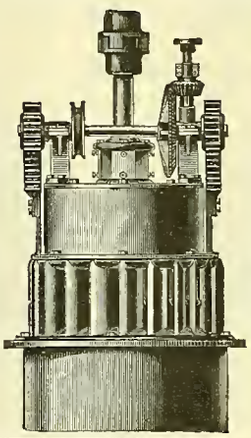

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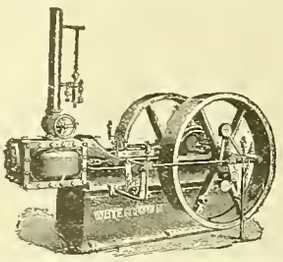

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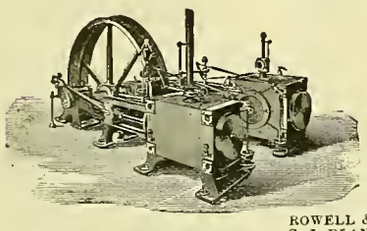

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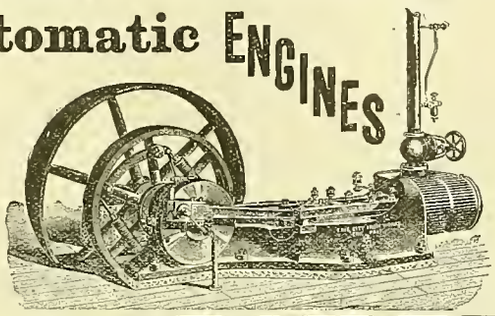

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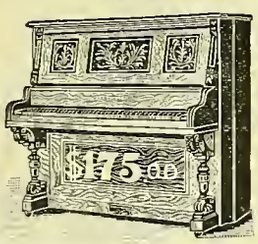

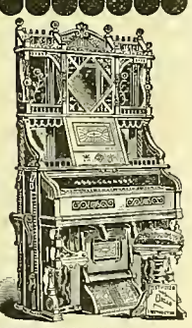

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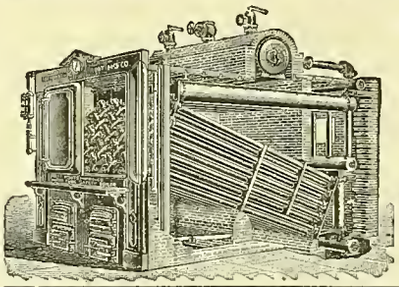

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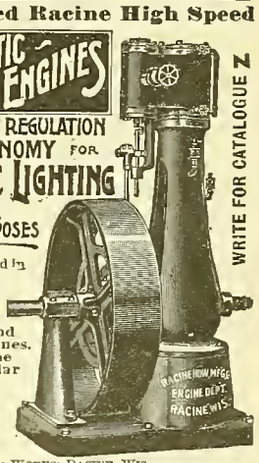

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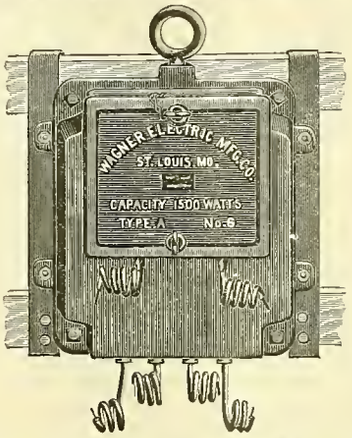


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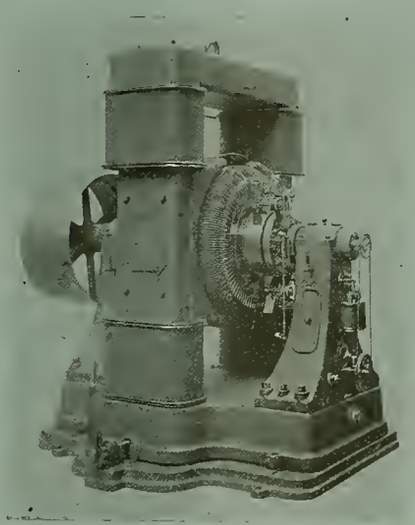

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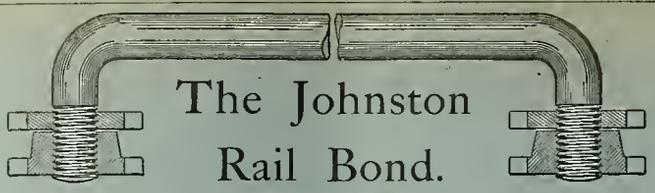

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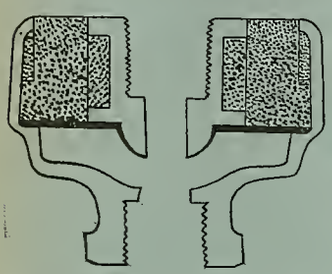

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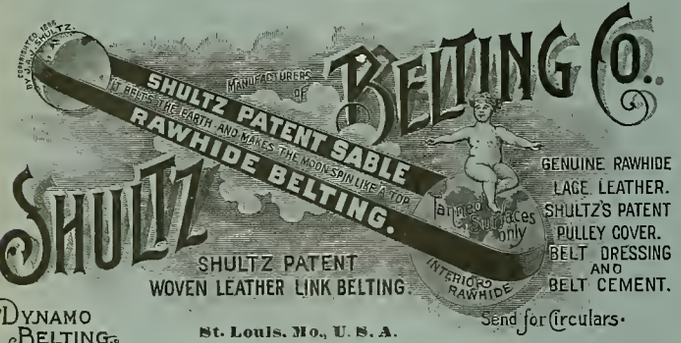


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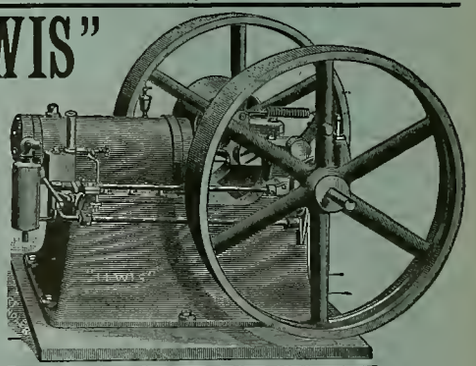

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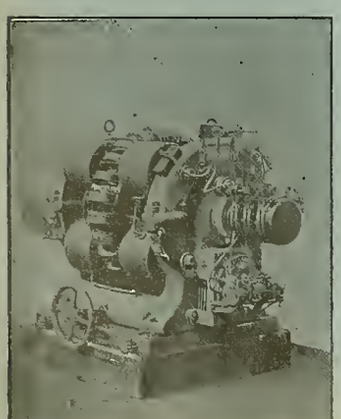

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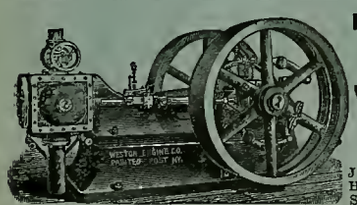

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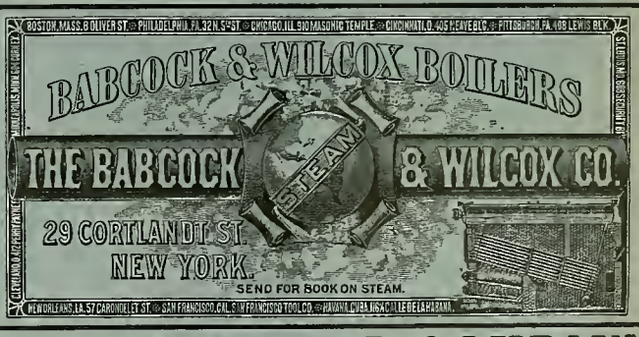


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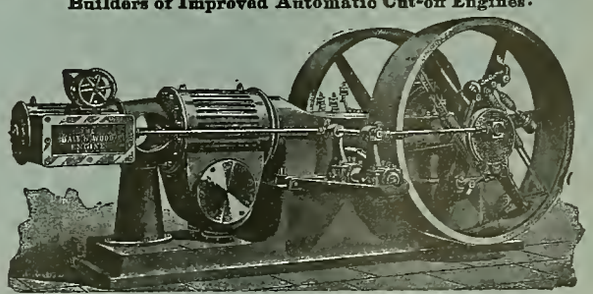

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Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Haschke & Creelman.
Law Battery Co.
Leclanche Battery Co., The.
Miamisburg Electric Co
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Phœnix Carbon Mfg. Co.
Wallace Electric Co.
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Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Electric Co.

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Phœnix Carbon Mfg. Co.

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Racine Hardware Co.
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Eastern Electric Cable Co.
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Fiberite Co., The.
General Electric Co.
Hays & Co., J. L.
High & Co., J. Grant.
Holtzer-Cabot Electric Co.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Metropolitan Electric Co.
Michigan Electric Co.
Nashold Cleat Co.
Nowotny Electric Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Poland, Lawrence.
Proctor-Raymond Elec. Co.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Thayer, Wm. C.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Gleason, E. P. Mfg. Co.
Jaeger Mfg. Co., The.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.

**Induction Coils.**
Splitdorf, C. F.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Holtzer-Cabot Electric Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
Little, F. P. Elec. C. & S. Co.
Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Nowotny Electric Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Paragon Insulating Co.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Atlas Covering Wks.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co., J. H.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
India Rubber & G. P. I. Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Am. Electrical Mfg. Co.
Beacon Vac Pump & Elec. Co.
Bernstein Electric Co.
Buckeye Electric Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Jaeger Mfg. Co., The.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg. Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Hine & Robertson Co.
Hunt Co., C. W
Lukens Iron & Steel Co.
Nicholas & Barr

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Bernard Co., The E. G.
Brush Electric Co.
C & C Electric Co.
Colburn Electric Mfg. Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Dayton Fan & Motor Co
Eddy Elec, Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Michigan Electric Co.
Onondaga Dynamo Co.
Poland, Lawrence.
Royal Electric Co.
Roth & Eck.
Shawhan-Thresher El. Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Oil Filters.**
Phoenix Auto. Filter Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Paragon Insulating Co.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd.

**Pianos and Organs.**
Beethoven Piano & Organ Co.

**Platinum.**
Baker & Co.

**Poles.**
Brownlee & Co.
Morris, Tasker & Co.
Nuttall Co., R. D.
Valentine-Clark Co.

**Porcelain.**
Empire China Works.
General Electric Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Electric Appliance Co
Partrick & Carter Co.

**Rheostats.**
General Electric Co.

**Sal Ammoniac.**
Klipstein, A. & Co.
Law Battery Co.

**Separators.**
Goubert Mfg. Co.
Hine & Robertson Co.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Steam Pumps.**
Worthington, Henry R.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Haschke & Creelman.
Porter & Buerdorf.
Syracuse Storage B. Co.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones**
Columbia Tel. Mfg. Co.
National Telep. Mfg. Co.
Nowotny Electric Co.
Partrick & Carter Co.
Western Electric Co.
Western Tel. Const. Co.
Williams & Abbott Elec. Co.

**Transformers.**
Diamond Electric Co.
General Electric Co.
Hornberger Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Trolley Cord.**
Samson Cordage Wks

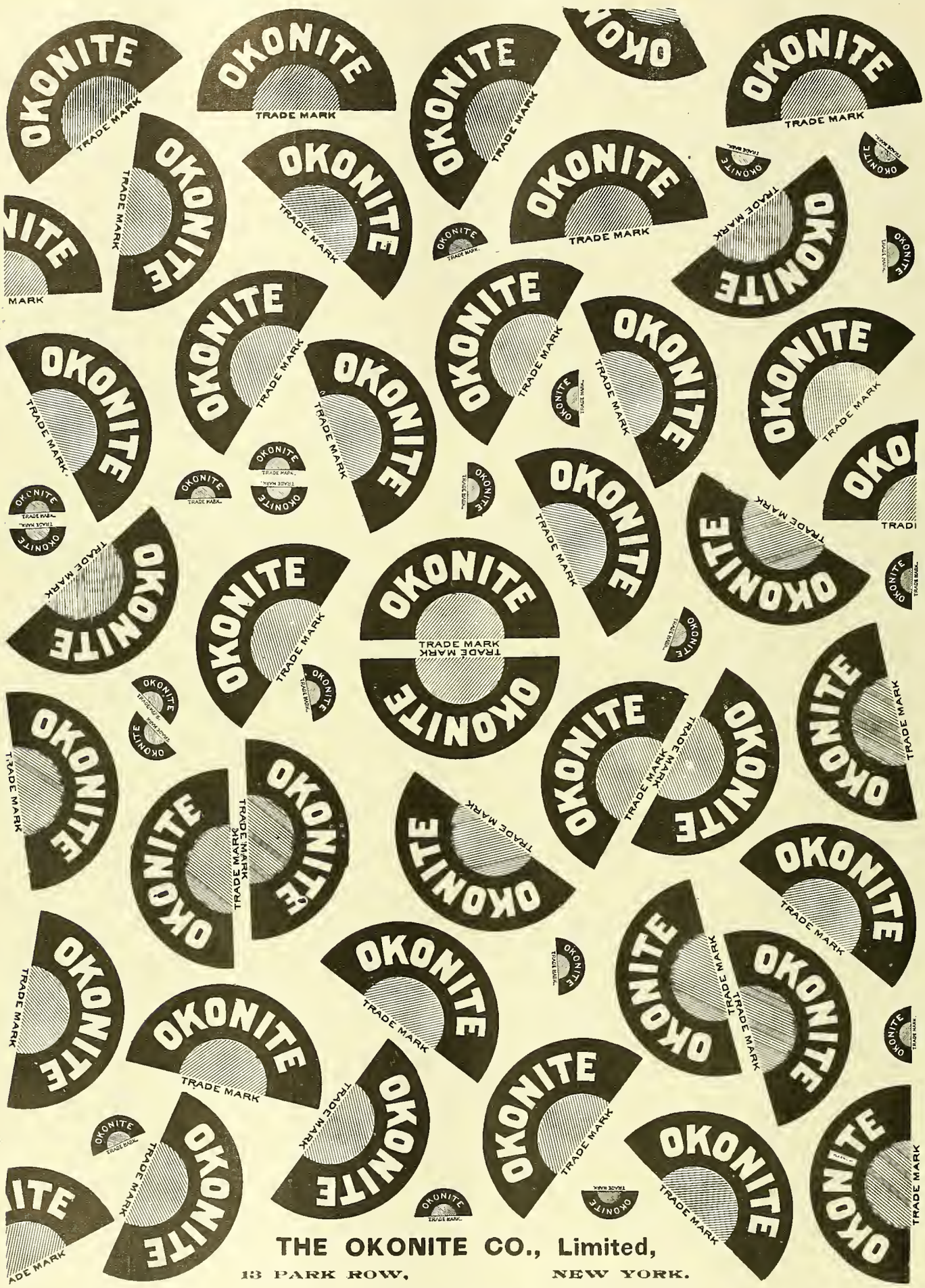
**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Int. Corr. Schools.
Scientific Machinist Co.

**Water Wheels.**
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonita Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co.




**THE OKONITE CO., Limited,**

13 PARK ROW, NEW YORK.

**AGENTS:**

CENTRAL ELECTRIC CO., 173-175 Adams St., Chicago, Ill.

NOVELTY ELECTRIC CO., Philadelphia, Penn.

STANDARD ELECTRICAL WORKS, Cincinnati, Ohio.

BUFFALO ENGINEERING COMPANY, Buffalo, N. Y.

PETTINGELL-ANDREWS CO., 72-74 Federal St., Boston, Mass.

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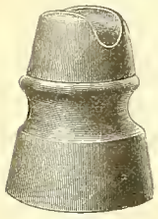
BUFFALO ENGINEERING COMPANY, Buffalo, N. Y.

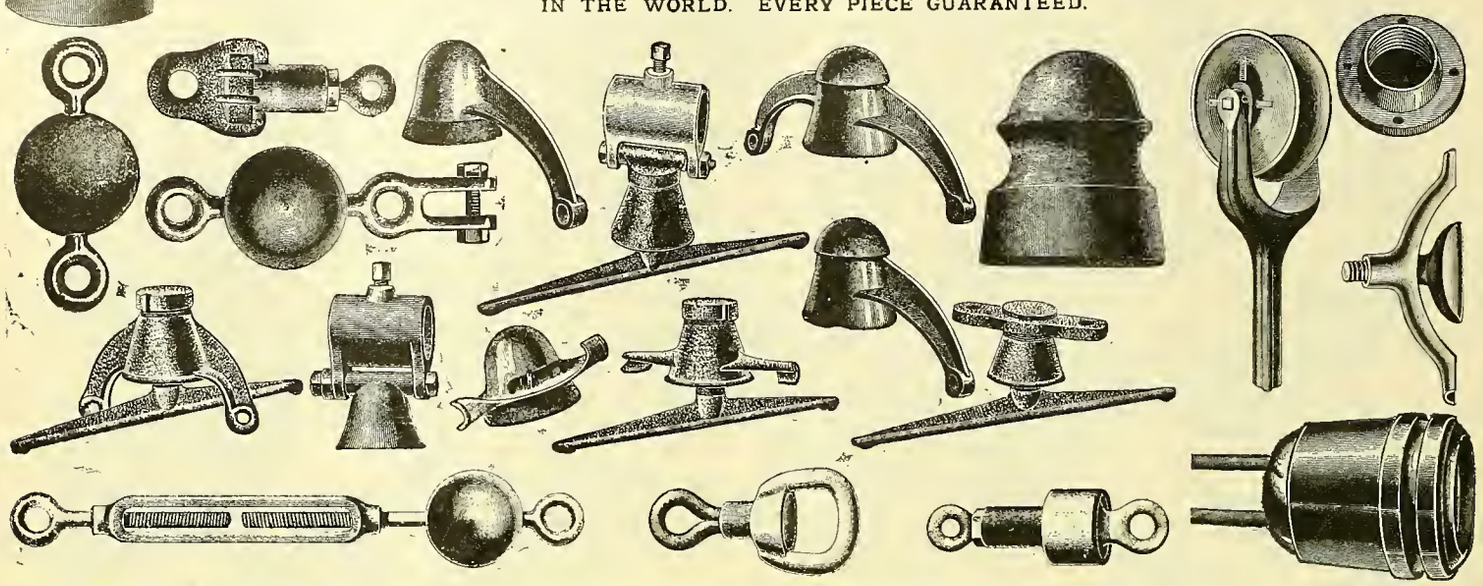
PETTINGELL-ANDREWS CO., 72-74 Federal St., Boston, Mass.

# THE MEDBERY INSULATION



## ALUMINUM-BRONZE OVERHEAD TROLLEY EQUIPMENT.

FOR ELECTRIC RAILWAYS. LEADS ALL OTHERS, AND IS THE STANDARD OF THE WORLD. HIGHEST ELECTRICAL RESISTANCE, AND GREATEST TENSILE STRENGTH. THE BEST IN THE WORLD. EVERY PIECE GUARANTEED.



**SELLING AGENTS.**

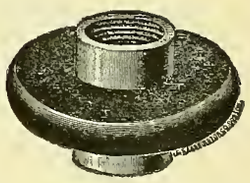
MASON ELECTRIC CO., Chicago, Ill.
THE E. S. GREELEY & CO., New York.
HUBLEY MANUFACTURING CO., Lancaster, Pa.
DRAKE, PAYSON & WHITTIER, Providence, R. I.
A. T. MOORE, JR., Buffalo, N. Y.
TECHNIC ELECTRICAL WORKS, Philadelphia, Pa.
AHEARN & SOPER, Ottawa, Ont.
A. W. SOLOMON, Savannah, Ga.
REGER & ATWATER, San Francisco, Cal.
THE OAKMAN ELECTRIC CO., New York.

5-8 in. Studs, Steel or Bronze. Tensile Strength 90,000 lbs. to the square inch.
ADOPTED BY THE BEST RAILROADS IN THE COUNTRY.

## THE FIBERITE COMPANY,

Manufacturers of Trolley Wheels and Harps, Cross-overs, and Everything in Line Material.
Write for Catalogue and Discounts.

**MECHANICVILLE, N. Y.**



In the words of Chas. Bradshaw, the superior quality of our **Helios Cored Carbons** is a fact which "**Reason Perceives, Experiment Verifies** and **Experience Confirms.**"

**Note what a recognized authority has to say on the subject.**

THE HELIOS ELECTRIC CO. PHILADELPHIA & LYNN MASS.
CABLE ADDRESS, HELIOS PHILADELPHIA
150 FILBERT ST

February, 12th, 1895.

The Washington Carbon Co.,
Pittsburgh, Pa.

Gentlemen:

We beg to say in answer to your inquiry that we have thoroughly tested the Helios cored carbons manufactured by your company, and we find them equal in every respect to the imported Helios carbons, and vastly superior to any other cored carbon made, either domestic or imported.

We congratulate you upon your success.

Yours truly,
HELIOS ELECTRIC CO.
Thos. Spencer
Sup't.

# HELIOS CORED CARBONS

For Direct and Alternating Currents.

# SOLID CARBONS

For Series Arc Lighting.

## MOTOR AND GENERATOR BRUSHES, BATTERY CUPS, PLATES AND SPECIALTIES.

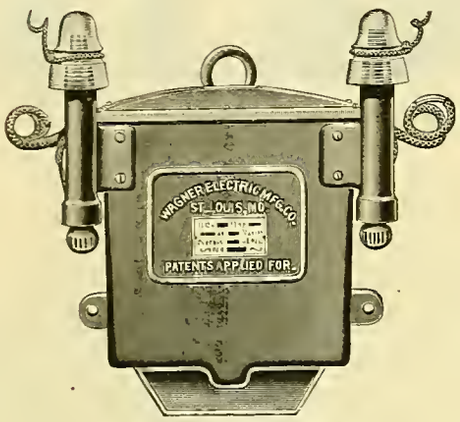
**REDUCED PRICES ON SOLID CARBONS FOR SERIES ARC LIGHTING.**

**NOTE THIS OFFER:** Let us know the price you are now paying, stating yearly consumption, and we will guarantee to beat it from 50 cents to $2.00 per thousand.

# THE WASHINGTON CARBON COMPANY,

**PITTSBURGH, PA.**

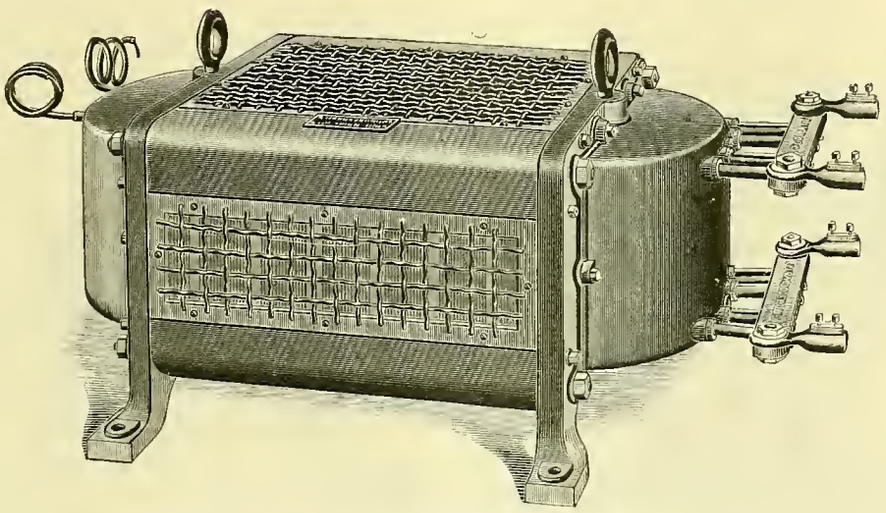
# TRANSFORMERS.




TYPE "D" TRANSFORMER.

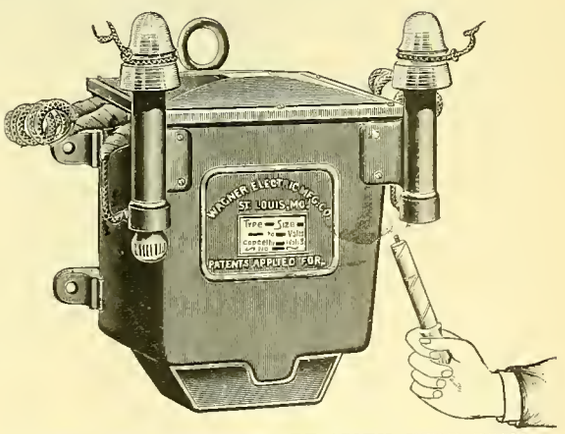
**A New Type**—*Transformer, Primary Cut-outs and Insulator Brackets all combined.*

No more brackets pulling off of walls.
With our wall or cross-arm hooks, transformer may be *Hung* and *Connected* in *Five minutes*.
No more trouble with primary fuses.
Our new fuse plugs will not hold an arc with 5,000 volts.
Absolute protection to lines and transformers secured.
Separate combination cutout brackets furnished for any purpose.
Type D transformers are made with either dry or oil insulation, as desired, and with either attached or separate primary cut-outs.



STANDARD 500 LIGHT TRANSFORMER. INDOOR TYPE.

*Our Transformers* are acknowledged by all experts to be the *Highest* in *Efficiency* ever made.
The accepted *Standard* for comparison.
The first in every competitive test.
Adopted by the largest stations in the country.
*We Challenge Competition* in any form of test, in laboratory or practical use.
One-half to one-eighth the iron loss of other transformers.
Insulation Guaranteed.



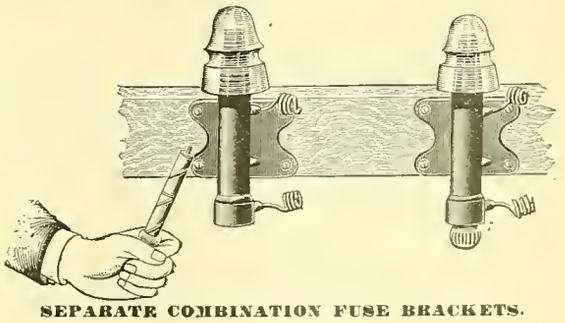

TYPE "D" TRANSFORMER WITH FUSE PLUG REMOVED.

## WAGNER ELECTRIC MFG. CO.,

ST. LOUIS, MO.

1664 Monadnock Block, Chicago, Ill.

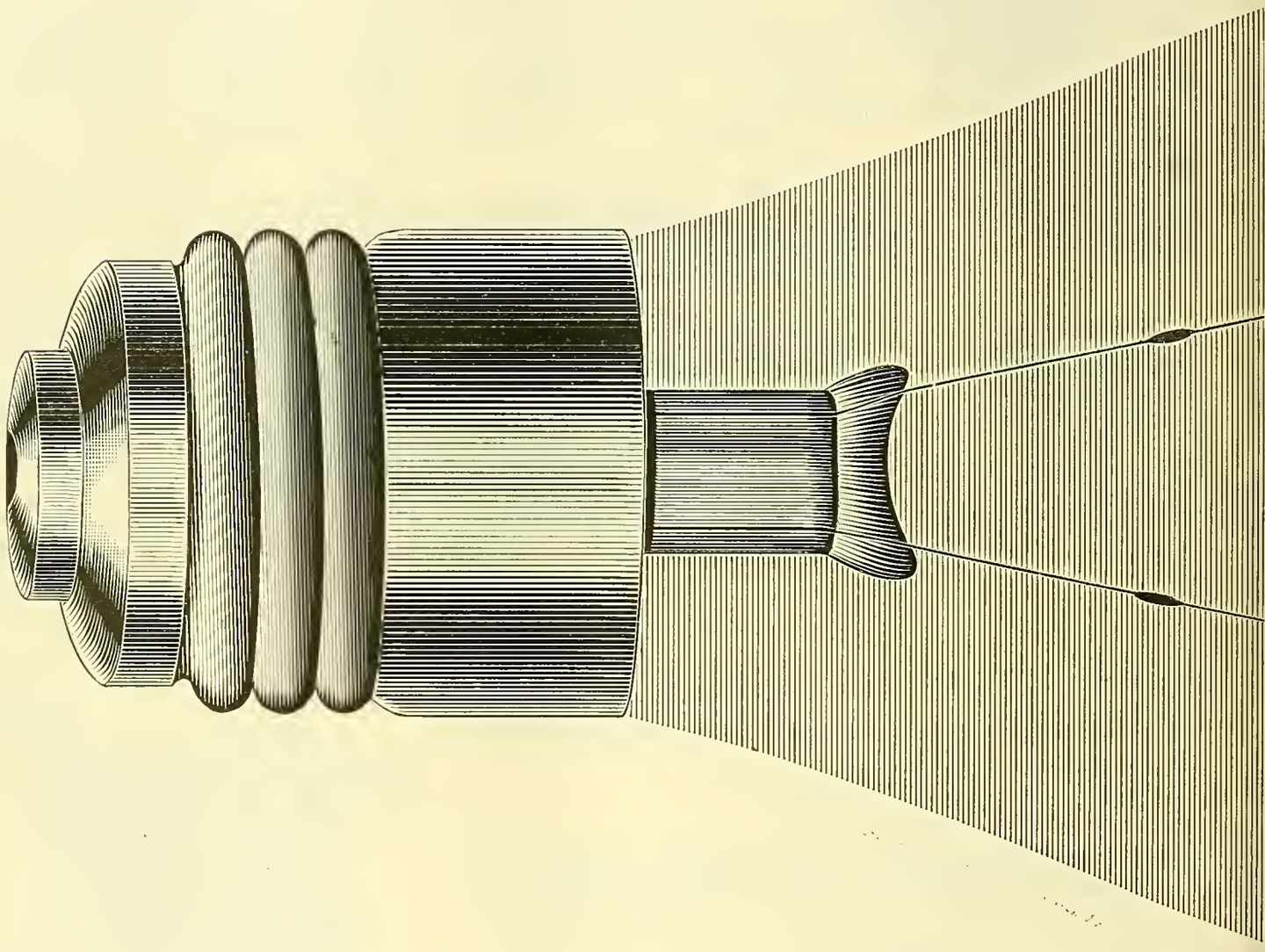
JOHN MUSTARD, Betz Building, Philadelphia, Pa.



SEPARATE COMBINATION FUSE BRACKETS.

# THE BUCKEYE

*401–404 Cuyahoga Building, Cleveland, O.*



**HEADQUARTERS DURING NATIONAL CONVENTION,**

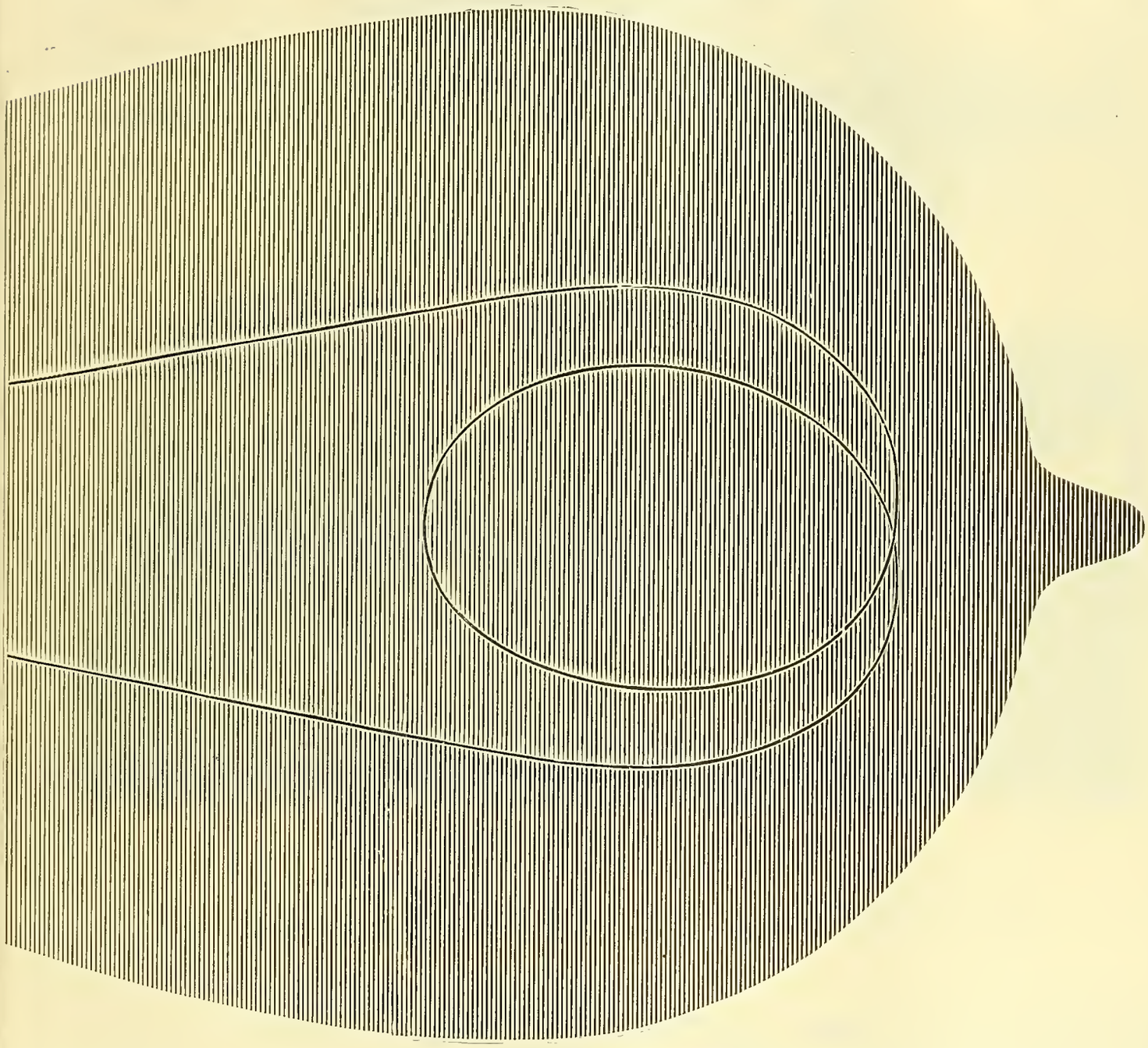
## PARLOR "B"

Hollenden Hotel.

**CALL IN AND SEE US.**

# ELECTRIC CO.

*753 Monadnock Building, Chicago, Ill.*



## AGENCIES:

**Electrical Engineering Co.,**
**Minneapolis, Minn.**

**California Electrical Works,**
**San Francisco, Cal.**

**Mississippi Valley Electric Co.,**
**St. Louis, Mo.**

**W. T. Osborn & Co.,**
**Kansas City, Mo.**

**L. E. Miller,**
**Houston, Texas.**

**Manhattan Gen'l. Construction Co.,**
**New York City.**

**Vallee Bros. & Co.,**
**Philadelphia, Pa.**

**Robbins Electric Co.,**
**Pittsburgh, Pa.**

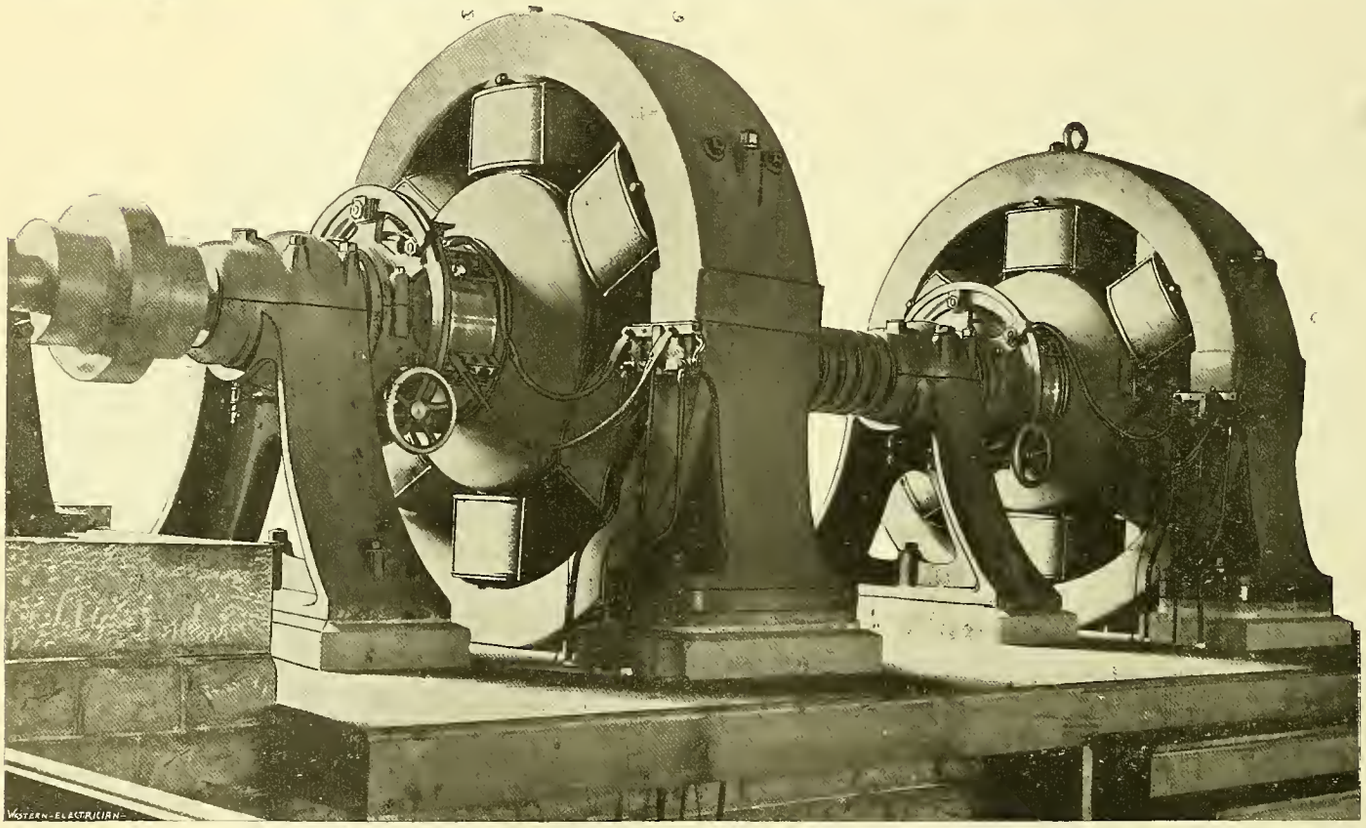
**The E. G. Bernard Co.,**
**Troy, N. Y.**

# Shawhan-Thresher Electric Co.,

## DAYTON, OHIO.

MANUFACTURERS OF

## Complete Installations of Electrical Apparatus.



200 K. W. GENERATORS.

Direct Coupled to Water Wheels at 150 Revolutions per Minute.

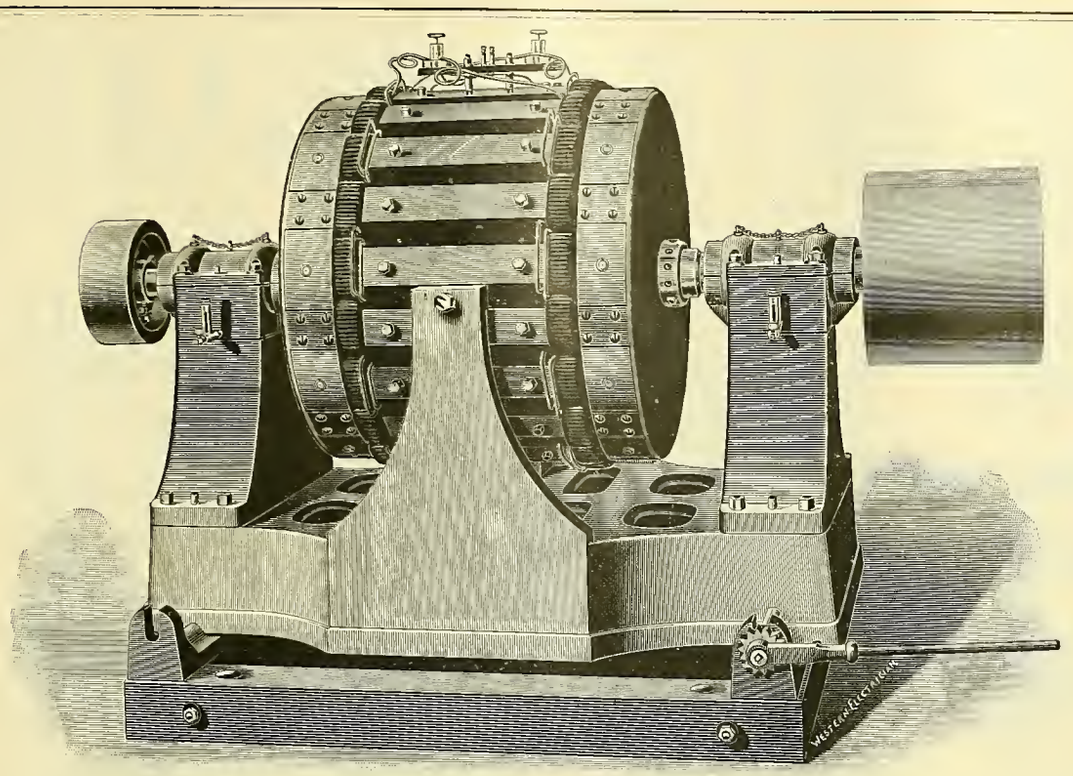
**CENTRAL STATION ELECTRIC LIGHTING,**
**ELECTRICAL TRANSMISSION OF POWER,**
**STREET RAILWAYS AND**
**ISOLATED PLANTS.**

**26 NORTH MAIN ST., - DAYTON, OHIO.**

No Brushes.

No Commutator.

No Moving Wire.



Insulation Perfect.

Unexcelled in Performance.

Fully Guaranteed.

150 K. W. ALTERNATOR.

# To Buyers who intend to operate Stations for profit we commend the Royal Alternator.

# IT WILL INCREASE YOUR DIVIDENDS.

SPECIAL POINTS OF MERIT—

**SIMPLICITY, ECONOMY, EFFICIENCY, DURABILITY.**

---

TRANSFORMERS { EFFICIENCY HIGH. GUARANTEED.

---

## GIVE THEM A TRIAL.

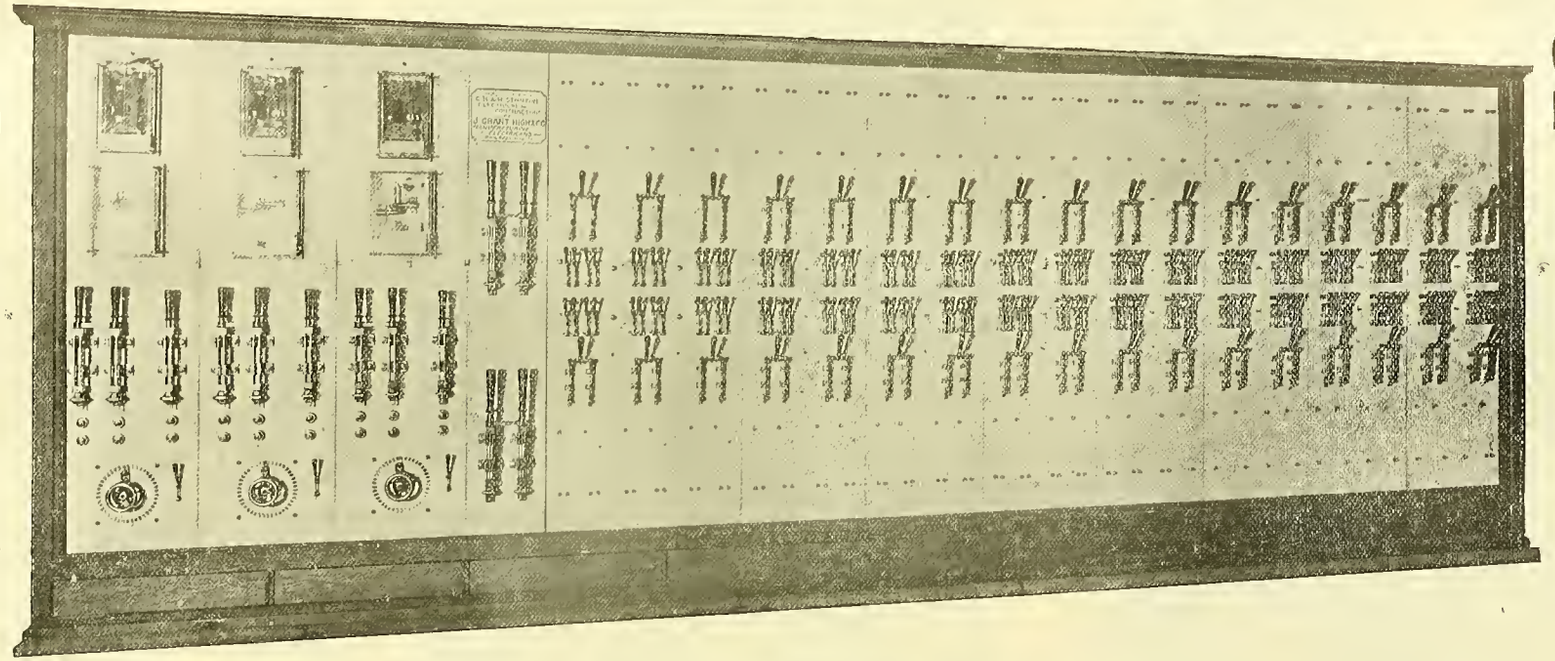
**CORRESPONDENCE SOLICITED.**

# Royal Electric Company,

## PEORIA, ILL.

# SWITCH-BOARDS!

## Switches,



## Switches,

**SWITCH-BOARDS**
For Power and Lighting.

**Plug Switch-Boards**
For Arc Circuits.

**SWITCHES,**
From 25 amp. to 10,000 amp.

**Main Line Fuse Blocks, Etc.**

**Bus-Bar Connectors,**
**Switch-Board Fillings,**
**Special Switches**
For all Purposes,
**Cable Terminals,**
**Tablet Boards.**

# J. GRANT HIGH & CO.,

**BRANCH OFFICES:**

Chicago, Ill., Room 815 Medinah Temple.
St. Louis, Mo., Commercial Elec. Sup. Co., 821 Pine St.
Louisville, Ky., Cooper & Clark, 315 W. Main St.
Pittsburgh, Pa., Elec. Supply & Con. Co., 947 Liberty St.
New Orleans, Widmer & Spanley, 78 Custom House St.

Main Office and Works,

**123 N. 3rd ST., PHILADELPHIA.**

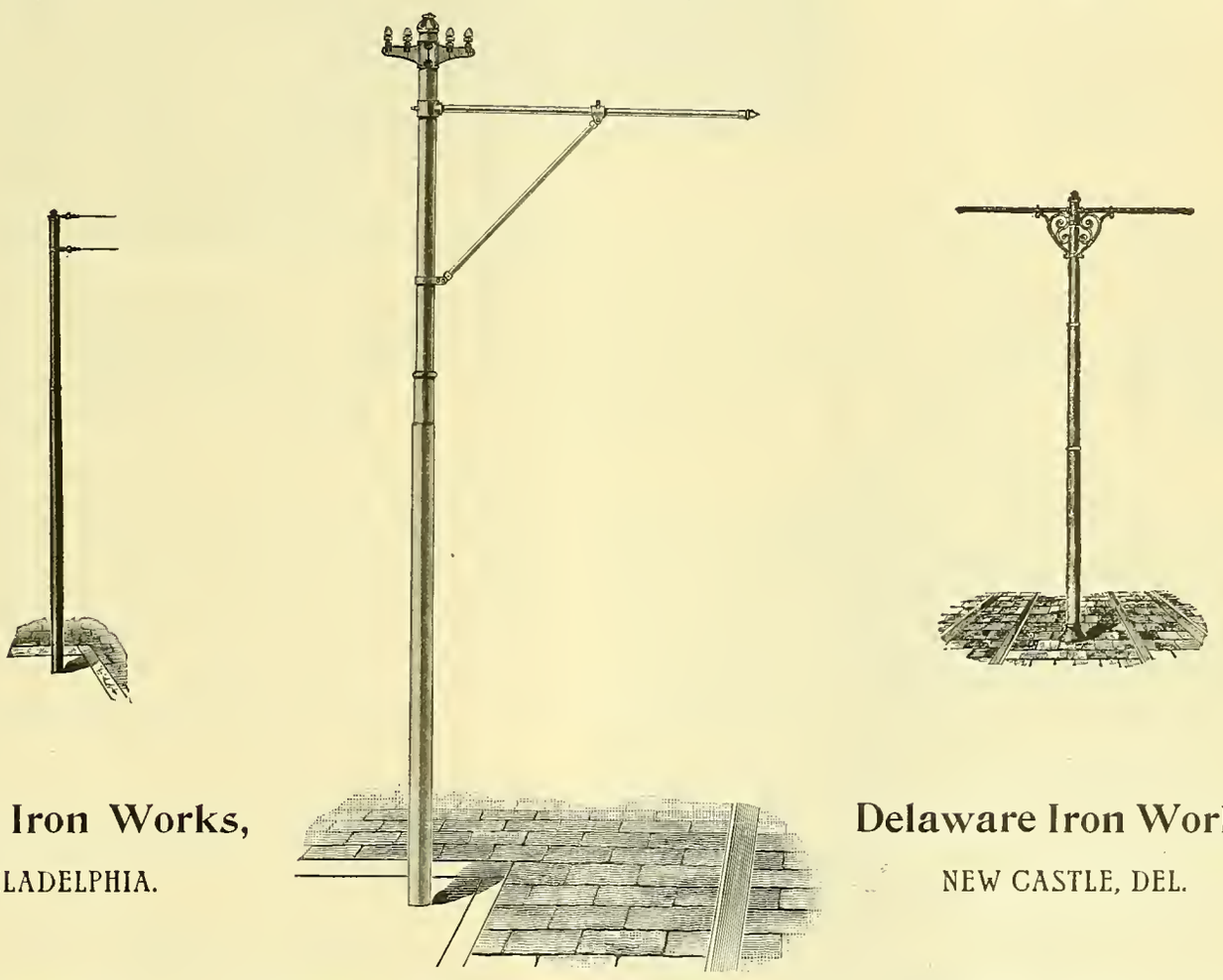
# ATTENTION, DELEGATES!!

1821. **Morris, Tasker & Co.,** 1888.

INCORPORATED.

**OFFICES: 222 and 224 South Third Street, PHILADELPHIA, PA.**

# OUR SPECIALTIES:



**Pascal Iron Works,**
PHILADELPHIA.

**Delaware Iron Works,**
NEW CASTLE, DEL.

## ELECTRIC LIGHT AND RAILWAY PIPE POLES.

MANUFACTURERS OF

Boiler Tubes, Wrought Iron Pipe and Fittings.

**SPECIAL GUN METAL CASTINGS FOR POWER PLANTS.**

BRACKETS. CROSS ARMS. STRAPS,

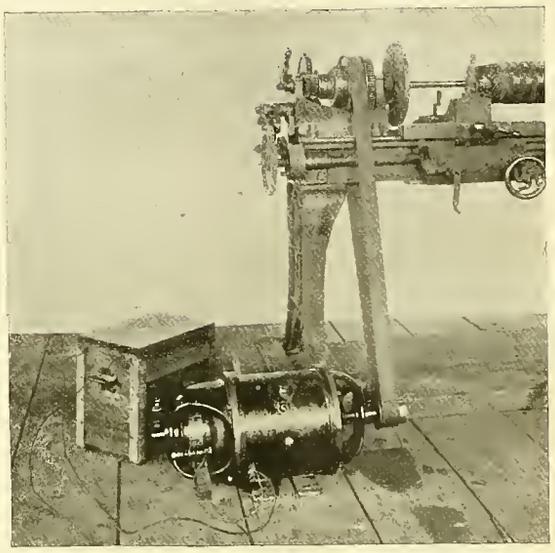
# HOLT ELECTRIC STORAGE COMPANY,

MANUFACTURERS OF

## Dry Portable Storage Batteries for Light Traction, and all Kinetic Purposes.

### Characteristics:

No Dirt,
No Noxious Fumes,
No Buckling,
No Short Circuiting,
No Freezing,
No Slopping Over,
No Extra Care in Setting Up.



One Horse Power Motor with Battery for Lathe, Etc.

### Compared with Other Batteries:

Less Space,
Less Weight,
Less Cost,
Less Annoyance,
Greater Durability,
Greater Adaptability,
Greater Tension,
Greater Satisfaction.

## 1227 Callowhill St., Philadelphia.

# REMOVAL NOTICE!

Approaching the close of the third year of our business as successors to the Construction, Wiring and Supply Department of the Edison Electric Illuminating Co., of N. Y., we find that our business has successfully outgrown the facilities in our present building at the corner of Duane and Elm Streets.

We are pleased therefore to give

### NOTICE OF REMOVAL

of our Principal Offices and Salesroom to the new and commodious Building now our Works at Nos. 572 to 578 First Avenue, corner 33d Street.

We shall continue business at 59 Duane Street as a Branch Salesroom for the convenience of nearby customers and as a Branch Supply Depot for other contractors, but the more central location of our new headquarters and the increased facilities consequent upon bringing together our Executive, Selling, Constructing, and Manufacturing forces in one building will enable us to meet the demands of our rapidly increasing business more promptly and thoroughly than ever.

# NEW YORK ELECTRIC EQUIPMENT COMPANY,

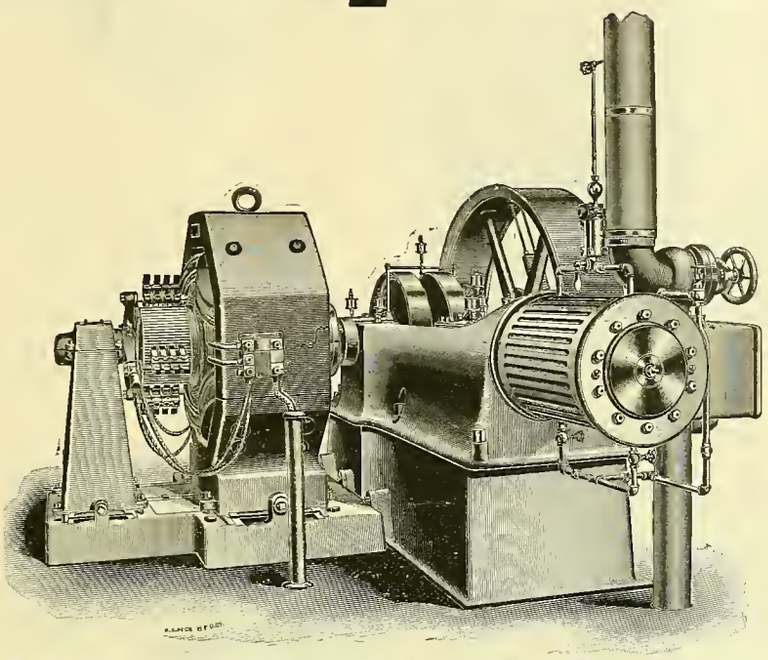
S. BERGMANN, President,

**Agents of the Edison Electric Illuminating Company of New York for Edison Patented Supplies.**

Wiring, Construction, etc., for Central Station Service and Isolated Plants, Electric, Gas and Combination Fixture Manufacturers, Sockets, Switches, Cut-outs, Motors, Dynamos, Arc Lamps, etc., Conduit Tubes and Appliances.

GENERAL OFFICES, SALESROOM AND WORKS: 572 to 578 First Avenue, Corner 33d Street, - *NEW YORK.*

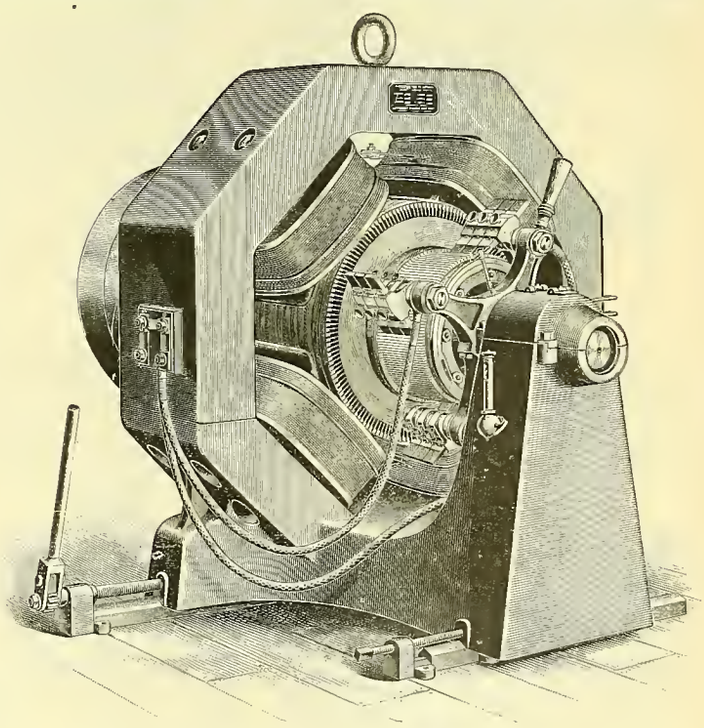
# Eddy Generators



DIRECT CONNECTED OR BELTED
FOR
ELECTRIC RAILWAYS,
CENTRAL STATIONS,
ISOLATED LIGHTING
OR
POWER PLANTS.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.



## All Our Apparatus Guaranteed As Represented.

## The Eddy Electric Manufacturing Company,

NEW YORK OFFICE,
HAVEMEYER BUILDING.

WINDSOR, CONN.

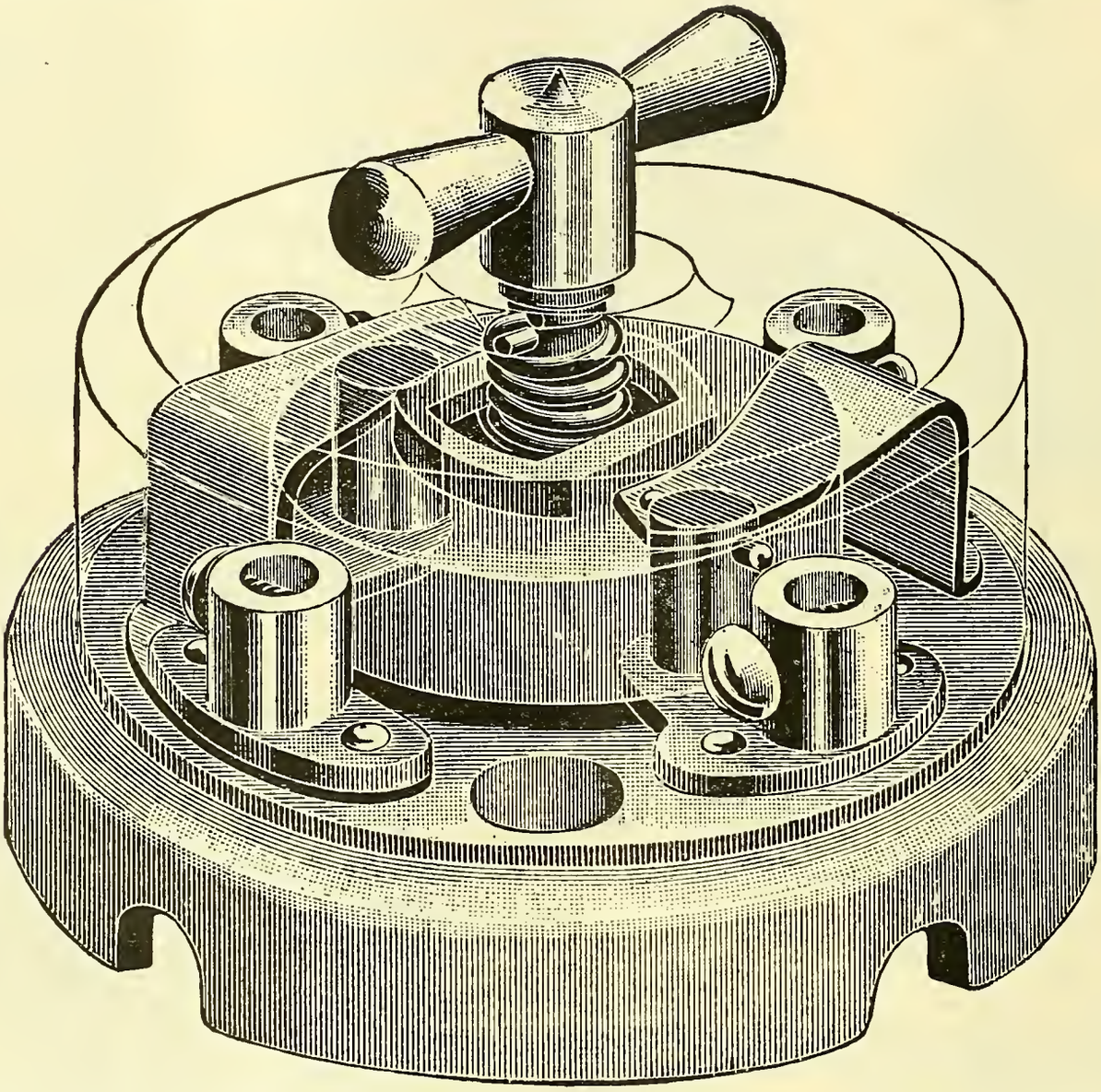
REPRESENTED BY:

Walter C. McIntire & Co., 506 Commerce St., Philadelphia.
Western Electrical Supply Company, St. Louis, Mo.
F. P. Little Electrical Construction & Supply Co., Buffalo, N. Y.
W. T. Osborn, Kansas City, Mo.

# GIBBS SWITCH!

"DEALERS DON'T KEEP THEM—
THEY **SELL** THEM."

*Write for Catalogue and Prices.*



This is not the actual size of the Switch, but the size of the users' opinion of it.

## THE PERKINS ELECTRIC SWITCH MFG. CO.,

**HARTFORD, CONN.**

Chicago Office and Storeroom:
1536 MONADNOCK BLK., CHICAGO.
G. W. CONOVER, Manager.

Boston Office:
182 SUMMER STREET.
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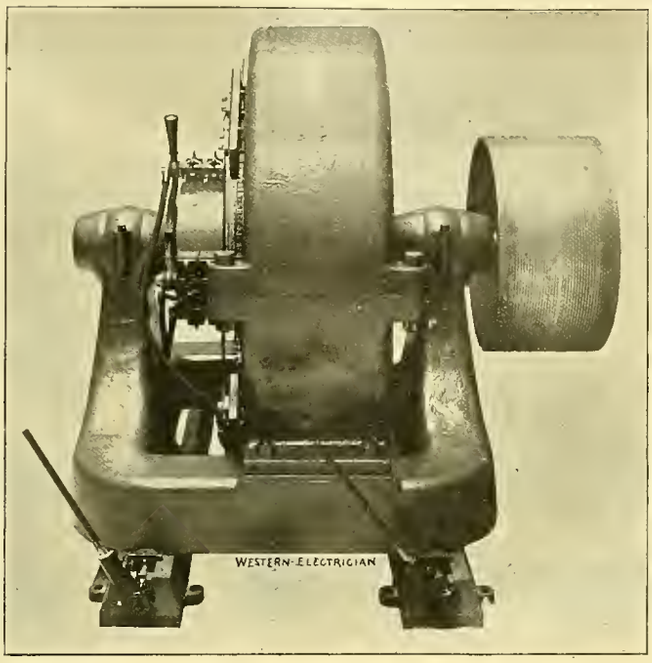
# ELECTRIC LIGHT AND STREET RAILWAY MEN, ATTENTION!

**Latest Pattern of Multipolar Light and Power Generator.**

Send for Catalogue with full Description.



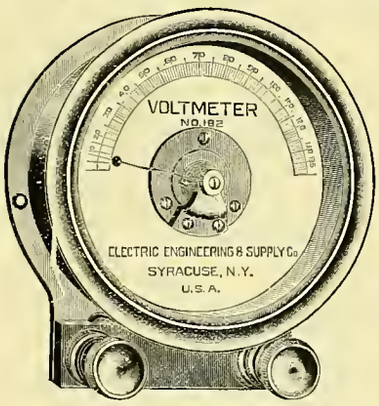

Slow Speed.
Compact.
Superior Workmanship.
Highest Efficiency.
Absolutely Sparkless.
Low Temperatures.

GRAMME RING ARMATURES.—BELT DRIVEN OR DIRECT CONNECTED.

# Commercial Electric Company

119 S. TENNESSEE STREET, INDIANAPOLIS, INDIANA.

# E. E. & S. SUPPLIES.




Volt and Ammeters.

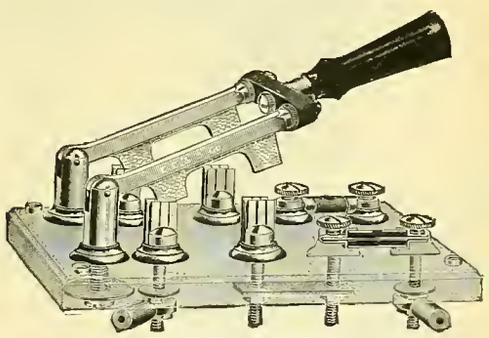
We Manufacture

**A FULL LINE**

OF ELECTRICAL SUPPLIES,

EMBRACING

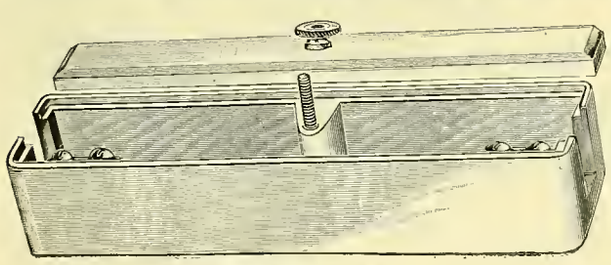
**Everything Necessary for the Complete Equipment of an Electric Plant.**



The E. E. & S. Switch.

**SPECIAL ATTENTION TO**

# Switch Boards.



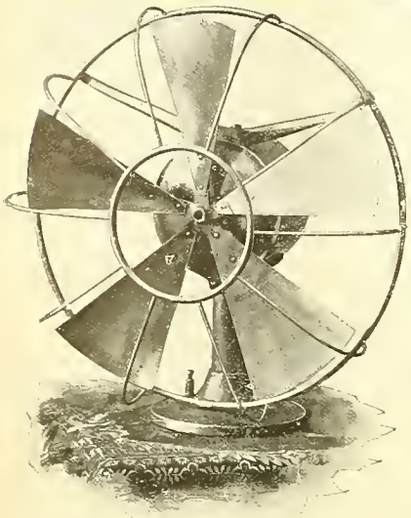
Motor Fuse Box.

*Send us your specifications and we will furnish you with estimates. Workmanship unsurpassed on all our goods.*

## ELECTRIC ENGINEERING & SUPPLY CO.,

**SYRACUSE, N. Y.**

NEW YORK OFFICE, 136 Liberty Street.



# The Best Electric Fan on the Market.

FOR EITHER ALTERNATING OR DIRECT CURRENT.

The Fan is 14 inches in diameter.
Will always start when current is on.
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

**AGENTS WANTED IN DIFFERENT LOCALITIES.**

FOR FURTHER INFORMATION ADDRESS,

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# "DAYTON"

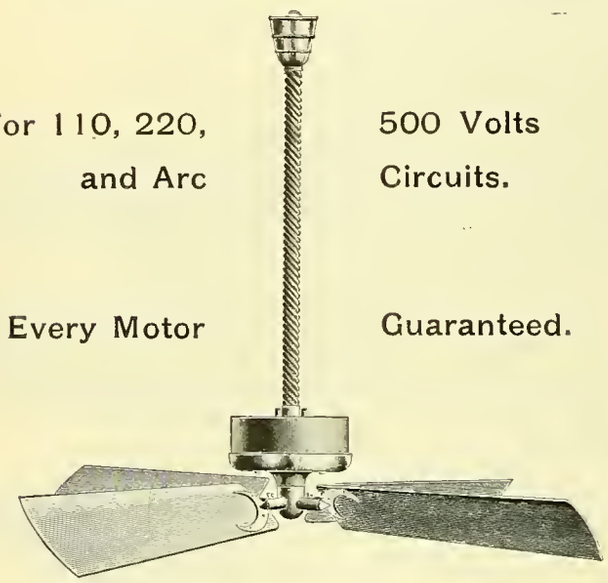
## ATMOSPHERE DISTURBERS.

For 110, 220, and Arc

500 Volts Circuits.

Every Motor

Guaranteed.



MANUFACTURED BY

## The Dayton Fan & Motor Company,

DAYTON, OHIO.

# IT IS SO.

James Brown & Son of 114 Wood St., Pittsburgh, Pa., have just completed a nine-story building, known as the Smith Building, in this city. This building is fire-proof throughout, having steel girders and cement floors. Weather-proof wire and brass covered conduit, of the Interior Conduit make, was the material used. All cement floors were laid after tubes and wires were in position, which is generally known to be very trying on electrical construction work. When the whole of the work was completed and building finished, ready for occupation, a thorough test was made by the Fire Marshal Inspector. Wheatstone bridge being used, and the resistance between ground and copper was more than 1,118,000 ohms; this certainly counts with people that think, and shows, at a glance, the class of work that is done by this firm.

This same firm has been awarded the contract for whole of the Electrical work of the Casino Building, Pittsburgh.

They are to place in position two 45 K. W. Multipolar Dynamos of General Electric type, one 20 horse power motor, 44 Arc Lamps, two 67 horse power Russell Engines, and a large quantity of Incandescent Lights, together with all the necessary construction work for the above.

This building is to be one of the finest in this section of the country, and we believe this firm will do justice, and live up to their contract in every detail.

The senior member of this firm has had many years' practical experience in this business, and has completed many similar contracts. They carry in stock a full line of Electric Supplies of every description. They are also makers and dealers in Gas, Electric and Combination Chandeliers, and are in a position to fill all orders promptly, and it may be to the interest of intending purchasers to consult them before placing their orders.

***James Brown & Son.***

You do not make an error when you buy the Product of the

# SYRACUSE STORAGE BATTERY CO.

UNDER LICENSE OF

## THE CONSOLIDATED ELECTRIC STORAGE CO.

(THE BRUSH PATENT.)

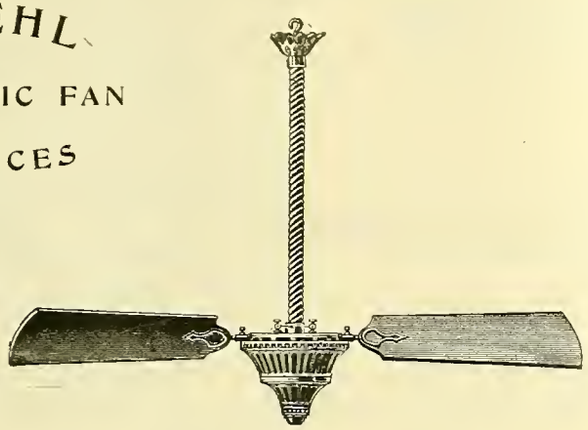
The **BEST** in every way for all purposes where it can be applied.
**IMPOSSIBLE** to buckle or short circuit.

**Factory at PHŒNIX, N. Y.** **Office: 38 and 39 Herald Bldg., SYRACUSE, N. Y.**

DIEHL

ELECTRIC FAN

DEVICES



WOUND FOR

110
220
250
500

Volts DIRECT Incandescent

OR ANY

DIRECT Arc Current.

SEND FOR CATALOGUES.

DIEHL & COMPANY,

385 BROADWAY,

NEW YORK CITY.

# AMERICAN ENGINE COMPANY,

Bound Brook, N. J., U. S. A.

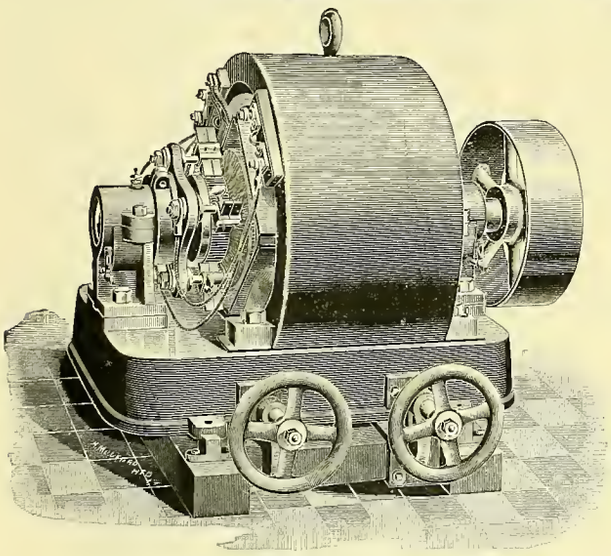
## Engines or Dynamos

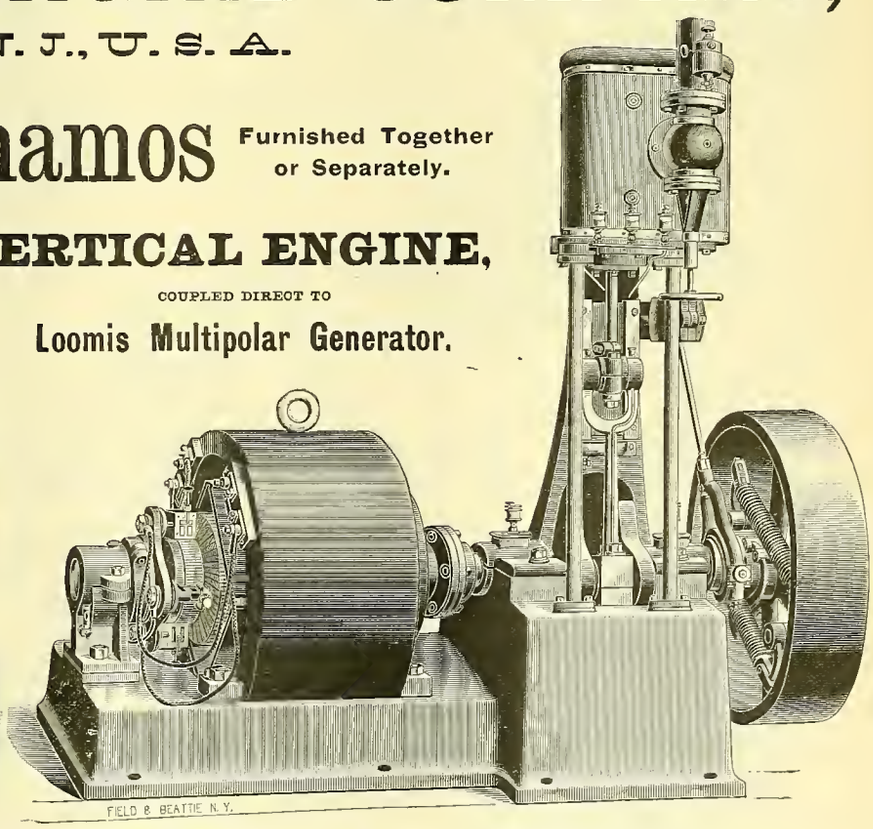
Furnished Together or Separately.

### SPAULDING VERTICAL ENGINE,

COUPLED DIRECT TO

Loomis Multipolar Generator.

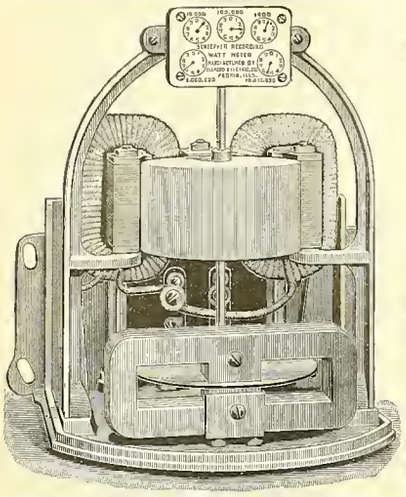





PLANTS OF ANY CAPACITY, FROM 25 H. P. TO 2,000 H. P.

ONE COMPANY. ONE RESPONSIBILITY.

ESTIMATES FURNISHED. SEND FOR NEW CATALOGUE.

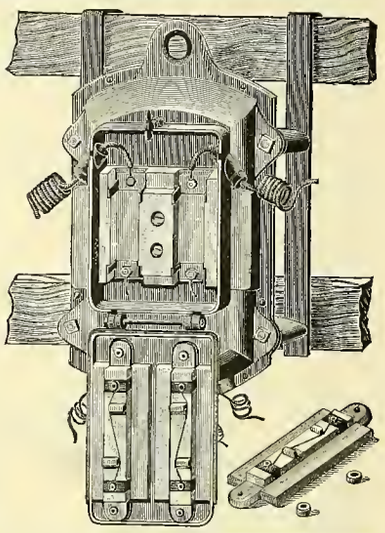


# SCHEEFFER'S RECORDING WATT-METER.

For Alternating Circuits. No Commutator. No Brushes.

Registers Direct Actual Power Consumed.

EASILY ADJUSTED. ABSOLUTELY RELIABLE.



# DIAMOND TRANSFORMER.

Simplest, Safest and Best.

FOR ANY VOLTAGE. FOR ALL SYSTEMS.

## DIAMOND ELECTRIC CO., Peoria, Ill.

Chicago Office, 1307 Manhattan Building, Central Electric Co., Selling Agents.

# Solar....

*Low Potential Direct Current*

# Lamps

Also

*Twin Lamps*

for 95 to 125 volts.

*Simplicity of Construction, Positive Action of Feed,*

*No Springs or Dash Pot, NO SEE-SAWING.*

Send for descriptive Catalogue.

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Represented at the Cleveland Convention by Mr. Joseph Sachs.

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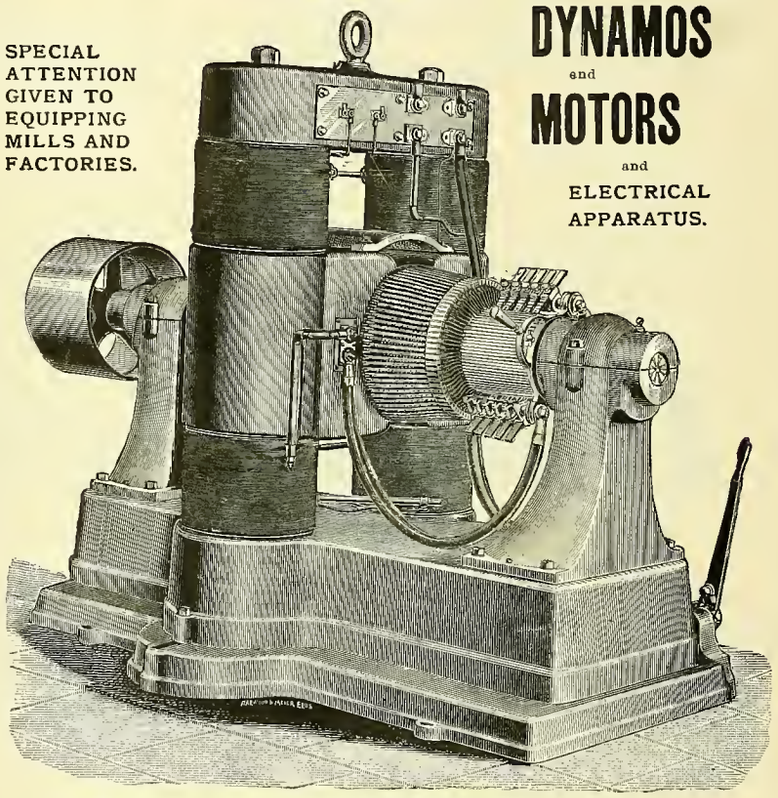
MANUFACTURERS OF

DYNAMOS and MOTORS and ELECTRICAL APPARATUS.

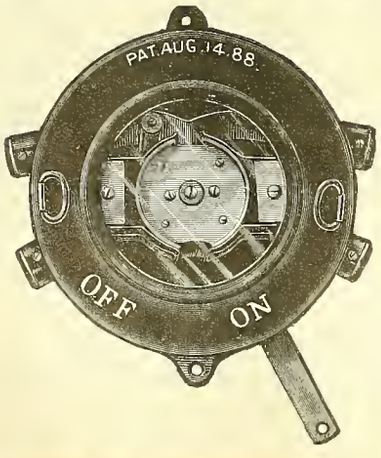
SPECIAL ATTENTION GIVEN TO EQUIPPING MILLS AND FACTORIES.



Main Office and Works, SYRACUSE, N. Y., U. S. A.

WESTERN OFFICE, LESLIE W. COLLINS, Manager. 1105 Monadnock, Chicago.

# WRITE FOR PRICES.



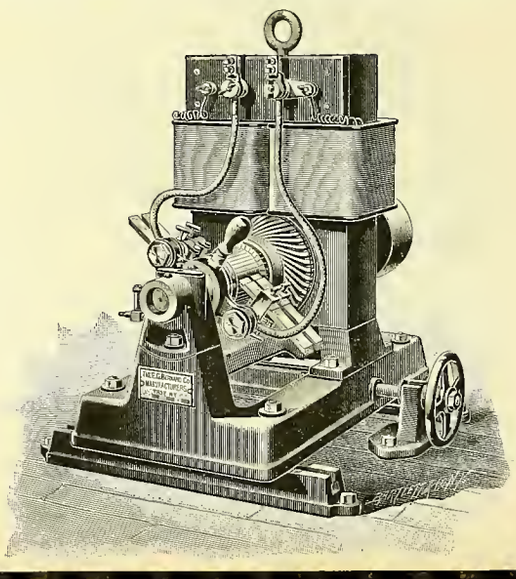

## Powers Arc Cut-Out.

## Bernard-Powers Arc Cut-Out.

Over 30,000 of these Cut-outs in use.
Special new prices to Central Stations.
Quality the best.
Price the cheapest.

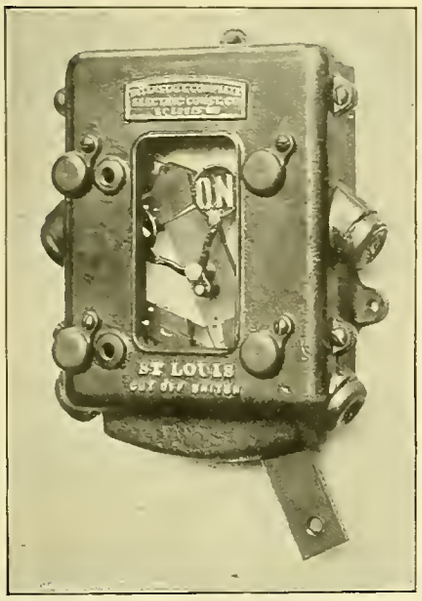
## Adams Dynamos and Motors.

We are the only manufacturers in America of these wrought iron machines with magnetic field forged in one piece; no joints; higher in efficiency and lower in price. Write for prices, etc.



## The E. G. Bernard Co.,

Manufacturers. 47 Fourth St., Troy, N. Y.




NEW AND RELIABLE.

# ST. LOUIS ARC CUT-OUT SWITCH.

THOROUGHLY WEATHERPROOF.

NON-ARCING. NON-COMBUSTIBLE.

Can be put up without removing cover. Write for prices and circulars.

## Interstate Complete Electric Construction Co.,

809 TO 817 S. SEVENTH ST., ST. LOUIS, MO.

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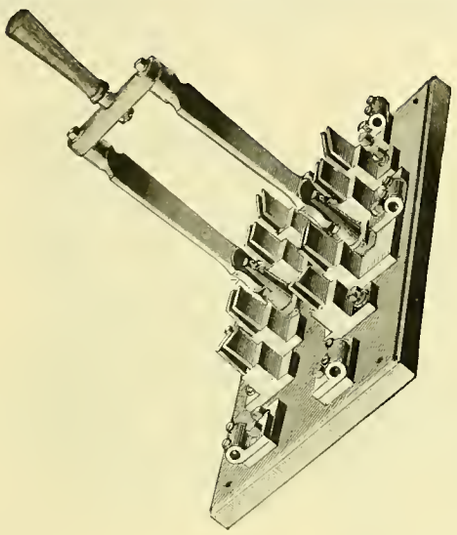


Metropolitan Electric Co.,
Chicago, Ill.

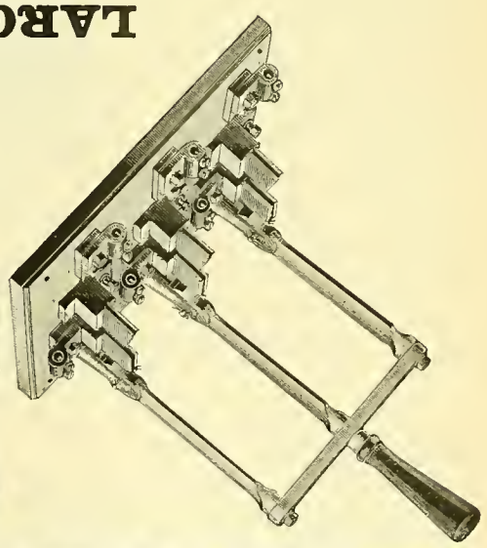
We make no claims we cannot prove. Our work of highest possible grade. Competition challenged.

Catalogue awaiting your request.

LARGE & TWINING,

319 Chestnut St.,

PHILADELPHIA, PA.



# SWITCHES

# TABLET BOARDS.

**A USEFUL DEVICE, taking the place of branch cut outs, and coming into general use wherever introduced. Illustrated Catalogue and Price List on application.**

MANUFACTURED BY

## J. L. HAYS & CO.,

830 Liberty Avenue,
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# STANDARD CARBON CO., Cleveland, Ohio.

**CORED CARBONS,**
**HOLLOW TREATED CARBONS,**
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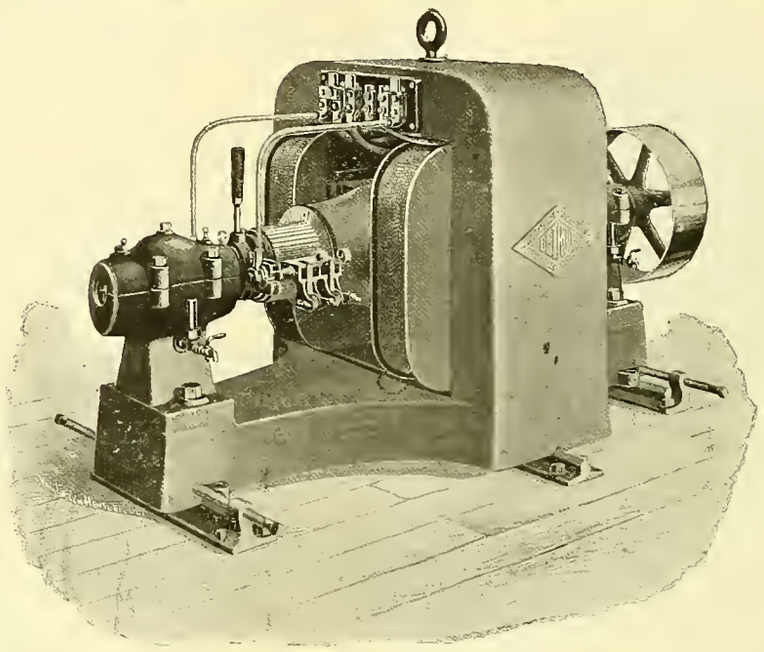
**CARBON BRUSHES,**
**BATTERY MATERIAL.**

**Carbon specialties for telephone and transmitter use. Also Carbon cups and cylinders for open and closed circuit work.**

# A GOOD ARTICLE AT A REASONABLE PRICE.

STRONG,
SIMPLE,
COMPACT,
EFFICIENT.

AUTOMATIC.
CARBON
COMMUTATOR BRUSHES.
NO REPAIRS.



Requires
the Least Attention
of any Machine
Made.

Guaranteed
for One Year
Against Mechanical or Electrical
Defects.

**GENERATOR OR MOTOR**—(Detroit Electrical Works' Manufacture).

General Selling Agents:

## MICHIGAN ELECTRIC COMPANY,

47-49 State Street, DETROIT, MICH.

SEE EXHIBIT AT THE CLEVELAND CONVENTION, FEBRUARY 19, 20, 21.

MARO S. CHAPMAN, Pres. THOMAS C. PERKINS, Vice-Pres. JOHN L. BUNCE, Sec'y and Treas. TH. GONET, Supt.

# THE MATHER ELECTRIC COMPANY,

## Manchester, Conn.

**Power Generators for Lighting and Railway Purposes.**
**Complete Station Equipments.**

Mather Apparatus for sale exclusively in their respective territories by the following well-known and reliable Contractors:

## J. HOLT GATES, 1140 Monadnock Building, Chicago, Western Contractor.

H. B. COHO & CO., 203 Broadway, New York: New York City, Brooklyn and vicinity and New Jersey.
G. M. ANGIER & CO., 64 Federal St., Boston, Mass.: New England.
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THE WILL & FINCK COMPANY, 818 Market St., San Francisco, Cal.: Agents for the Pacific Coast.

# The "ELECTRA" CARBONS.

A highly EFFICIENT and ECONOMICAL Arc Light Service depends on the quality of the Carbons.

**THE BEST QUALITY IS THE CHEAPEST.**

·TRADE MARK·

Highest Award at the World's Columbian Exposition, Chicago, 1893.

## High Grade Nuernberg Carbons

For direct and alternating current Arc Lamps, are the most economical and efficient manufactured. They produce a very brilliant and absolutely steady light.

·TRADE MARK·

Highest Award at the World's Columbian Exposition, Chicago, 1893.

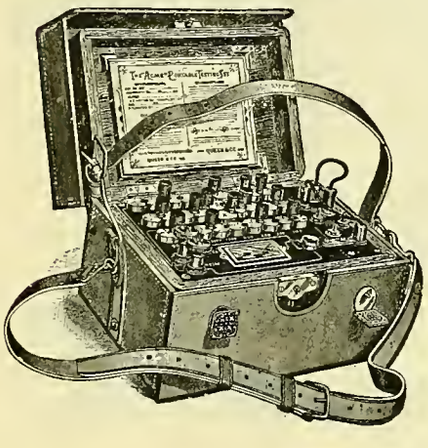
SEND FOR NEW PRICE LISTS AND SAMPLES TO

**HUGO REISINGER,** No. 38 BEAVER STREET, NEW YORK,

Sole Importer for the United States, Canada, Etc.

**NOTICE!**—It has come to my knowledge that inferior carbons are offered to the trade under the name of "Electra," which name has been properly registered by me as my trade-mark, and therefore cannot be used by anybody else without infringing on my rights. Beware of imitations, and see that every packet of carbons bears the label with my trade-mark, "Electra."

# OHM'S LAW $T146 = \frac{T156}{T459}$



For ***Current*** measurement use our T146, T147 or T148 ***Standard Dynamometers*** which are being sold at a lower price than ever before.

For ***E. M. F.*** use our T156 ***Acme Portable Voltmeter*** for direct and alternating circuits.

For ***Resistance*** use our T459 ***Acme Portable Testing Set.*** This set comprises a Wheatstone's Bridge, Rheostat, Galvanometer, Battery and Keys, the whole being contained in a polished mahogany case, 8¼ x 5¾ x 5 inches. The set complete weighs only seven pounds and is guaranteed accurate to one-fifth per cent. The greatly reduced price of this set should place it in the hands of every electrician.

The **ASSIGNEE'S SALE** has reduced the prices on almost all of our large line of ***Electrical Testing Apparatus.*** *Write to us* before ordering elsewhere.

***OUR SPECIALTIES*** are Magnetic Vane Volt and Ammeters, Acme Voltmeters, Electro-dynamometers, Testing Sets, Testing Batteries, Cable Testing Outfits, Photometers and Tachometers.

## QUEEN & CO., Incorporated,

**NEW YORK OFFICE,** 116 Fulton St.

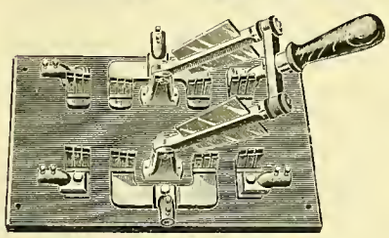
J. G. GRAY, Assignee.

1010 Chestnut St., PHILADELPHIA, PA.

# "LYON" BRAKE.

**INDESTRUCTIBLE and PRACTICAL.**

Will Wear Indefinitely.



No Ratchets or Gears.

WILL OUTWEAR TEN ORDINARY HANDLES—CANNOT SLIP.

## Switches and Switch-Boards

ARE OUR SPECIALTY.

# CONSOLIDATED ELECTRIC MANUFACTURING CO., BOSTON, MASS.

# THE KING BRIDGE CO.,

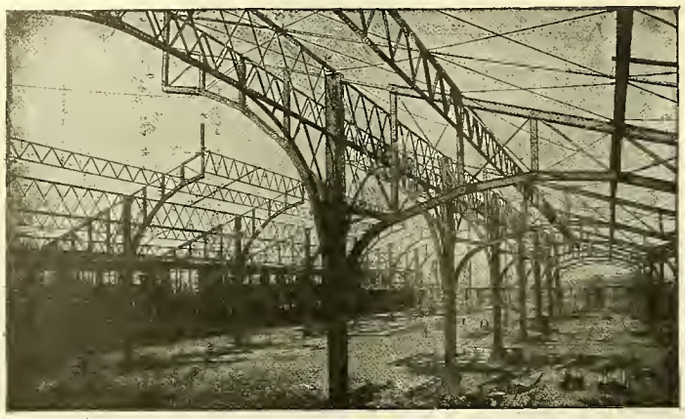
BRIDGES. CLEVELAND, OHIO. VIADUCTS.

IRON AND STEEL EYE BARS, GIRDERS AND STRUCTURAL WORK FOR BUILDINGS.

PLANS, ESTIMATES AND SURVEYS FREE OF COST.

The works of The King Bridge Company are at the head of Ruskin and St. Clair Streets, on the line of the St. Clair street cars, running by the Hollenden.

We shall be pleased to have the delegates visit us.

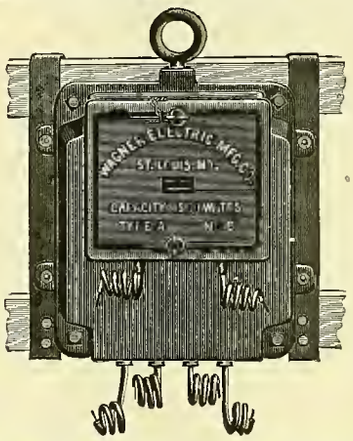


Erection of Steel Work of Mines and Mining Building, World's Columbian Exposition, Chicago, Ill.
BUILT BY THE KING BRIDGE CO.

We design and build Iron and Steel Structures of every description for Electric Lighting and Power Stations, Etc.

# ALTERNATING CURRENT TRANSFORMERS

Highest Efficiency Ever Obtained.



Standard Sizes, 5 Lights to 2,000 Lights.

## TRANSFORMERS

To order for any purpose, voltage or capacity.

## ALTERNATING CURRENT MOTORS.

## HIGH POTENTIAL SWITCHES,

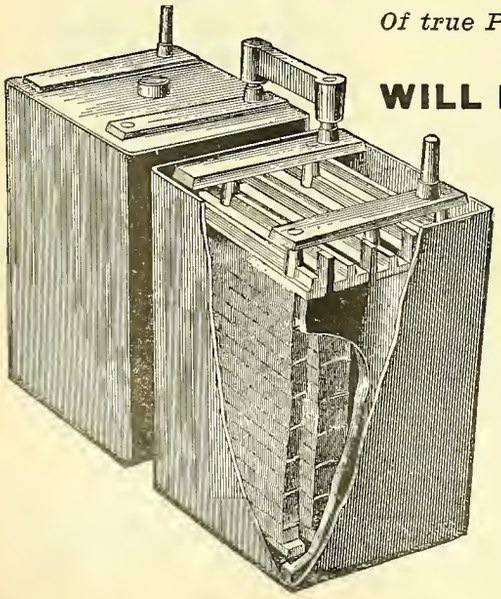
Complete Switch Boards

For Central Stations and Isolated Plants.

# WAGNER ELECTRIC MFG. CO., ST. LOUIS, MO.

CHICAGO OFFICE, Wells Goodhue, 1564 Monadnock Block. PHILADELPHIA OFFICE, John Mustard, 1000 Betz Bldg.

# STANDARD PLANTE STORAGE BATTERIES



*Of true PLANTE Type and CRYSTALLINE FORMATION.*

Will give or receive without injury, currents that would destroy other batteries.

## WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.

Contain no asbestos or other separating material to increase their internal resistance.

## ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

## Highest efficiency, largest delivery, lowest internal resistance.

For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

## Cannot be damaged by excessive charge or discharge currents.

A 400 ampere current has been taken from a 120 ampere hour cell.

☞ CHALLENGE: We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

# ELECTRIC POWER STORAGE COMPANY,

Room 1210 Havemeyer Building, 26 Cortlandt Street, New York.

# Making Paranite.

Fig. 1. Mixers.
Fig. 2. Ca'ender.
Fig. 3 Cutting Machine.
Fig. 4. Insulating Machines.
Fig. 5. Braiding Room.
Fig. 6. View of Second Floor.

***Paranite Rubber-Covered Wire Is Celebrated Not Only for Being Made of the "Pure Stuff," but Also from the Fact that It Is Made with the Greatest Possible Care.***

## MADE LIKE A WATCH.

**Use Nothing but Paranite where a high grade insulation is required.**

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# Electric Appliance Company,

## ELECTRICAL SUPPLIES.

**242 Madison Street, CHICAGO, ILL.**

EASTERN SALES DEPARTMENT:

**F. W. BRIGHAM, Manager,**

**BOSTON, 220 Devonshire St.** **NEW YORK, 32 Frankfort St.**

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GATE CITY ELEC. SUPPLY & CONS. CO., Atlanta, Ga
ELECTRICAL ENGINEERING CO., Minneapolis, Minn.
W. T. OSBORN & CO., Kansas City, Mo.
POST-GLOVER ELECTRIC CO., Cincinnati, O.
CLEVELAND ELECTRIC MFG. CO., Cleveland, O.

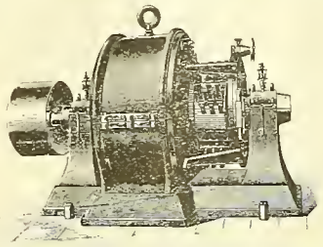
MANUFACTURERS:

**INDIANA RUBBER & INSULATED WIRE COMPANY, Marion, Indiana.**

# Lawrence Poland,

130 W. Second St., Cincinnati, Ohio.

Multipolar and Bipolar Generators and Motors.



Low Speed, High Efficiency, Moderate Prices.

## A FULL LINE OF ELECTRIC SUPPLIES.

Write for prices before ordering elsewhere.

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—OF—

All Colors and Descriptions.

**Automatic Mercurial Pumps**

OF LATEST DESIGN

For Incandescent Lamp Companies.

Scientific glass apparatus for Laboratories, Colleges, etc. Reliable workmanship and lowest prices. Agents wanted in Western Cities. **Send for new Catalogue.**

**The Jaeger Mfg. Co.,**

169 William St., NEW YORK.

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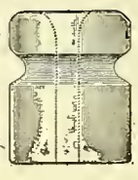

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I've went and had my picture took,
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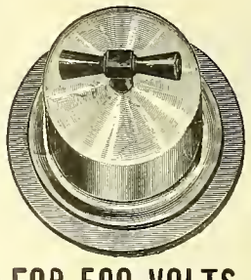

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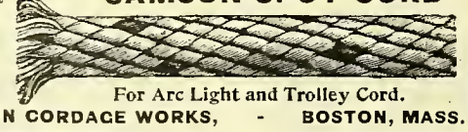

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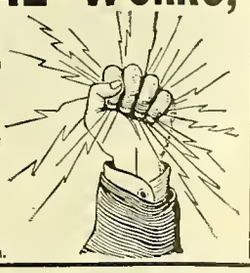

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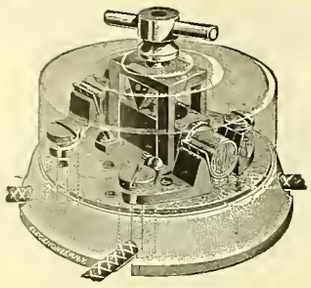

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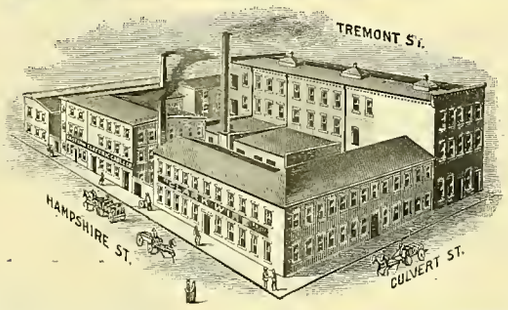


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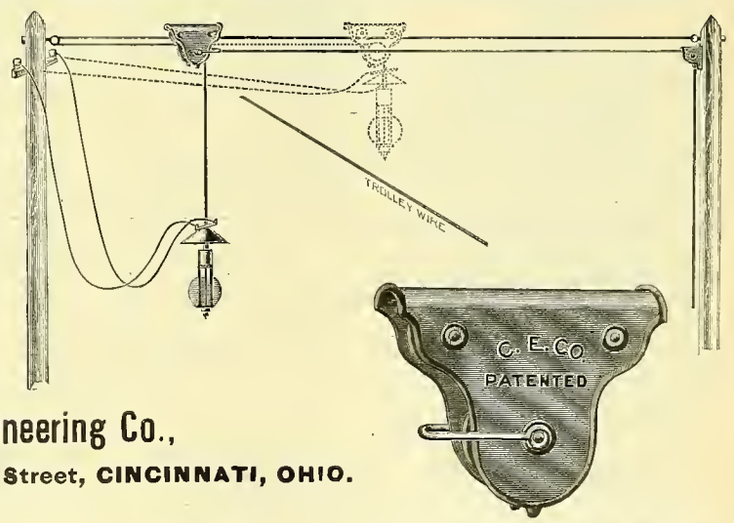


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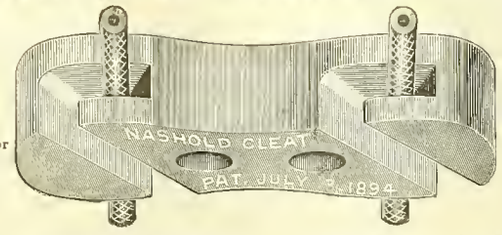


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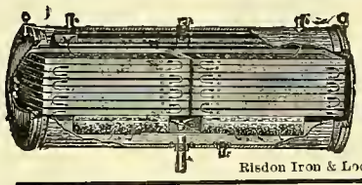

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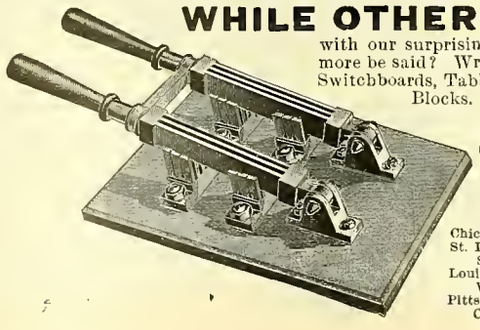

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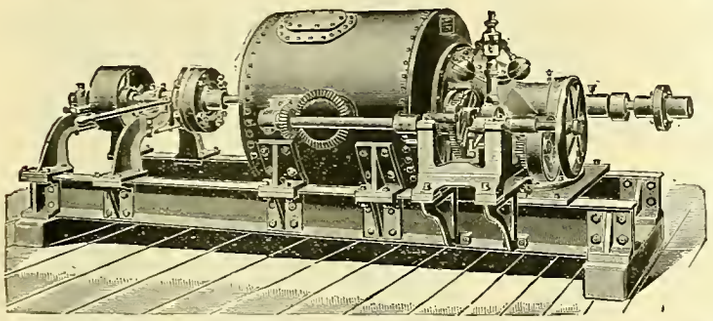

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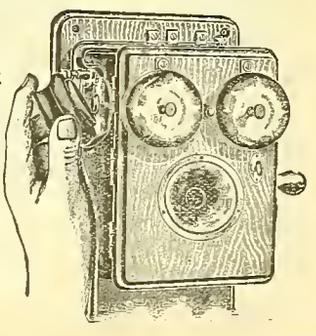

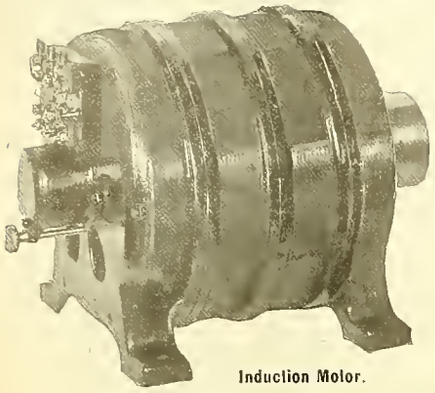

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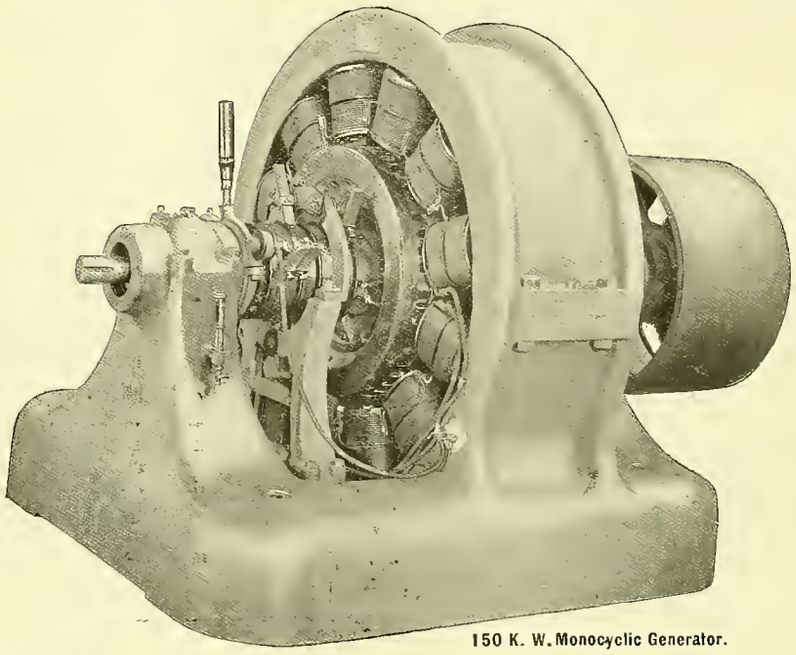
Generators will carry full Load in Lights or Motors or any proportion in Lights and the rest in Motors. There can be no unbalancing.



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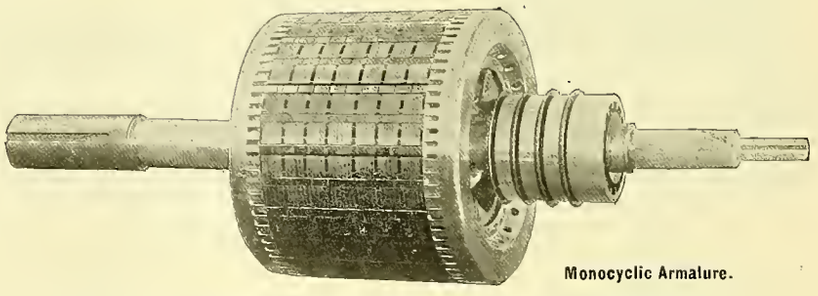

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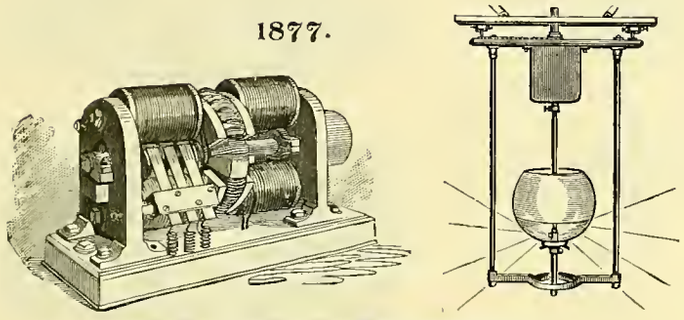
**For all business outside the United States and Canada—Foreign Department, Schenectady, N. Y., and 44 Broad Street, New York.**
**For Canada—Canadian General Electric Co., Ltd., Toronto, Canada.**

**SEE OUR EXHIBIT AT THE CLEVELAND ILLUMINATING CO.'S STATION, CLEVELAND, FEB. 19, 20, 21, 1895.**

# THE BRUSH

## Electric Co., Cleveland, Ohio.

1877.



THIS IS WHAT THEY BOUGHT.

BALTIMORE, MD, April 10, 1893.

**BRUSH ELECTRIC CO., Cleveland, Ohio.**

GENTLEMEN:—We have this day shipped to you by express the little Dynamo which was purchased from you by our predecessors, Messrs. Davis & Watts in 1877.

This machine has been in constant use since it was purchased until about four years ago and then it was laid aside, from no fault or failure, but because we had a larger one in circuit for lighting our premises, we do not need this little one. The repairs have simply amounted to such supplies as segments and brushes.

We part with the little old friend regretfully, but consider that it is going home to rest, and will be better preserved than with us.

Yours very truly,
THE VIADUCT MANUFACTURING CO.,
By A. G. Davis, Prest.

1895.

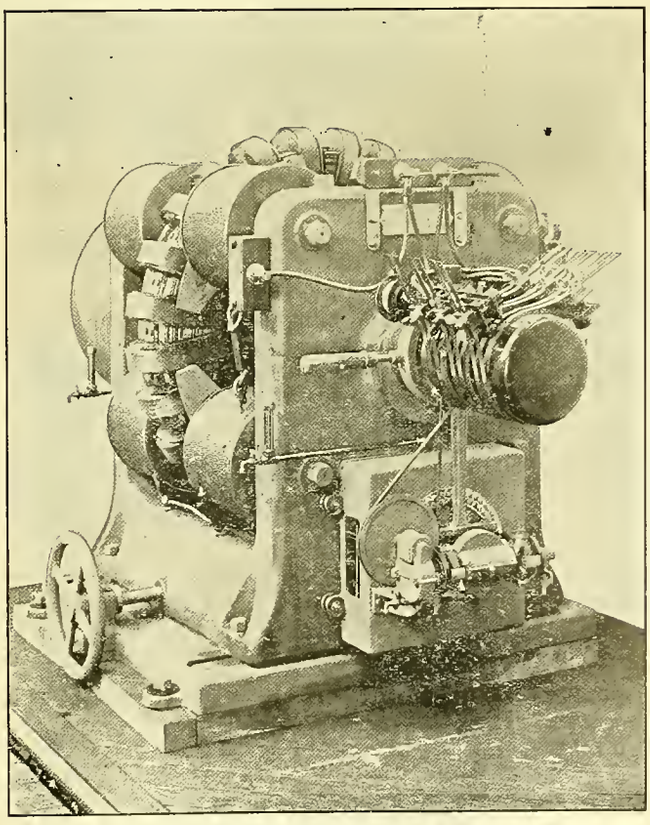
**The following is from one of the oldest and largest Electric Light Companies in the Country.**

February 5, 1895.

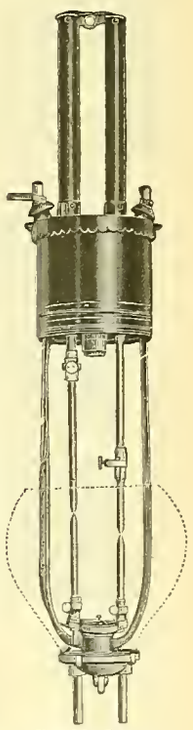
GENTLEMEN:—We have been in the local electric lighting business for more than thirteen years—being one of the oldest companies in the country—and have used, in our experience, nearly every style of arc dynamo and lamp placed on the market.

For the past two years we have been using Brush Adams arc lamps, and our recent order to you for dynamos of 1500-2000 C. P. arc lamp capacity will indicate what we think of Brush apparatus.

As far as the Brush-Adams lamps are concerned, we can only say that they have been by all odds the most satisfactory lamps we have ever used, and our experience with the Brush dynamos has been fully as good.



No. 11 Brush Arc Dynamo with Automatic Regulator.
Capacity 125 2000-C. P. Lamps



Double Lamp.
The MODERN all-night Arc Lamp.

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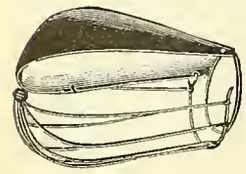
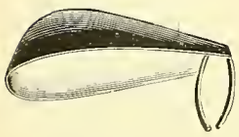
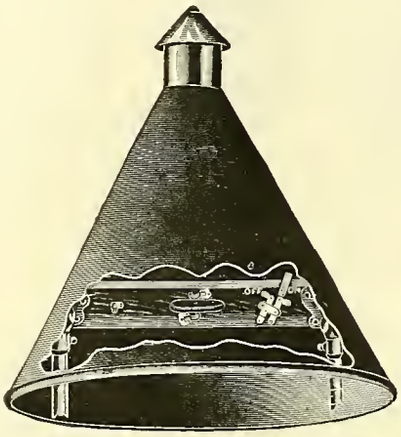
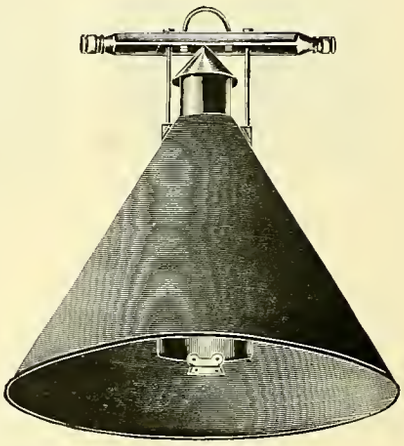
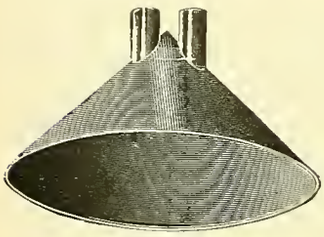
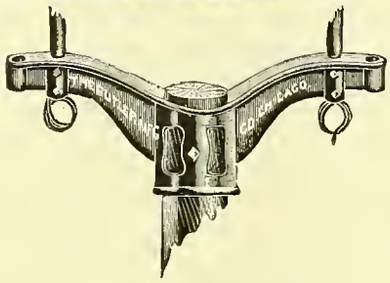
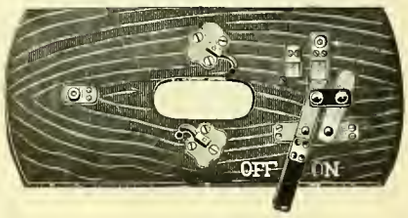
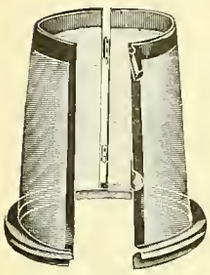
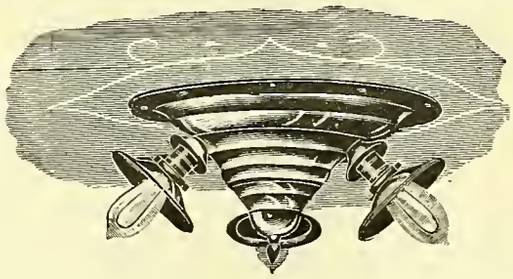
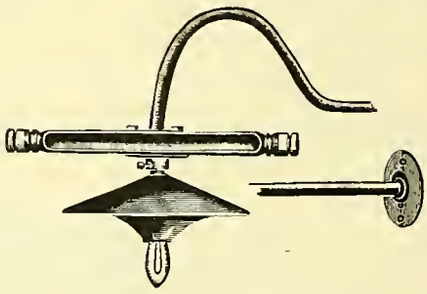
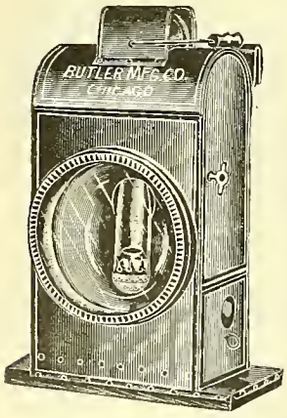
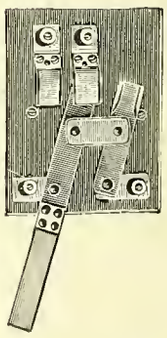
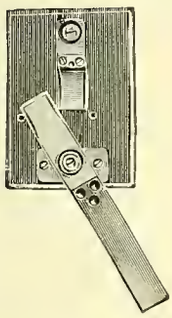
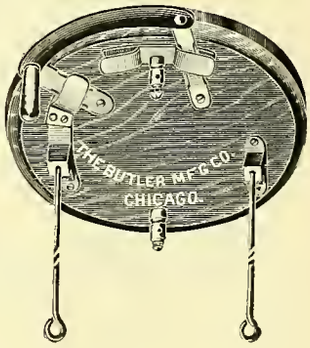
We manufacture the Best Line of Electric Lighting Specialties to be found anywhere. Here are a few that we aim to keep constantly in stock. Do you use them? Can you sell them?

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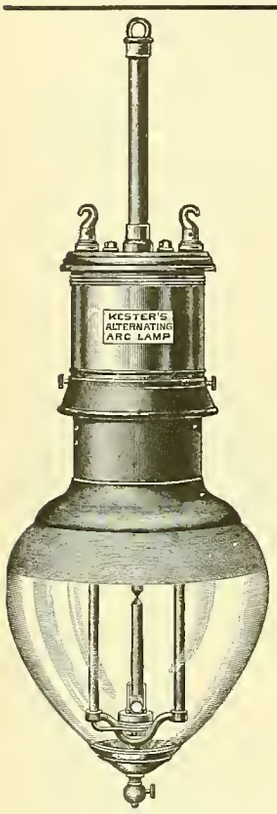


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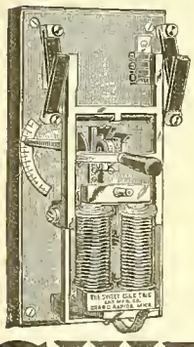

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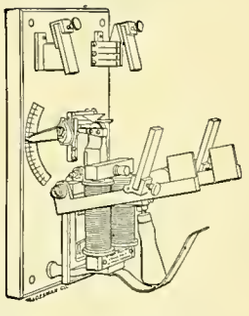

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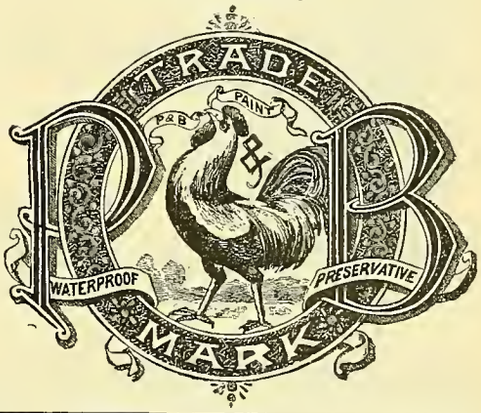


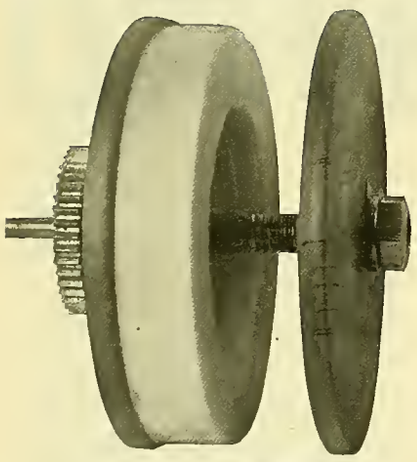

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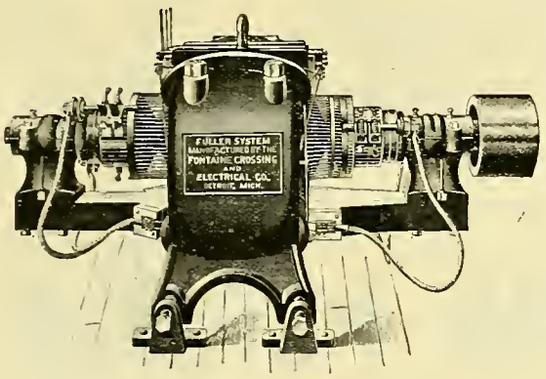


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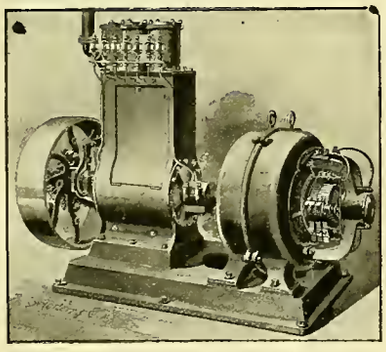

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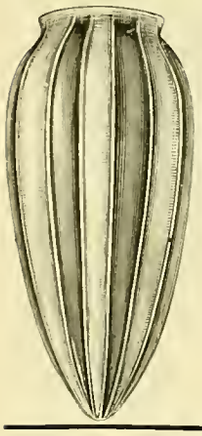

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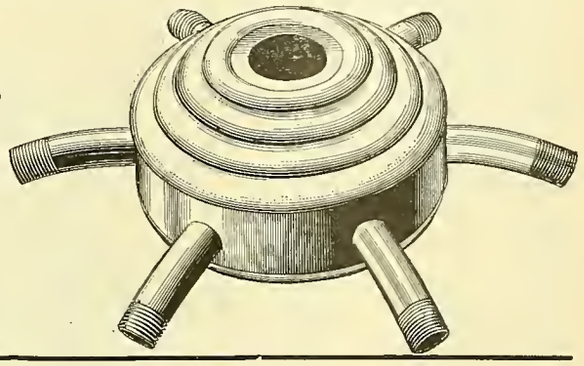

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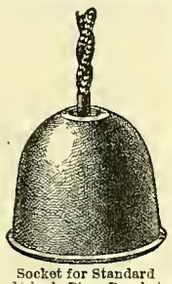

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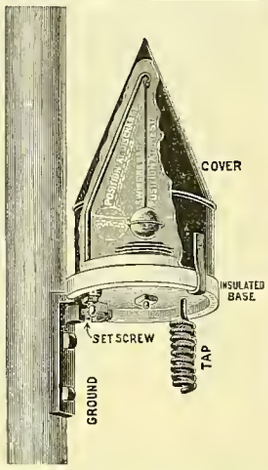


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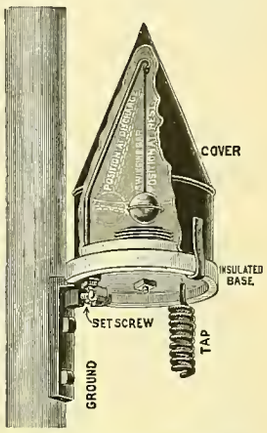


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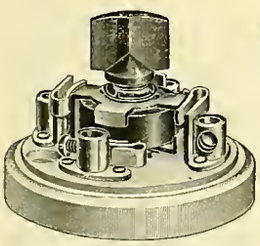

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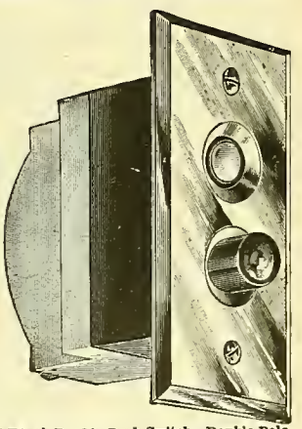

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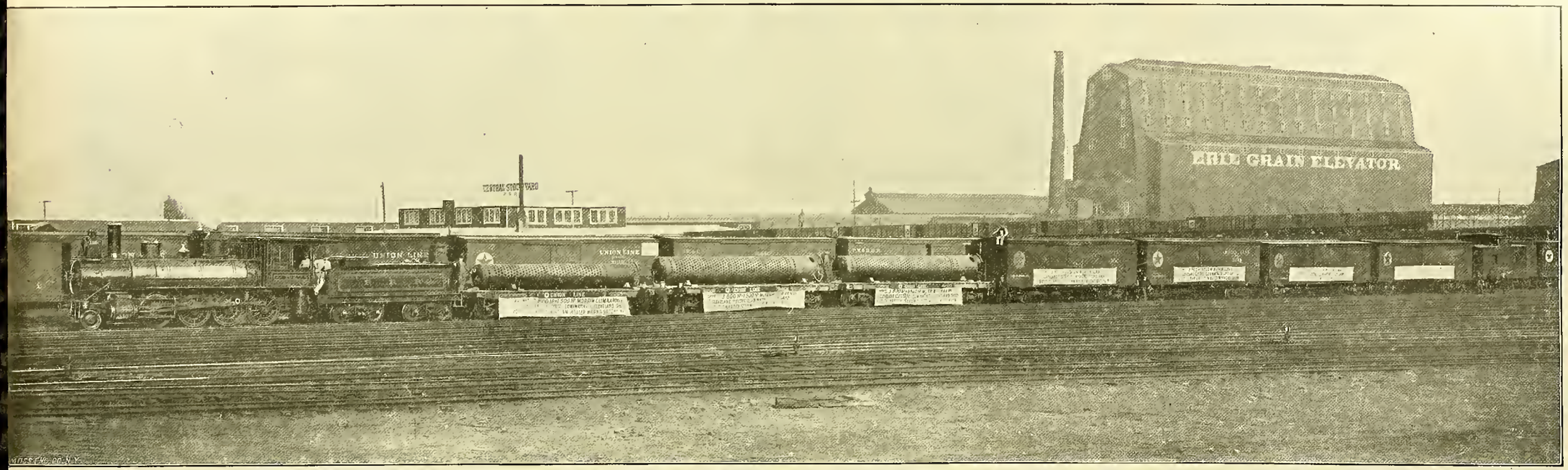


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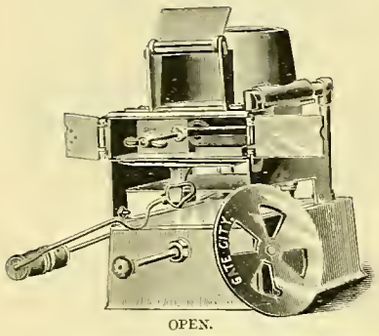

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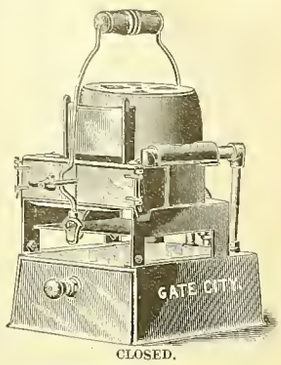

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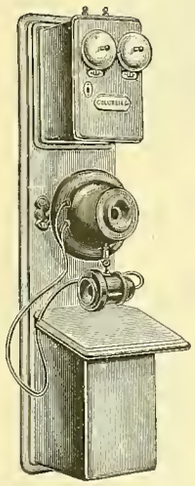

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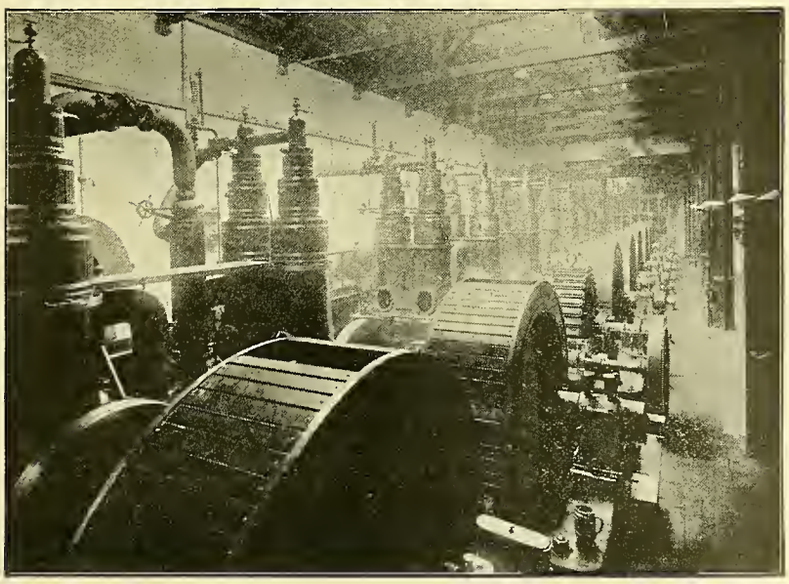

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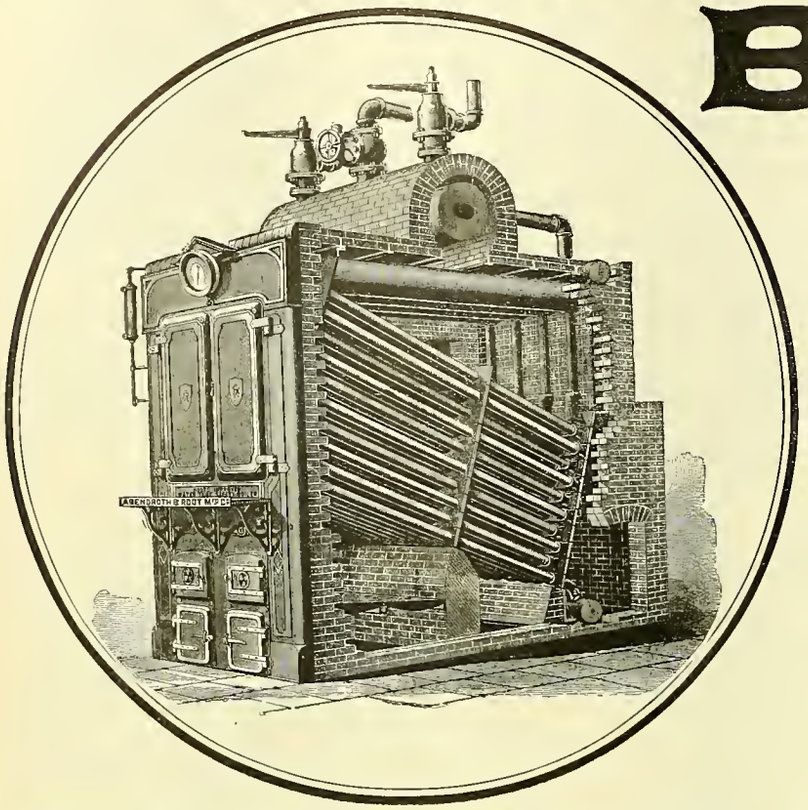

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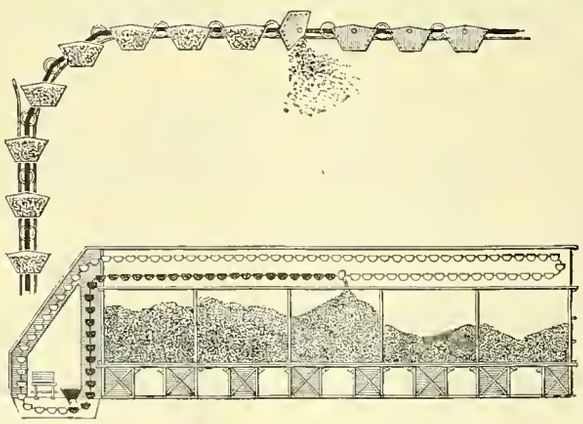

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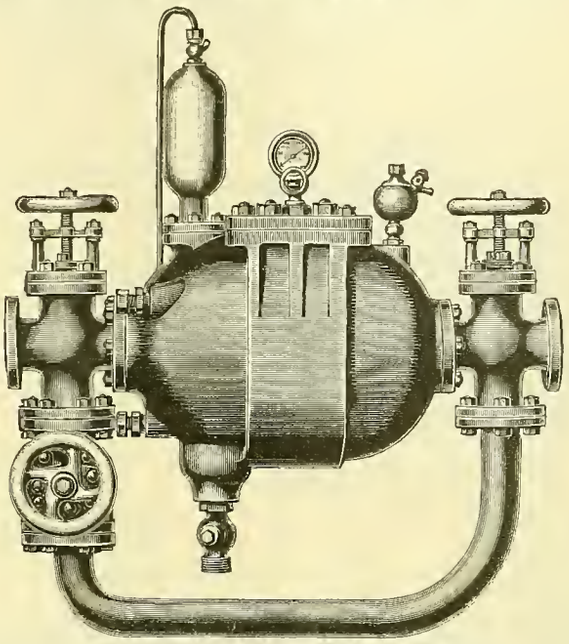

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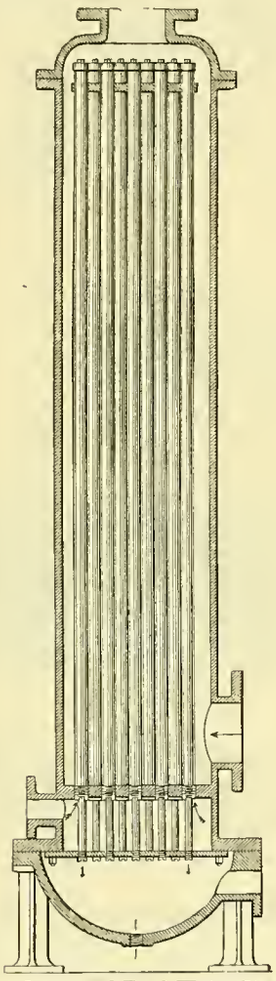

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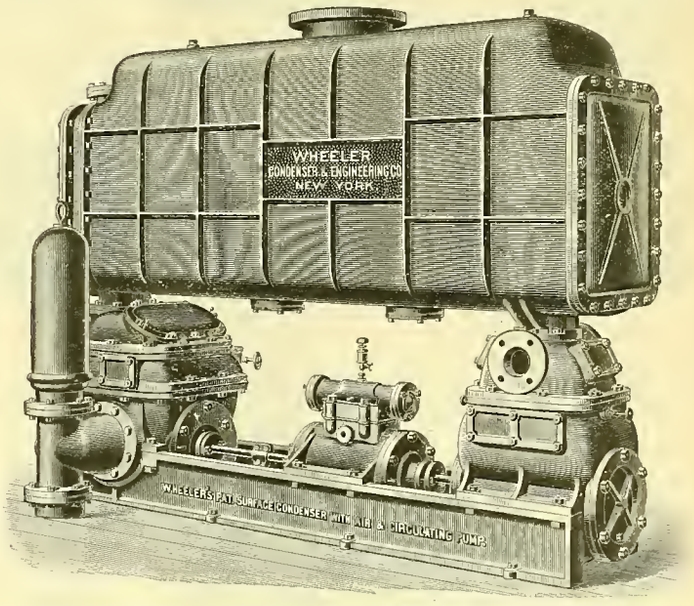


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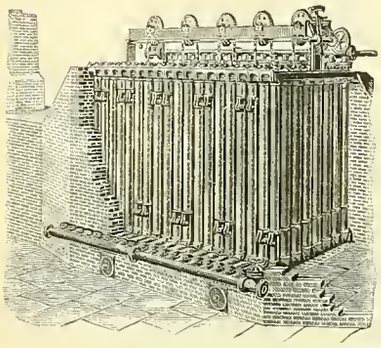

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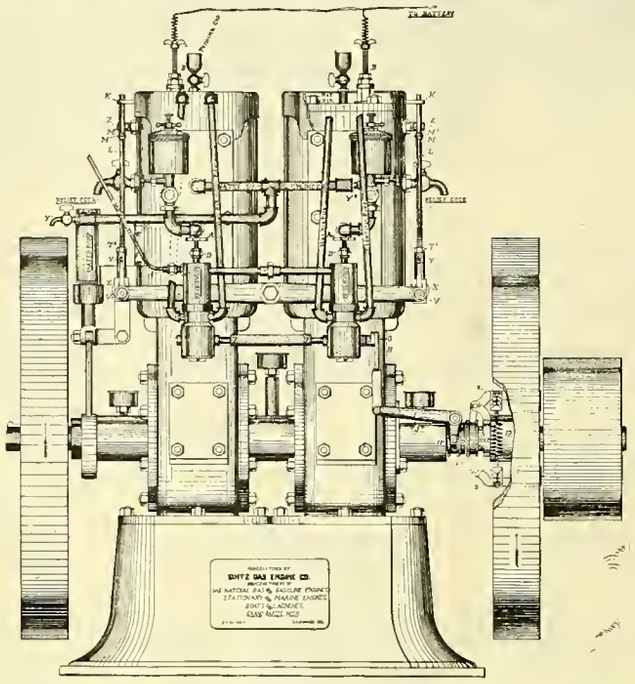

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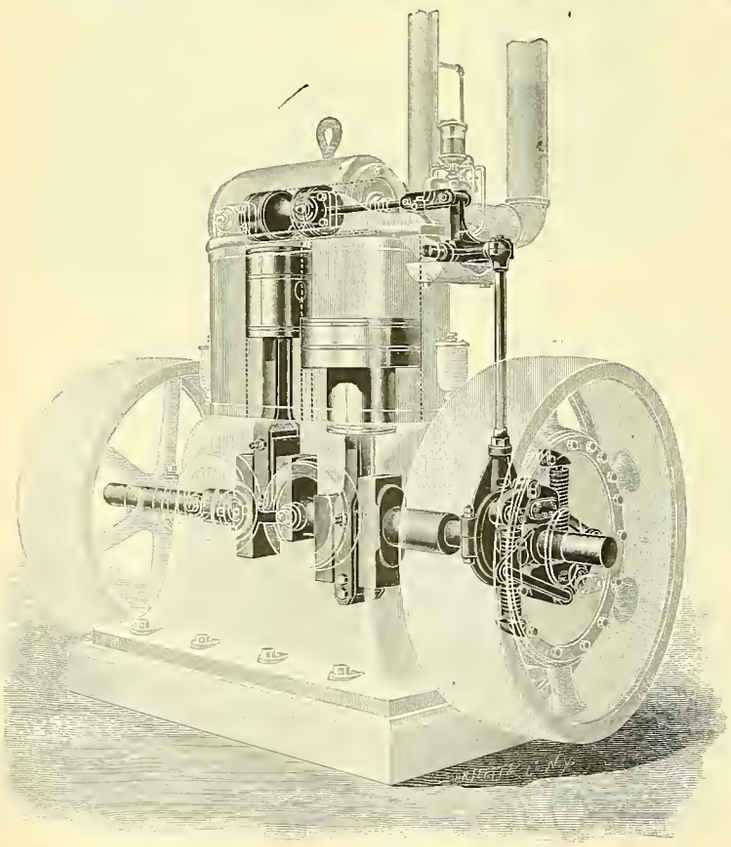

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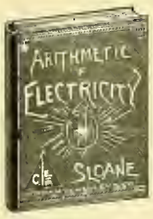


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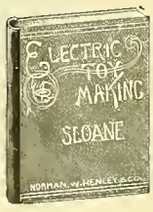


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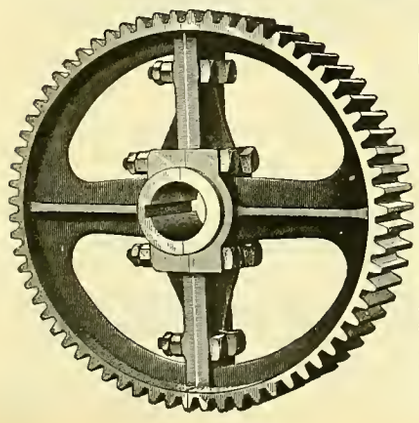

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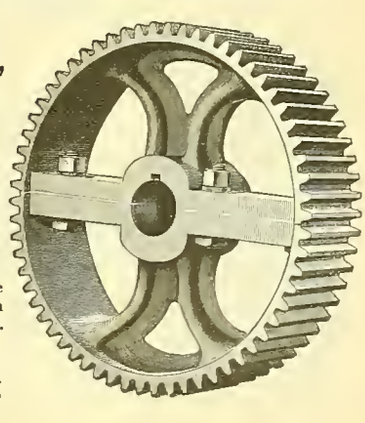

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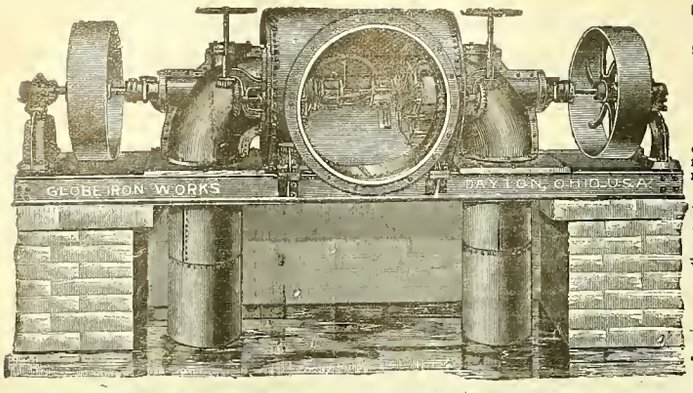


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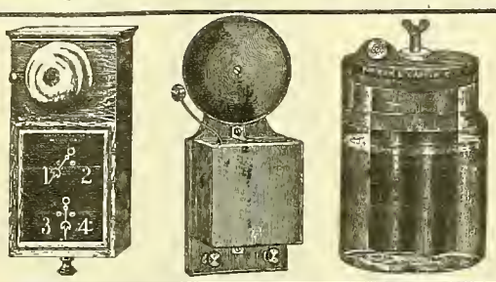

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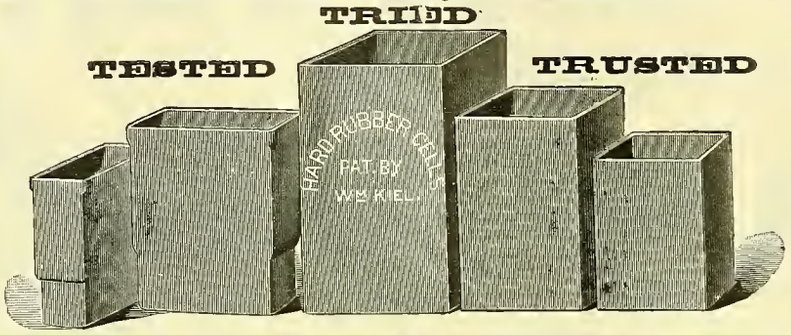


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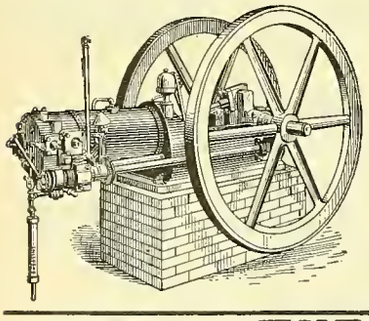

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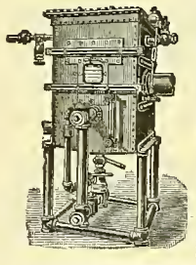

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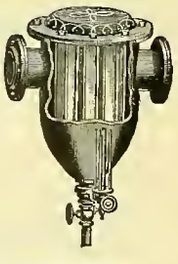

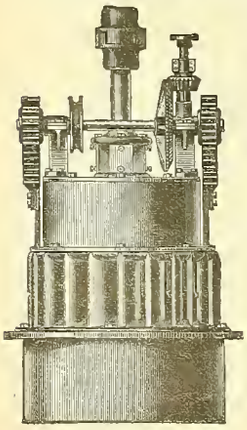

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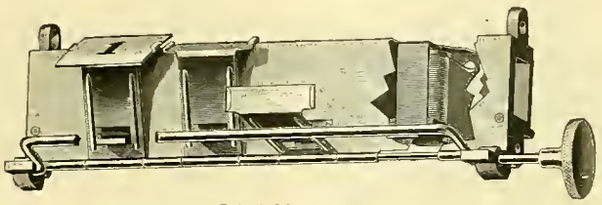

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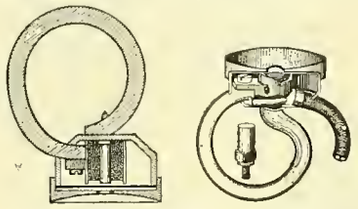
ductor. In the D'Arsonval receiver a curved permanent magnet is used, one pole of which terminates



FIGS. 27 AND 28. D'ARSONVAL RECEIVER.

in a soft iron polepiece that serves as the core of the coil, and the other in an iron box, or cylinder, that

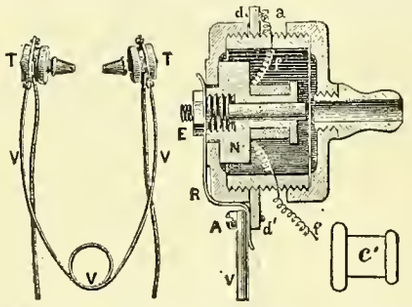



FIG. 29. MERCADIER'S BI-TELEPHONE. *T T* RECEIVERS, *V* SPRING, *N* MAGNET, *E* NUT, *R* STEEL STRIP, *A* SCREW CLAMPING *R* TO *V*, *d d'* METAL COLLAR CLAMPING *V* TO RECEIVER CASE, *f f* TERMINALS OF COIL *a* CONNECTING SCREW, *c'* SOFT RUBBER NIPPLE FOR EARPIECE.

completely encloses the coil. The two poles are magnetically insulated from each other by the wooden case, to the upper part of which the diaphragm is

48 TELEPHONE HAND BOOK.

appeared on the scene with an application for a patent on a microphonic transmitter, and according to the rules of the Patent Office no patent could be issued to any of the three until it was determined whether the Drawbaugh claim was valid or not. This was finally decided against Drawbaugh, as it was proved that the Edison carbon transmitter had been in public use for more than two years before Drawbaugh made his application for a patent, and his application was thrown out. A patent was then issued to Berliner on the broad

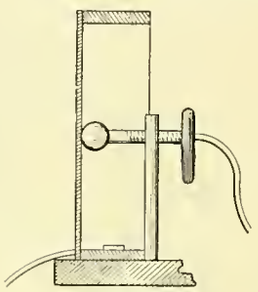


FIG. 44. BERLINER'S FIRST TRANSMITTER.

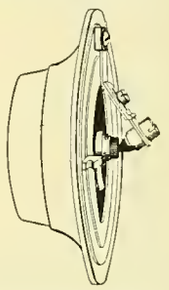


FIG. 45. BERLINER CARBON TRANSMITTER.

principle of the microphone transmitter in November, 1891. In May of the following year a patent was issued to Edison, so that both sides of the interference eventually got their patents—more than fourteen years after the filing of the original applications.

78. Both Berliner and Edison obtained in 1878 patents on special forms of transmitters designed in accordance with the principles laid down in their applications for the broad principle of battery telephones, and the Berliner transmitter especially has been modified out of all semblance to its original form. The broad claim in the Berliner patent is as follows: "The method of producing in a circuit electrical undulations similar in form to sound waves by caus-

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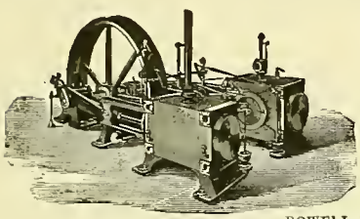

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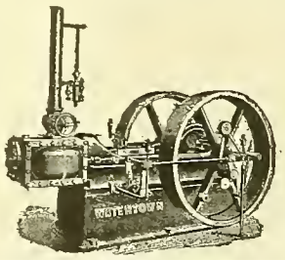

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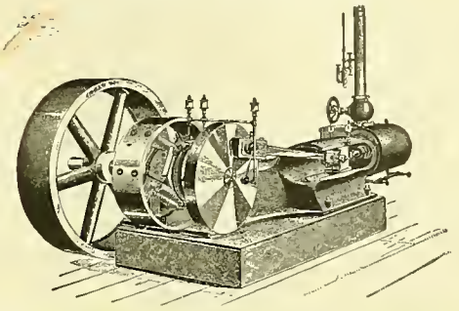

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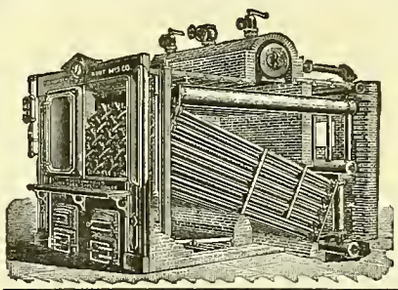

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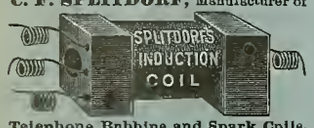


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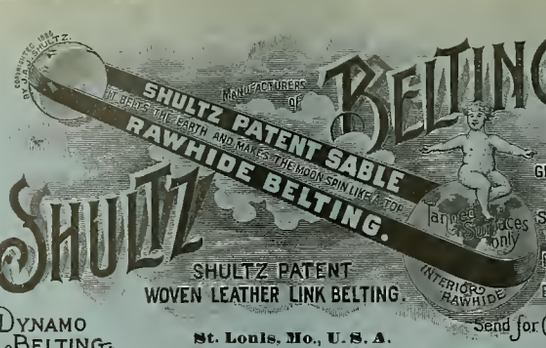


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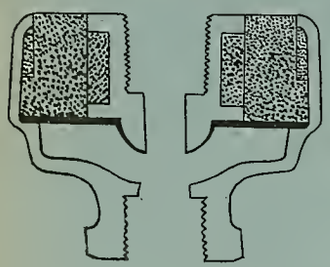

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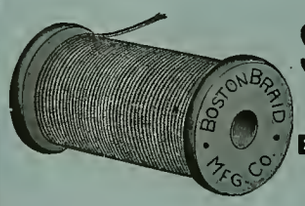


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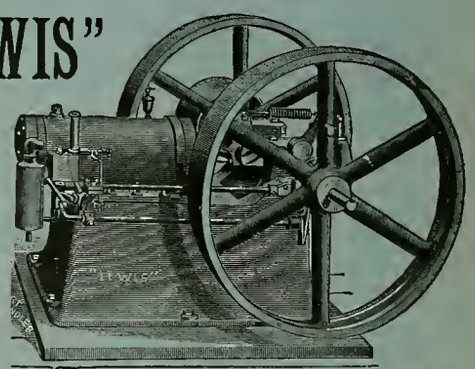

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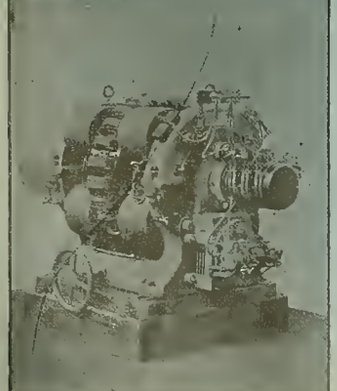

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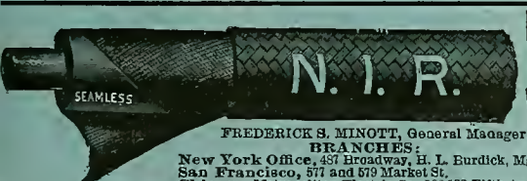


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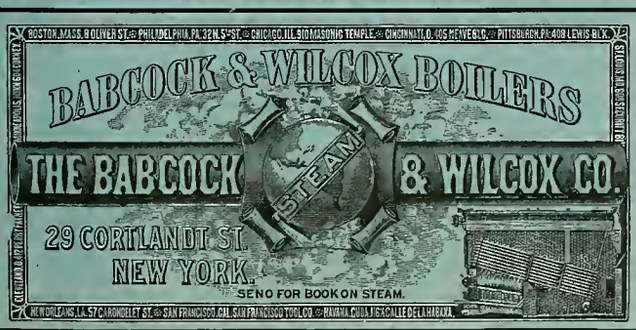


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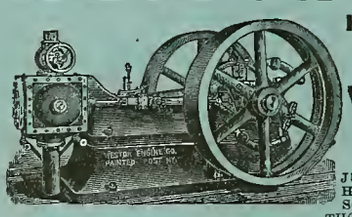

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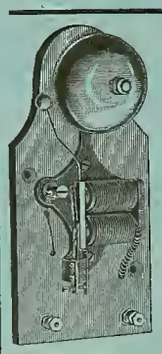

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**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Brownell & Co., The.
Clonbrock Steam Boiler Wks.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Partridge Caroon Co.
Phœnix Carbon Mfg. Co.

**Burglar Alarms.**
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Bishop Gutta Percha Co.
Brixey, W. R.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Carbons, Points & Plates.**
General Electric Co.
Partridge Carbon Co.
Phœnix Carbon Mfg. Co.
Reisinger, Hugo.
Standard Carbon Co.
Wasnington Carbon Co.
Wertheim, Ed.
Western Electric Co.

**Clocks, Electric.**
Self-Winding Clock Co.

**Compound.**
Eureka Compound Co

**Conduits.**
Interior Conduit & Ins Co.
National Conduit Mfg. Co.

**Construction & Repairs.**
Allen-Hussey Co.
Amstutz, N. S.
Hogue, Chas. J.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El. Const. Co.

**Contractors and Electric Light Plants.**
Allen-Hussey Co.
Amstutz, N. S.
Armstrong, Chas. G.
Arnold, B. J.
Bain, Foree.
Ball, Wm. D.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Clark Electric Co.
Consolidated Engineering Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Goltz & Sinclair.
Interior Conduit & Ins. Co.
Mather Electric Co.
Siemens & Halske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Wheeler Cond. & Eng. Co.

**Copper.**
Besly & Co., Chas. H.
Law Hattery Co.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co., J. H.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard U derground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brownlee & Co.
Electric Appliance Co.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Bryant Electric Co.
Hunnell & Co., J. H.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec, Mfg, Co.
Electric Appliance Co.
Elec. Selec. & Signal Co.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Nuttall Co., R. D.
Partrick & Carter, Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Utica Elec. Mfg. & Sup. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Dynamos.**
American Engine Co.
Brush Electric Co.
C & C Electric Co.
Clark Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Michigan Elec. Co.
Onondaga Dynamo Co.
Poland, Lawrence.
Roth & Eck.
Royal Electric Co.
Shawhan-Thresher El. Co.
Siemens & Halske Elec. Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Allen-Hussey Co.
Amstutz, N. S.
Armstrong, Chas. G.
Arnold, B. J.
Bain, Foree.
Brown & Son, Jas.
Bryan, Wm. H
Consolidated Eng. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg, Co,
Field & Hinchman.
Ford, Owen.
Goltz & Sinclair.
Spencer, E. J.
Thayer Electric Co.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bunnell & Co., J. H.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Electrical Specialties.**
Clark El. Specialty Mfg. Co.
Interstate Com. El. Const Co.
Holtzer-Cabot Electric Co.
Nashold Cleat Co.
Proctor-Raymond Elec. Co.

**Electroliers, etc.**
Edwards, W. S. Mfg. Co.
Gleason, E. P. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.
Sintz Gas Engine Co.
Webster Mfg. Co.

**Engines, Steam.**
Am. Engine Co.
Ball & Wood Co., The.
Brownell & Co., The.
Erie City Iron Wks.
Racine Hardware Co.
Sioux City Eng. & Iron Wks.
Watertown Steam Engine Co.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Davis Elec. Co., W. J.
Dayton Fan & Motor Co.
Diehl & Co.
Interior Conduit & Ins. Co.

**Feed Water Heaters.**
Goubert Mfg. Co.
Webster & Co., Warren
Wheeler Cond. & Eng. Co.

**Fibre.**
Butler Hard Rubber Co.
Kartaverl Mfg. Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Hutler Hard Rubber Co.
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Chicago Ins. Wire Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Holtzer-Cabot Electric Co.
Partrick & Carter Co.

**Gauges.**
Reliance Gauge Co.

**Gears.**
Besly & Co., Chas. H.
Grant, Geo. H.
Nuttall Co., R. D.

**General Elec. supplies.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bogue, Chas. J.
Brown & Son, Jas.
Bryant Electric Co.
Bunnell & Co., J. H.
Butler Mfg. Co.
Chicago Edisu Co.
Colgate Co., Geo. L.
Cons. Elec. Mfg. Co.
Creaghead Eng. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Elec. Eng. & Sup. Co.
Elliott-Lincoln Elec. Co.
Fiberite Co., The.
Forest City Elec. Wks.
General Electric Co
High & Co., J. Grant.
Holtzer-Caoot Electric Co.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Metropolitan Electric Co.
Michigan Electric Co.
Morris & MacCurdy;
Nashold Cleat Co.
Nowotny Electric Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Poland, Lawrence.
Proctor-Raymond Elec. Co.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Thayer Electric Co.
Wallace Electric Co.
Wood, M. M.

**Globes and Electrical Glassware.**
Gleason, E. P. Mfg. Co.
Jaeger Mfg. Co., The.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.

**Induction Coils.**
Splitdorf, C. F.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Holtzer-Cabot Electric Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
Little, F. P. Elec. C. & S. Co.
Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Nowotny Electric Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Paragon Insulating Co.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.
Wallace Electric Co.
Wood, M. M.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co., J. H.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Am. Electrical Mfg. Co.
Beacon Vac Pump & Elec. Co.
Bernstein Electric Co.
Buckeye Electric Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Jaeger Mfg. Co., The.
New York & Onio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg. Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Hine & Robertson Co.
Hunt Co., C. W
Lukens Iron & Steel Co.
Nicholas & Barr.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Brush Electric Co.
C & C Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Dayton Fan & Motor Co
Eddy Elec, Mfg, Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Michigan Electric Co.
Onondaga Dynamo Co.
Poland, Lawrence.
Royal Electric Co.
Roth & Eck.
Shawhan-Thresher El. Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Oil Filters.**
Peoria Auto. Filter Co.
Phoenix Auto. Filter Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.
Paragon Insulating Co.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd

**Pianos and Organs.**
Beethoven Piano & Organ Co.

**Platinum.**
Baker & Co.

**Poles.**
Brownlee & Co.
Morris, Tasker & Co.
Nuttall Co., R. D.
Valentine-Clark Co.

**Porcelain.**
Empire China Works.
General Electric Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Electric Appliance Co
Partrick & Carter Co.

**Rheostats.**
General Electric Co.

**Sal Ammoniac.**
Klipstein, A. & Co.
Law Battery Co.

**Separators.**
Goubert Mfg. Co.
Hine & Robertson Co.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Steam Pumps.**
Worthington, Henry R.

**Storage batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Baschke & Creelman.
Porter & Buerdorf.
Pumpelly-Sorley S. B. Co.
Syracuse Storage B.Co.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones**
Columbia Tel. Mfg. Co.
Nowotny Electric Co.
Partrick & Carter Co.
Western Electric Co.
Western Tel. Const. Co.
Williams & Abbott Elec. Co.

**Transformers**
Diamond Electric Co.
General Electric Co.
Hornberger Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Trolley Cord.**
Samson Cordage Wks

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

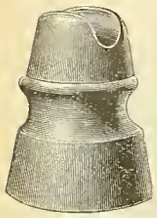
**Turbine Wheels.**
Dayton Globe Iron Works Co
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Int. Corr. Schools.
Scientific Machinist Co.

**Water Wheels.**
Smith, S. Morgan.

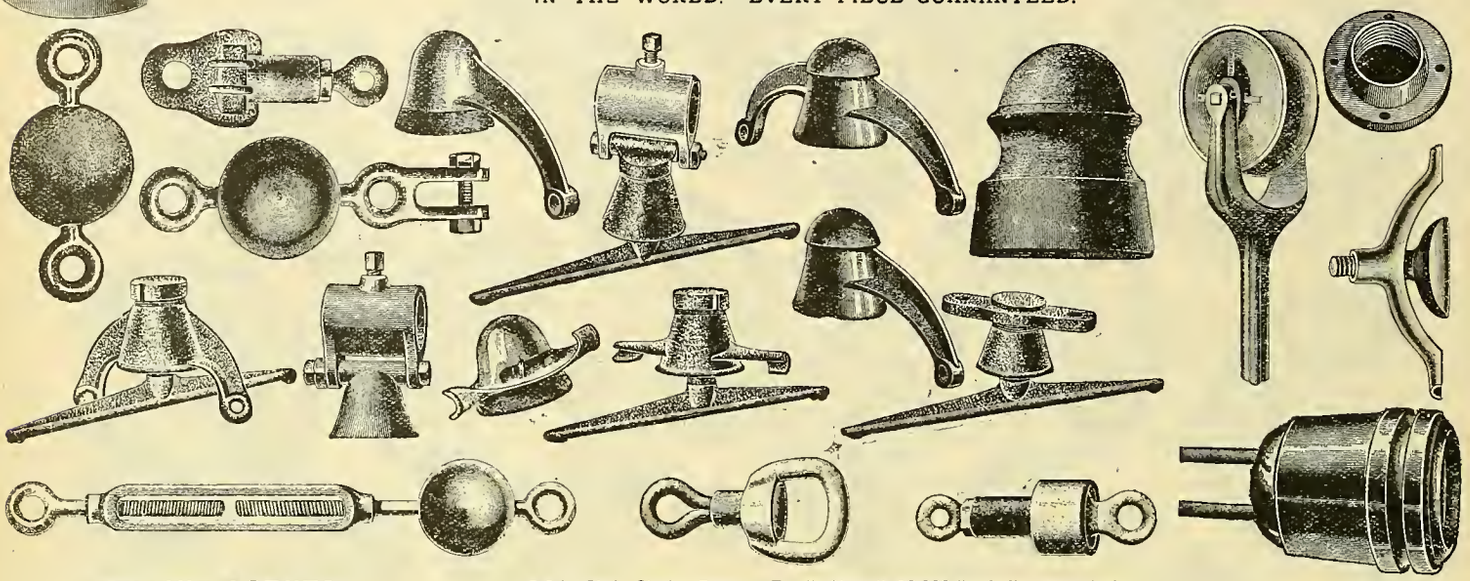
**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co,
Brixey, W. R.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C.Co.

# THE MEDBERY INSULATION



## ALUMINUM-BRONZE OVERHEAD TROLLEY EQUIPMENT.

FOR ELECTRIC RAILWAYS. LEADS ALL OTHERS, AND IS THE STANDARD OF THE WORLD. HIGHEST ELECTRICAL RESISTANCE, AND GREATEST TENSILE STRENGTH. THE BEST IN THE WORLD. EVERY PIECE GUARANTEED.



**SELLING AGENTS.**

MASON ELECTRIC CO., Chicago, Ill.
THE E. S. GREELEY & CO., New York.
HUBLEY MANUFACTURING CO., Lancaster, Pa.
DRAKE, PAYSON & WHITTIER, Providence, R. I.
A. T. MOORE, JR., Buffalo, N. Y.
TECHNIC ELECTRICAL WORKS, Philadelphia, Pa.
AHEARN & SOPER, Ottawa, Ont.
A. W. SOLOMON, Savannah, Ga.
REGER & ATWATER, San Francisco, Cal.
THE OAKMAN ELECTRIC CO., New York.

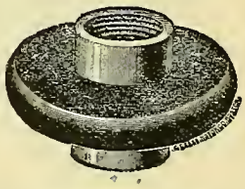
5-8 in. Studs, Steel or Bronze. Tensile Strength 90,000 lbs. to the square Inch.
ADOPTED BY THE BEST RAILROADS IN THE COUNTRY.

## THE FIBERITE COMPANY,

Manufacturers of Trolley Wheels and Harps, Cross-overs, and Everything in Line Material.

Write for Catalogue and Discounts.

**MECHANICVILLE, N. Y.**



In the words of Chas. Bradshaw, the superior quality of our **Helios Cored Carbons** is a fact which "**Reason Perceives, Experiment Verifies** and **Experience Confirms.**"

**Note what a recognized authority has to say on the subject.**

THE HELIOS ELECTRIC CO. PHILADELPHIA PA. U.S.A.
CABLE ADDRESS HELIOS PHILADELPHIA.
130 FIBERT ST

February, 12th, 1895.

The Washington Carbon Co.,
Pittsburgh, Pa.

Gentlemen:

We beg to say in answer to your inquiry that we have thoroughly tested the Helios cored carbons manufactured by your company, and we find them equal in every respect to the imported Helios carbons, and vastly superior to any other cored carbon made, either domestic or imported.

We congratulate you upon your success.

Yours truly,
HELIOS ELECTRIC CO.
Thos Spencer
Sup't.

# HELIOS CORED CARBONS

For Direct and Alternating Currents.

# SOLID CARBONS

For Series Arc Lighting.

## MOTOR AND GENERATOR BRUSHES, BATTERY CUPS, PLATES AND SPECIALTIES.

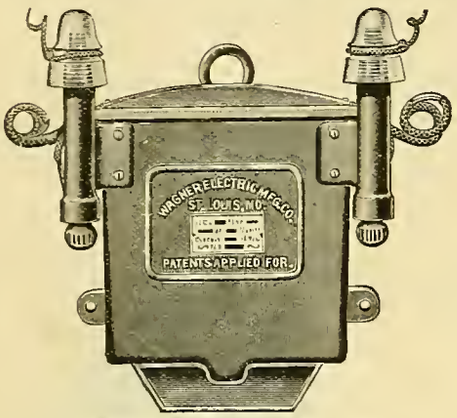
**REDUCED PRICES ON SOLID CARBONS FOR SERIES ARC LIGHTING.**

**NOTE THIS OFFER:** Let us know the price you are now paying, stating yearly consumption, and we will guarantee to beat it from 50 cents to $2.00 per thousand.

# THE WASHINGTON CARBON COMPANY,

**PITTSBURGH, PA.**

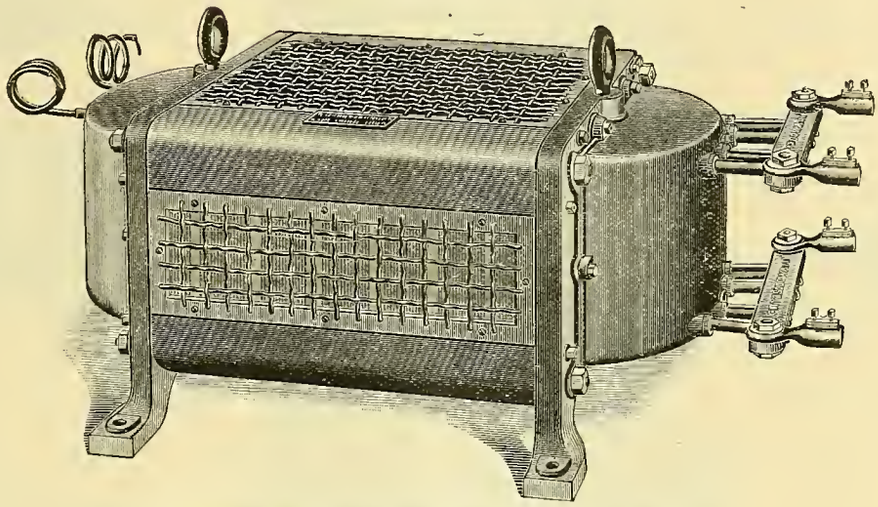
# TRANSFORMERS.




TYPE "D" TRANSFORMER.

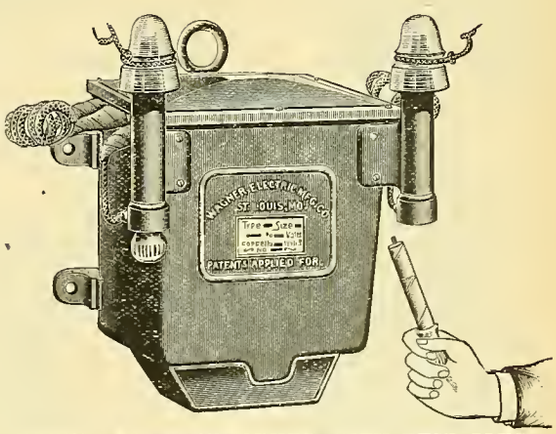
**A New Type**—*Transformer, Primary Cut-outs and Insulator Brackets all combined.*

No more brackets pulling off of walls.
With our wall or cross-arm hooks, transformer may be *Hung* and *Connected* in *Five minutes.*
No more trouble with primary fuses.
Our new fuse plugs will not hold an arc with 5,000 volts.
Absolute protection to lines and transformers secured.
Separate combination cutout brackets furnished for any purpose.
Type D transformers are made with either dry or oil insulation, as desired, and with either attached or separate primary cut-outs.

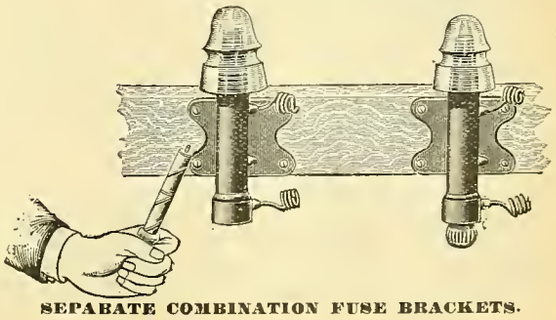


STANDARD 500 LIGHT TRANSFORMER. INDOOR TYPE.

*Our Transformers* are acknowledged by all experts to be the *Highest* in *Efficiency* ever made.
The accepted *Standard* for comparison.
The first in every competitive test.
Adopted by the largest stations in the country.
*We Challenge Competition* in any form of test, in laboratory or practical use.
One-half to one-eighth the iron loss of other transformers.
Insulation Guaranteed.




TYPE "D" TRANSFORMER WITH FUSE PLUG REMOVED.



SEPARATE COMBINATION FUSE BRACKETS.

## WAGNER ELECTRIC MFG. CO.,

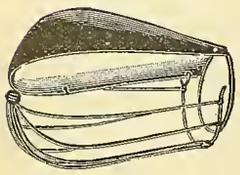
ST. LOUIS, MO.

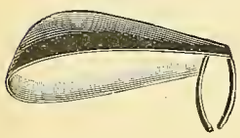
1564 Monadnock Block, Chicago, Ill.

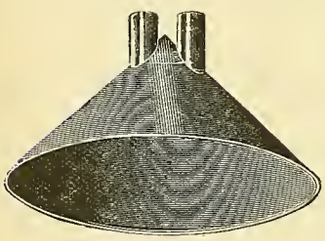
JOHN MUSTARD, Betz Building, Philadelphia, Pa.

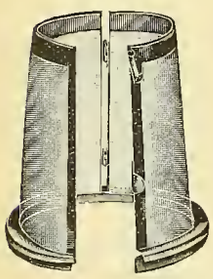
# THE BUTLER MANUFACTURING CO.

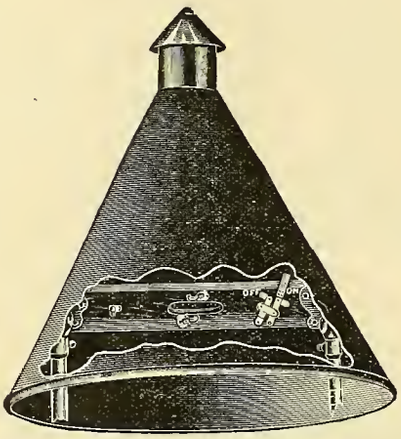
We manufacture the Best Line of Electric Lighting Specialties to be found anywhere. Here are a few that we aim to keep constantly in stock. Do you use them? Can you sell them?

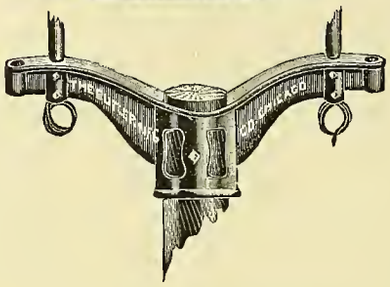


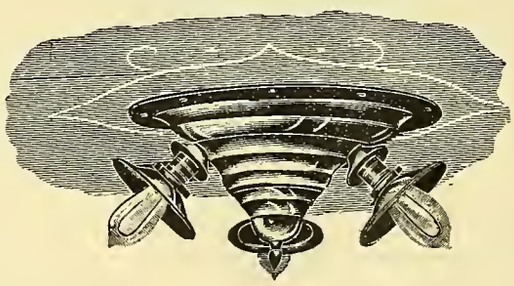


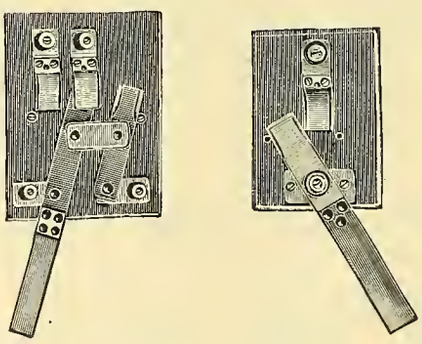


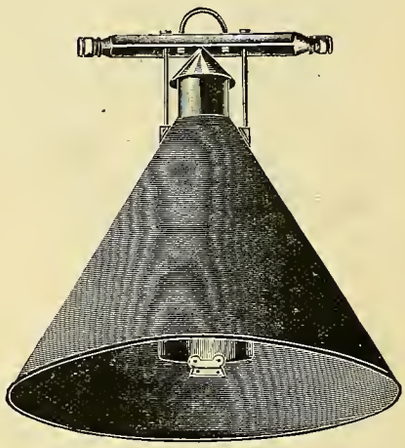


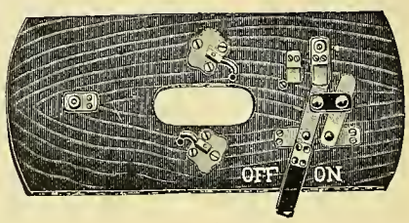


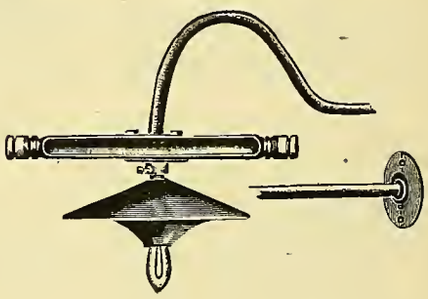


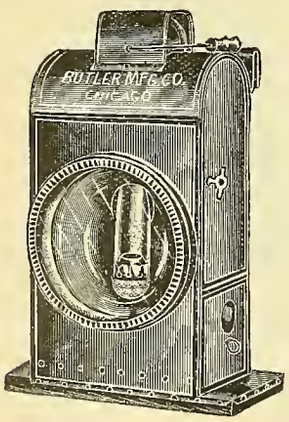



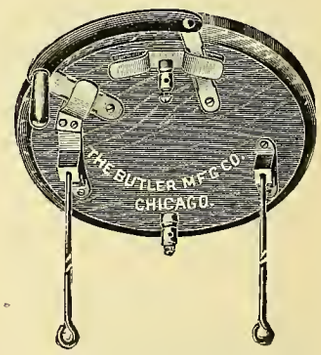









**Send for our catalogue No. 894. It may interest you.**

## The Butler Manufacturing Co., - Chicago.

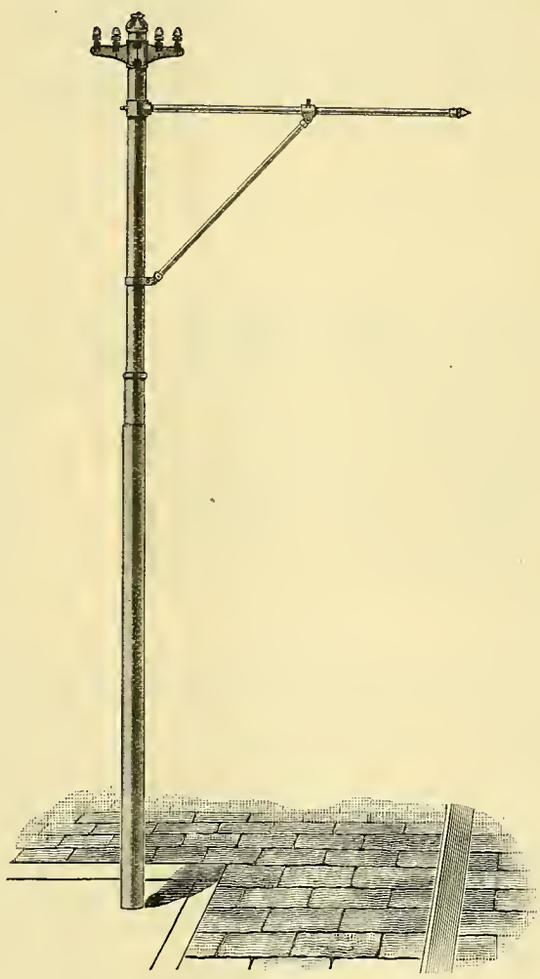
# ATTENTION, DELEGATES!!

1821. **Morris, Tasker & Co.,** 1888.

INCORPORATED.

**OFFICES: 222 and 224 South Third Street, PHILADELPHIA, PA.**

# OUR SPECIALTIES:



**Pascal Iron Works,**
PHILADELPHIA.

**Delaware Iron Works,**
NEW CASTLE, DEL.

## ELECTRIC LIGHT AND RAILWAY PIPE POLES.

MANUFACTURERS OF

Boiler Tubes, Wrought Iron Pipe and Fittings.

**SPECIAL GUN METAL CASTINGS FOR POWER PLANTS.**

BRACKETS. CROSS ARMS. STRAPS.

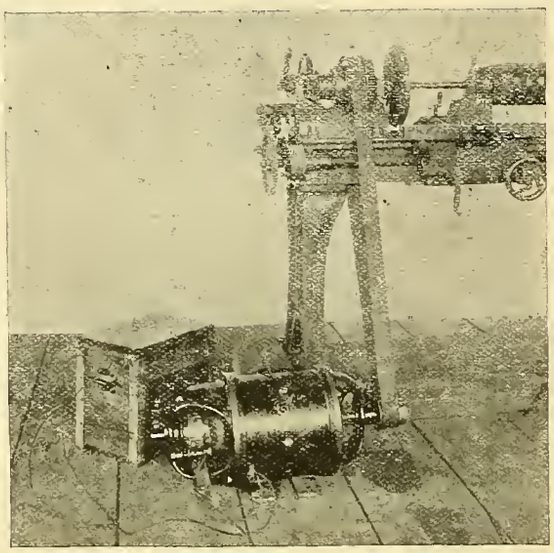
# HOLT ELECTRIC STORAGE COMPANY,

MANUFACTURERS OF

**Dry Portable Storage Batteries for Light Traction, and all Kinetic Purposes.**

## Characteristics:

No Dirt,
No Noxious Fumes,
No Buckling,
No Short Circuiting,
No Freezing,
No Slopping Over,
No Extra Care in Setting Up.



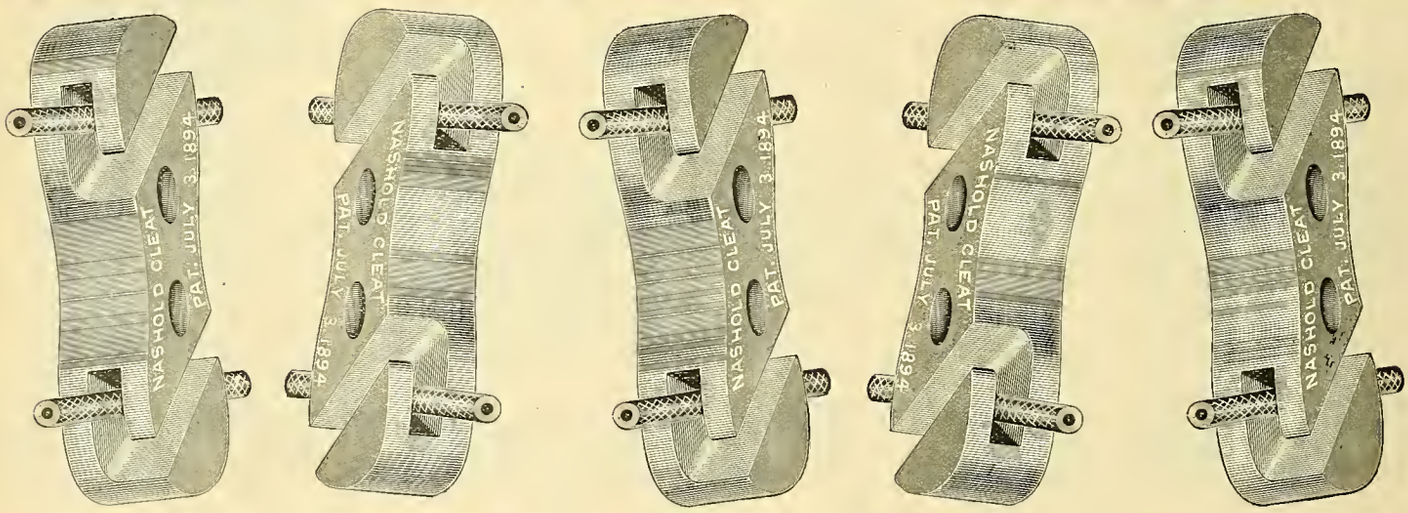
One Horse Power Motor with Battery for Lathe, Etc.

## Compared with Other Batteries:

Less Space,
Less Weight,
Less Cost,
Less Annoyance,
Greater Durability,
Greater Adaptability,
Greater Tension,
Greater Satisfaction.

**1227 Callowhill St., Philadelphia.**

# Nashold
# SELF-LOCKING CLEAT!




**We Sell all Leading Supply Houses.**

TRY US. YOU DON'T KNOW WHAT YOU'RE MISSING BY NOT HANDLING THE NASHOLD CLEAT.

## THE NASHOLD CLEAT CO.,

934 Monadnock Building, CHICAGO.

"DAYTON" ATMOSPHERE DISTURBERS, MOTORS AND DYNAMOS,

—MANUFACTURED FOR—

110, 220, 500 Volts and Arc Circuits.

MOTORS, 110, 220, 500 Volts, and Arc Circuits 1 6 to 50 h. p.

DYNAMOS, 50 to 125 Volts, 1 to 50 K. W.

EVERY MACHINE GUARANTEED.

AGENTS WANTED BY

THE DAYTON FAN & MOTOR CO., Dayton, Ohio.

WALTER F. PHELPS, President.

EDWIN O. WAYMIRE, Secretary and Treasurer.

# HAVE YOU STOPPED TO THINK

THAT M. M. WOOD AND HIS

## Eureka Porcelain Cleat

HAS A SURE GRIP ON THE CLEAT BUSINESS?

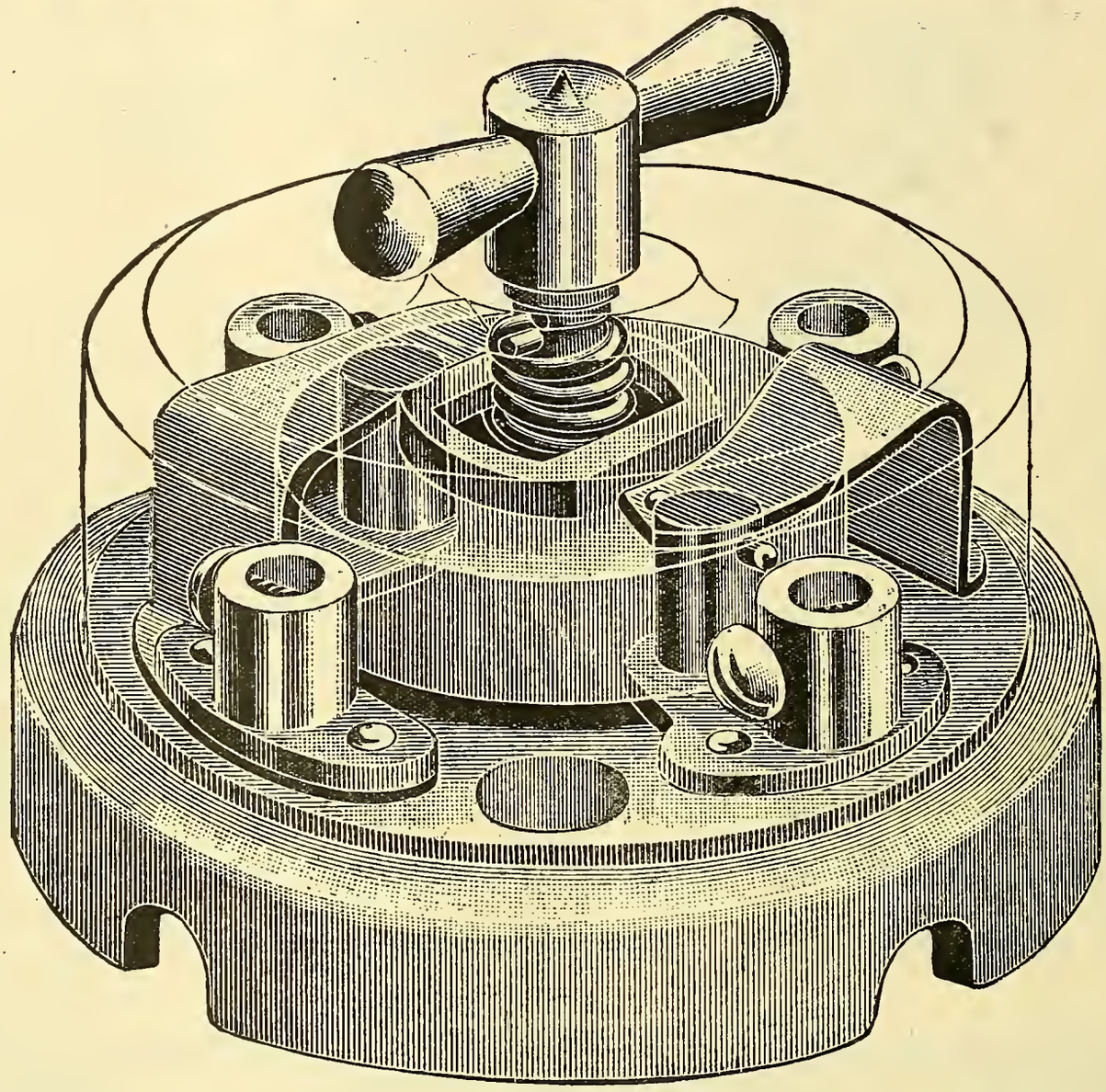
**Why?** He deals square.
His prices are square.
His cleat is square.

**Because:** It holds the wire square.
And he is a square man.
If you doubt it, try him and see.

**M. M. Wood,** Patentee and Manufacturer of Wood's Electric Light and Railway Specialties.
**1536 Monadnock Block, Chicago.**

# GIBBS SWITCH!

"IT'S A GOOD THING—



PUSH IT ALONG!"

This is not the actual size of the Switch, but the size of the users' opinion of it.

---

**DID YOU SEE THE WATERHOUSE-GAMBLE ARC LAMPS AT THE CONVENTION?**

---

# THE PERKINS ELECTRIC SWITCH MFG. CO.,

## HARTFORD, CONN.

**Chicago Office and Storeroom:**
1536 MONADNOCK BLK., CHICAGO.
G. W. CONOVER, Manager.

**Philadelphia Office:**
806 WALNUT STREET.
O. D. PIERCE, Manager.

**Boston Office:**
182 SUMMER STREET.
F. B. SMITH, Manager.

# The Peoria Automatic Filter

We candidly recommend to all users of dynamos and other high speed fine machinery, as well as all other mechanical appliances where oil is used as a means of lubrication.

Lubricating oil which has formerly been thrown away and wasted can be saved by the use of this Filter so as to be used again indefinitely. The saving is so great that consumers can well afford to use a better grade of oil.

*Correspondence Solicited.*

Simple in Construction.

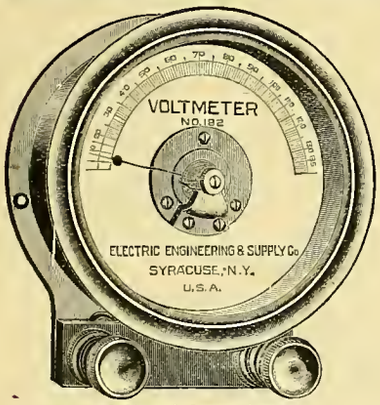
Easy in Operation.

Principles of Construction are Capillary Attraction and the Syphon.

No water being used in the Filter to wash oil, consequently the oil is thoroughly cleaned and purified.

## PEORIA AUTOMATIC FILTER CO., Peoria, Ill.

# E. E. & S. SUPPLIES.




Voit and Ammeters.

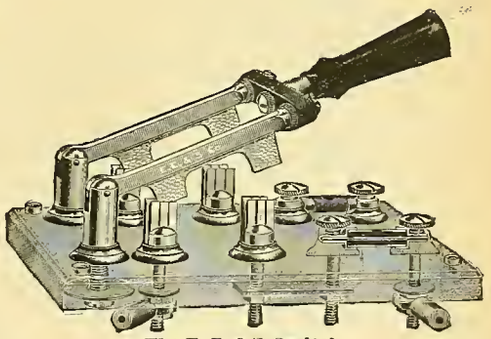
We Manufacture

**A FULL LINE**

OF ELECTRICAL SUPPLIES,

EMBRACING

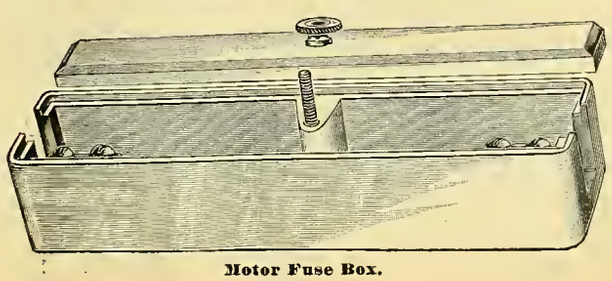
**Everything Necessary for the Complete Equipment of an Electric Plant.**



The E. E. & S. Switch.

**SPECIAL ATTENTION TO**

# Switch Boards.



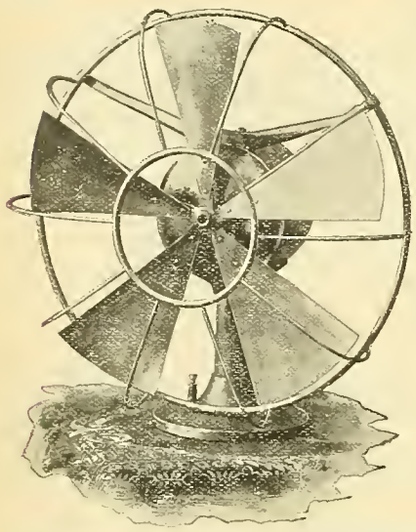
Motor Fuse Box.

*Send us your specifications and we will furnish you with estimates. Workmanship unsurpassed on all our goods.*

## ELECTRIC ENGINEERING & SUPPLY CO.,

**SYRACUSE, N. Y.**

NEW YORK OFFICE, 136 Liberty Street.



# The Best Electric Fan on the Market.

FOR EITHER ALTERNATING OR DIRECT CURRENT.

The Fan is 14 inches in diameter.
Will always start when current is on.
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

**AGENTS WANTED IN DIFFERENT LOCALITIES.**

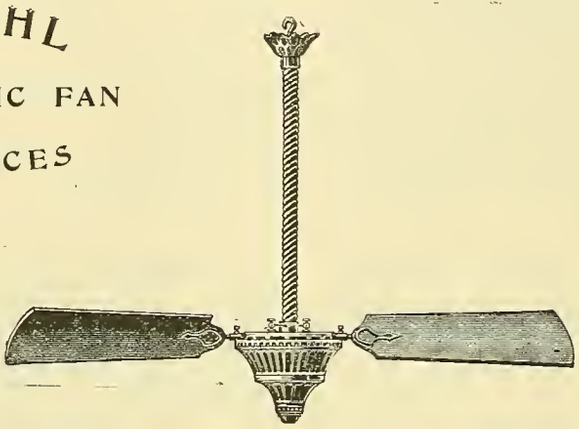
FOR FURTHER INFORMATION ADDRESS,

**The W. J. DAVIS ELECTRIC CO., - Pittsfield, Mass.**

DIEHL

ELECTRIC FAN

DEVICES



WOUND FOR

110
220
250
500

Volts DIRECT Incandescent

OR ANY

DIRECT Arc Current.

SEND FOR CATALOGUES.

DIEHL & COMPANY,

385 BROADWAY,

NEW YORK CITY.

CONTRACT FOR 5,500 LIGHTING PLANT IN DEY BROS. & CO.'S CLOSED.

YOU DO NOT MAKE AN ERROR WHEN YOU BUY THE PRODUCT OF THE

# Syracuse Storage Battery Co.,

Under License of THE CONSOLIDATED ELECTRIC STORAGE CO.
(The Brush Patent.)

FOR LAUNCHES, PHONOGRAPHS, CAUTERY WORK, and all purposes where it can be applied.

## The Best, the Lightest, the Most Efficient, the Most Durable for Traction, Lighting, Power.

Not a single renewal of plates in cells made over two years ago, the same having made 4,000 miles of traction work and being now used for lighting purposes.

**IMPOSSIBLE TO BUCKLE OR SHORT CIRCUIT.**

Can be charged and discharged at higher rate than any battery on the market.

IF YOU CARE TO MAKE 100 MILES OR MORE TRACTION WORK ON ONE CHARGE, WE CAN HELP YOU.

The Paragon Plaster Company in our city is using it. Plants now in the Syracuse Tube Company's Works; also the residences of E. T. Hawkins, E. L. Loomis and A. O. Ames.

**FACTORY AT PHOENIX, N. Y.**

**OFFICE, 38 and 39 HERALD BUILDING, SYRACUSE, N. Y.**

WRITE US.

NOT THE CHEAPEST IN FIRST COST, BUT WE GUARANTEE IT TO DO THE WORK.

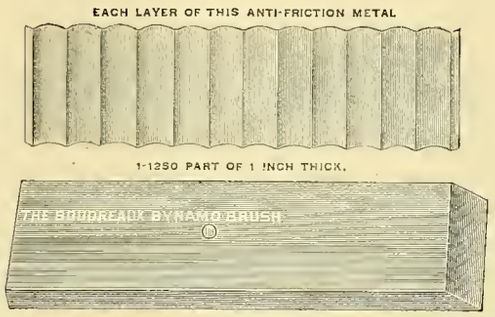
# The Boudreaux Dynamo Brush Co.,

(INCORPORATED)

226 and 228 LA SALLE ST., CHICAGO.

**NO COPPER.**

**NO WOVEN WIRE.**




**NO GAUZE.**

**NO CARBON.**

## Something Infinitely Better.

# TO TRY IS TO ADOPT IT.

# AMERICAN ENGINE COMPANY,

Bound Brook, N. J., U. S. A.

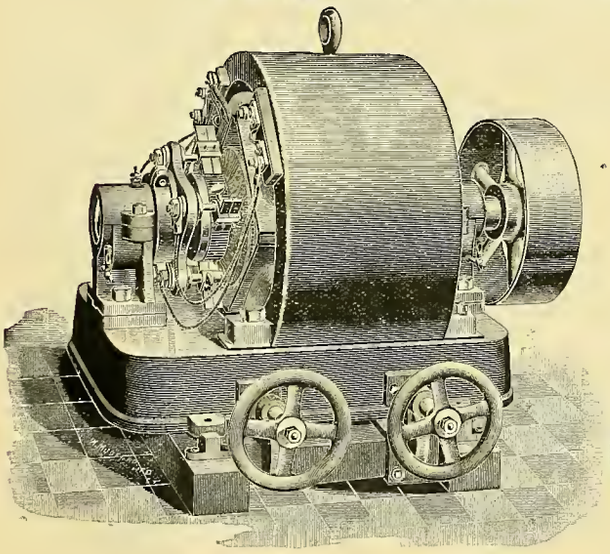
## Engines or Dynamos

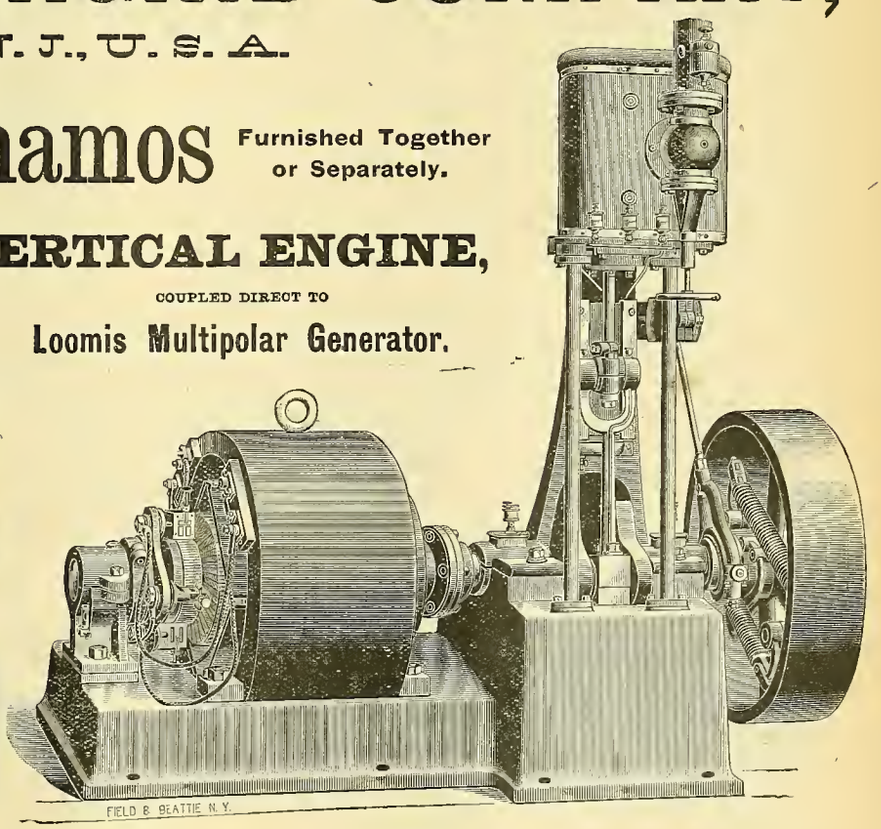
Furnished Together or Separately.

**SPAULDING VERTICAL ENGINE,**

COUPLED DIRECT TO

**Loomis Multipolar Generator.**





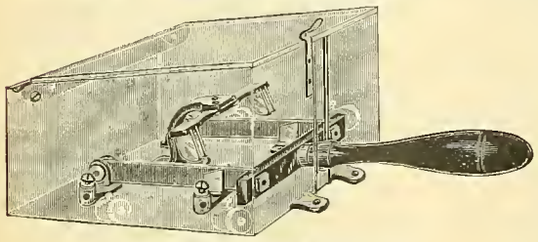

PLANTS OF ANY CAPACITY, FROM 25 H. P. TO 2,000 H. P.

**ONE COMPANY.** **ONE RESPONSIBILITY.**

**ESTIMATES FURNISHED.** **SEND FOR NEW CATALOGUE.**

# WE MAKE THIS SWITCH TO SELL.

ARC LIGHT KNIFE SWITCH.

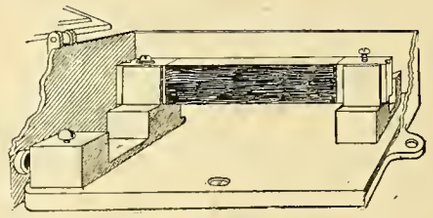


CARRYING CAPACITY 50 AMP.

NO SPRINGS TO BREAK.
ALWAYS RELIABLE.

Besides these two excellent specialties we manufacture Incandescent, Arc and Power Switches; Fuse Boxes and Mast Arms.
General Jobbing and Repairing.

UTICA FUSE BOX.



SINGLE OR DOUBLE POLE.

## UTICA ELECTRICAL MFG. & SUPPLY CO., Utica, N. Y.

## To pay dividends, save them.

**Fact 1**—The **Reliance Columns** prolong the life of steam boilers. How much would it be worth to you to have your boilers last, say, five years longer than they will otherwise last?

**Fact 2**—The **Reliance Columns** save repair bills. Leaky tubes and burned crown sheets are unknown where they are used.

**Fact 3**—The **Reliance Columns** save fuel. 5c a day pays 75% per annum on their cost.

**Fact 4**—The **Reliance Columns** protect life and property. What would be the cost in life, money and stoppage of an explosion in your plant?

**Fact 5**—The **Reliance Columns** are not an expense, but an investment paying phenomenal returns. The saving of fuel, saving of repairs, and prolonged life of the boilers aggregates several times their cost every year.

**Fact 6**—The **Reliance Columns** turn loss into profit. Unless you are rich you cannot afford to operate boilers without them.

**WRITE FOR CIRCULARS** and determine the matter for yourself. You need not buy unless you wish to.

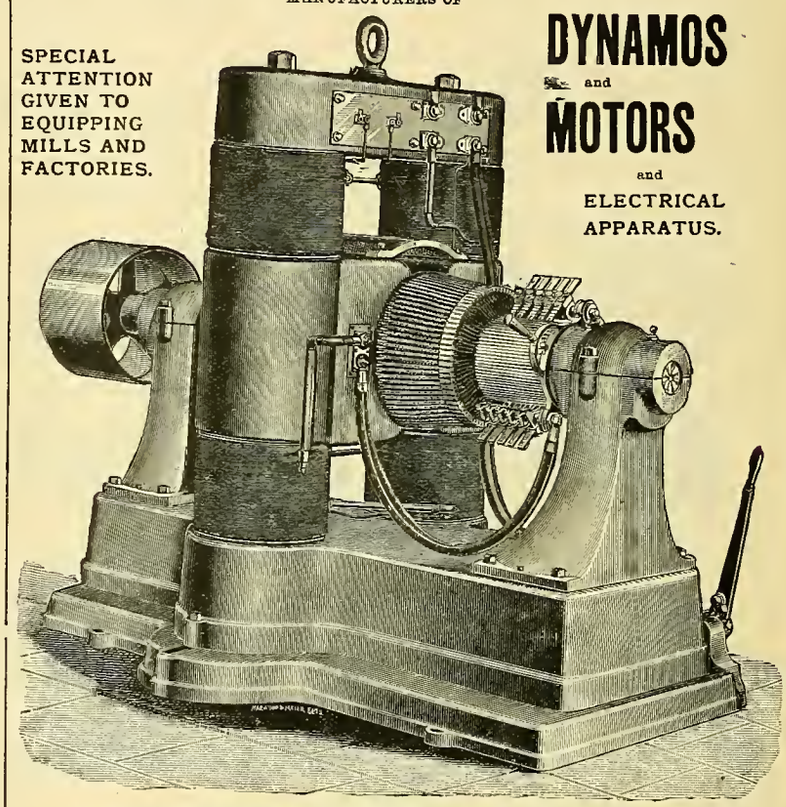
*The Reliance Gauge Company,*
SOLE MANUFACTURERS,
85 to 95 East Prospect Street, CLEVELAND, OHIO.

## ONONDAGA DYNAMO CO.,

MANUFACTURERS OF

SPECIAL ATTENTION GIVEN TO EQUIPPING MILLS AND FACTORIES.

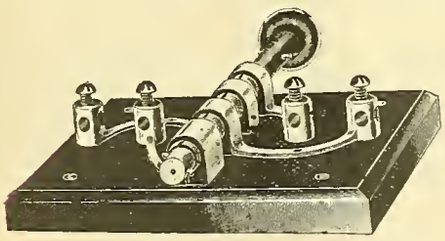
**DYNAMOS** and **MOTORS** and ELECTRICAL APPARATUS.



Main Office and Works, SYRACUSE, N. Y., U. S. A.

**WESTERN OFFICE,** LESLIE W. COLLINS, Manager. 1105 Monadnock, Chicago.

# FOR SALE CHEAP.



KELSCH HANGER BOARD.
(See description in this paper January 19, 1895.)
PRICES ON APPLICATION.

A LOT OF 50 AND 100 VOLT

## SLATTERY ALTERNATING METERS,

10, 25, 50 and 100 LIGHT CAPACITY.

ALSO A LARGE QUANTITY OF **SERIES ARC LAMPS,** 1200 and 2000 C. P.

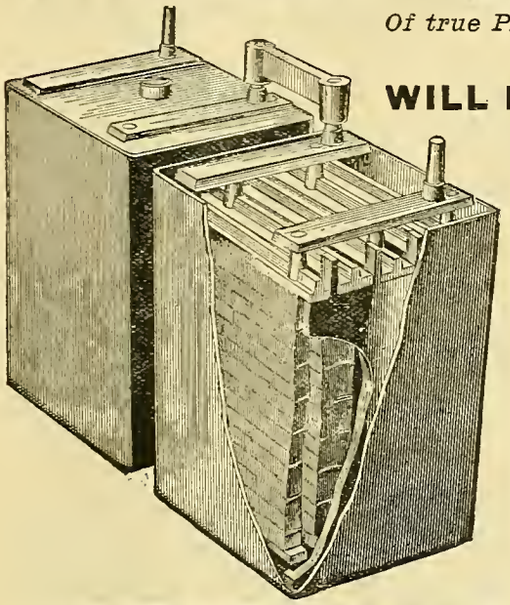
*AND SOME*

**HEINE BOILERS AND HIGH SPEED ENGINES,**

*which were replaced by larger ones.*

**Chicago Edison Co.,** SUPPLY DEPARTMENT 139 Adams St., CHICAGO.

# STANDARD PLANTE STORAGE BATTERIES



*Of true PLANTE Type and CRYSTALLINE FORMATION.*

Will give or receive without injury, currents that would destroy other batteries.

**WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.**

Contain no asbestos or other separating material to increase their internal resistance.

**ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.**

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

**Highest efficiency, largest delivery, lowest internal resistance.**

For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

**Cannot be damaged by excessive charge or discharge currents.**

A 400 ampere current has been taken from a 120 ampere hour cell.

☞ **CHALLENGE:** We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

**ELECTRIC POWER STORAGE COMPANY,**

Room 1210 Havemeyer Building, 26 Cortlandt Street, New York.

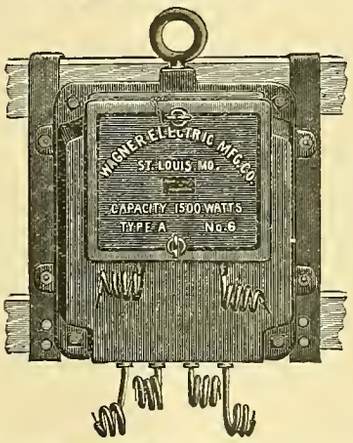
# ALTERNATING CURRENT TRANSFORMERS

**Highest Efficiency Ever Obtained.**

## TRANSFORMERS

To order for any purpose, voltage or capacity.

**ALTERNATING CURRENT MOTORS.**




**Standard Sizes, 5 Lights to 2,000 Lights.**

**HIGH POTENTIAL SWITCHES,**

**Complete Switch Boards**

For Central Stations and Isolated Plants.

# WAGNER ELECTRIC MFG. CO., ST. LOUIS, MO.

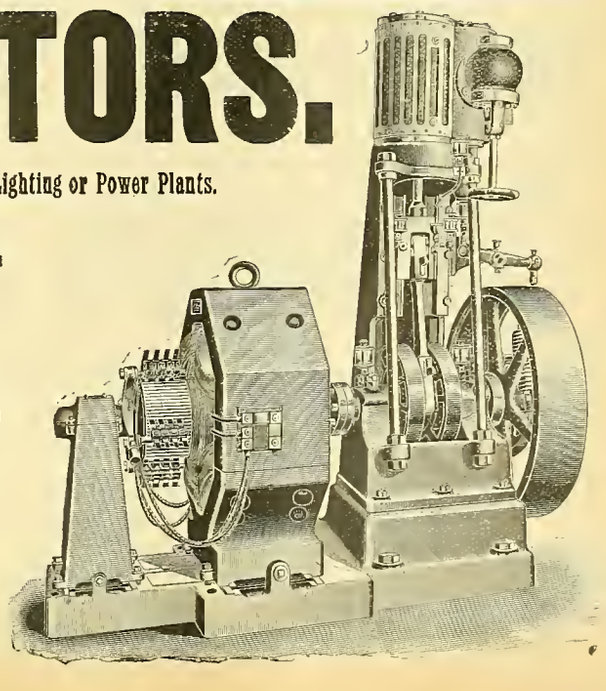
CHICAGO OFFICE, Wells Goodhue, 1564 Monadnock Block. PHILADELPHIA OFFICE, John Mustard, 1000 Betz Bldg.

# EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

**EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.**

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*



## THE EDDY ELECTRIC MFG. CO.,

*WINDSOR, CONN.*

NEW YORK OFFICE, HAVEMEYER BLDG.

*REPRESENTED BY:*

Walter C. McIntire & Co., 506 Commerce St., Philadelphia, Pa.
Western Electrical Supply Company, St. Louis, Mo.
F. P. Little Electrical Construction & Supply Co.
W. T. Osborn, Kansas City, Mo.

**All Our Apparatus Guaranteed as Represented.**

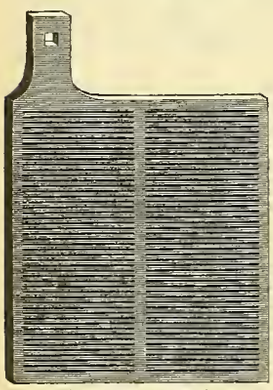
# STANDARD CARBON CO., Cleveland, Ohio.

**CORED CARBONS,**
**HOLLOW TREATED CARBONS,**
**SOLID FORCED CARBONS,**
**SOLID MOULDED CARBONS,**
**CARBON BRUSHES,**
**BATTERY MATERIAL.**

**Carbon specialties for telephone and transmitter use. Also Carbon cups and cylinders for open and closed circuit work.**

"Simplest is Best!"

# PLANTE CELLS?



(FORMED PLATE.)

Telephone Men,
Phonograph Men,
Kinetoscope Men,
Dentists.

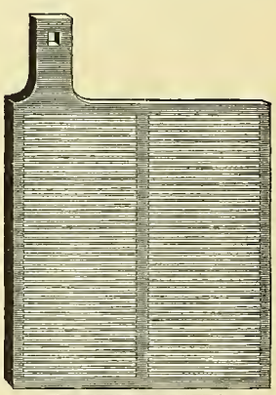
Do you know anything about Storage Batteries and the relative advantages of a PLANTE Cell over a pasted plate?

Do you know what some of the foremost Telephone Exchanges of the country are doing with our cells?

Write us stating the kind of work you wish to do and we'll tell you what you can depend upon.

WE ARE NOT IN THE TRUST.

Lighting Station Men,
Power Station Men,
Electric Heating Men.



(UNFORMED PLATE.)

# PUMPELLY-SORLEY STORAGE BATTERY COMPANY,

WARD S. ARNOLD, Manager. **The Rookery, Chicago, Ill.**

MARO S. CHAPMAN, Pres. THOMAS C. PERKINS, Vice-Pres. JOHN L. BUNCE, Sec'y and Treas. TH. GONET, Supt.

# THE MATHER ELECTRIC COMPANY,

## Manchester, Conn.

**Power Generators for Lighting and Railway Purposes.**

**Complete Station Equipments.**

Mather Apparatus for sale exclusively in their respective territories by the following well-known and reliable Contractors:

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For direct and alternating current Arc Lamps, are the most economical and efficient manufactured. They produce a very brilliant and absolutely steady light.

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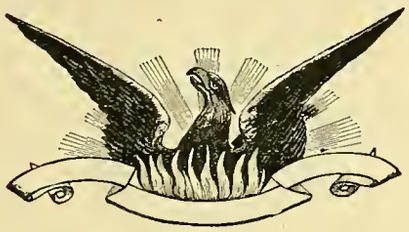

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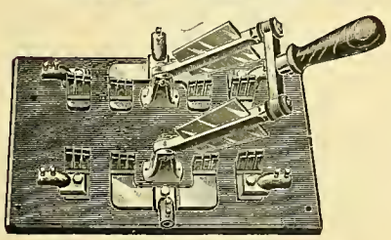

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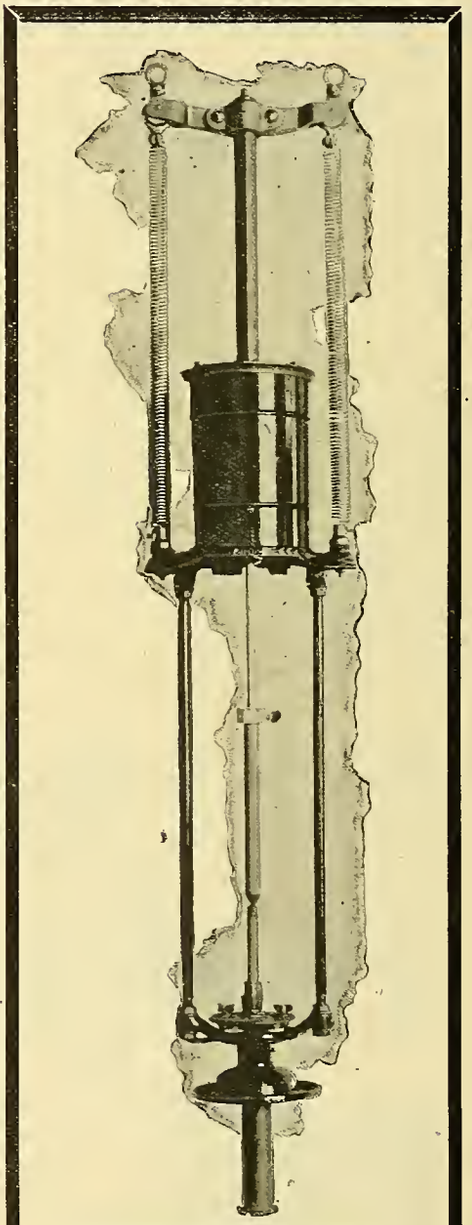

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The resistance used with the lamp is connected directly to it as shown in the illustration. It facilitates the hanging of the lamp, and overcomes the objections made by the Fire Underwriters to the ordinary form of resistances which are inclosed in boxes placed upon the wall.

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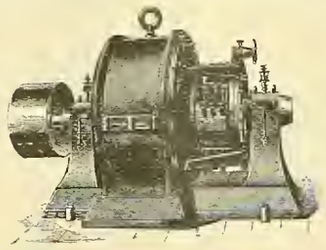

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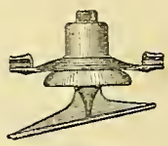

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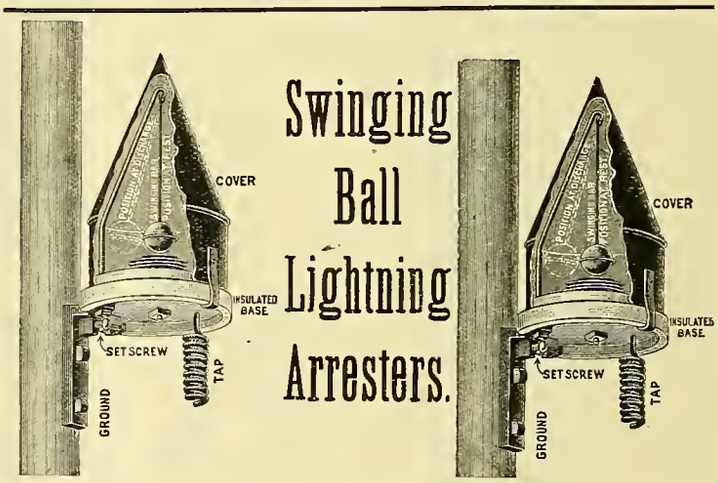


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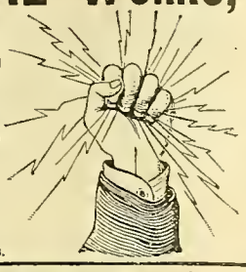

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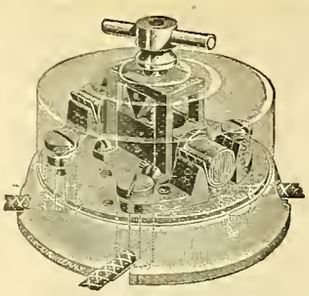

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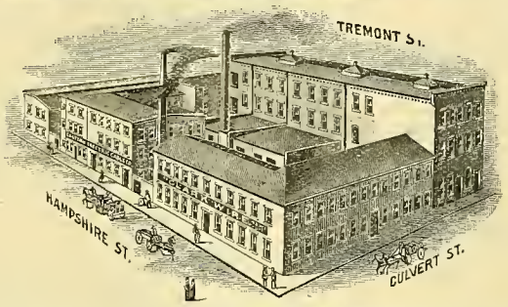


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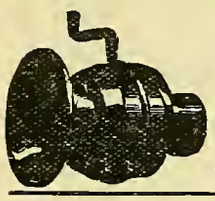

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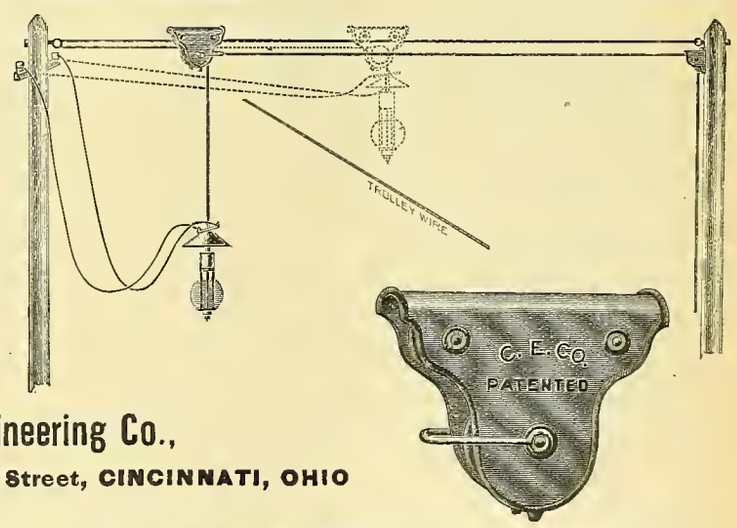


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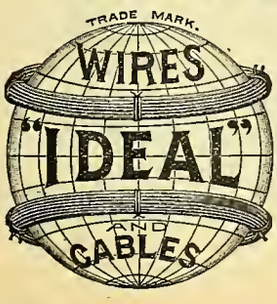
Approved by the New York Board of Fire Underwriters.

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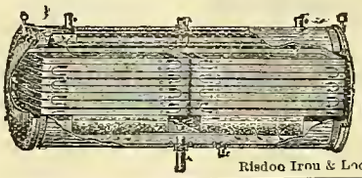

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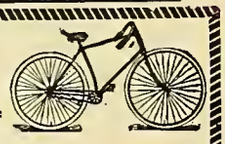

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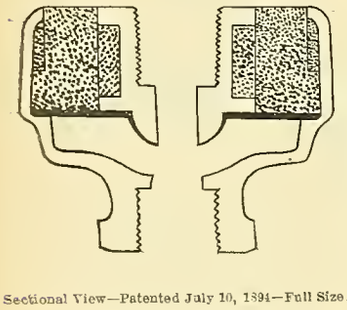

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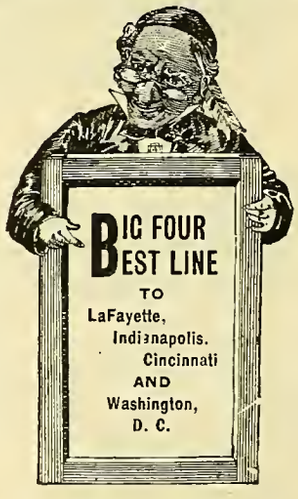


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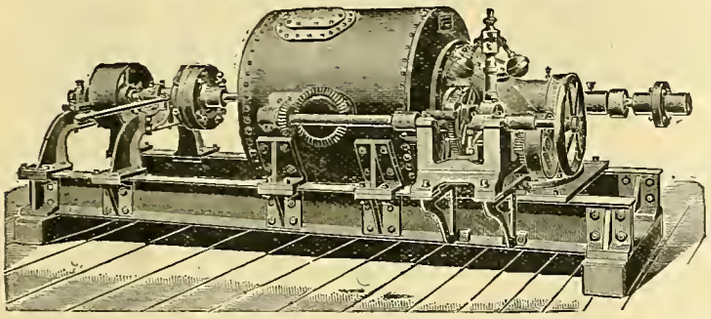
# VICTOR TURBINE WATER WHEEL.



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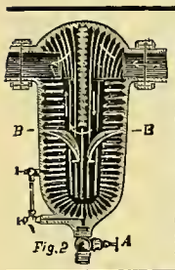


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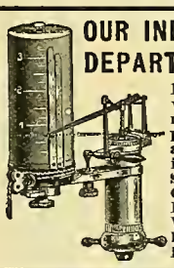

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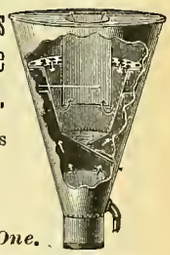

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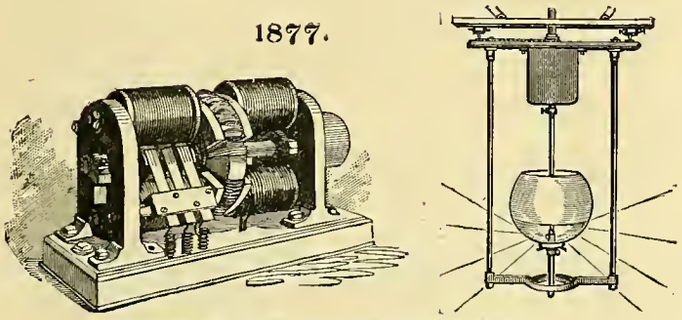
## Electric Co., Cleveland, Ohio.

1877.



THIS IS WHAT THEY BOUGHT.

BALTIMORE, MD., April 10, 1893.

BRUSH ELECTRIC CO., Cleveland, Ohio.

GENTLEMEN:—We have this day shipped to you by express the little Dynamo which was purchased from you by our predecessors, Messrs. Davis & Watts in 1877.

This machine has been in constant use since it was purchased until about four years ago and then it was laid aside, from no fault or failure, but because we had a larger one in circuit for lighting our premises, we do not need this little one. The repairs have simply amounted to such supplies as segments and brushes.

We part with the little old friend regretfully, but consider that it is going home to rest, and will be better preserved than with us.

Yours very truly,
THE VIADUCT MANUFACTURING CO.,
By A. G. Davis, Prest.

1895.

**The following is from one of the oldest and largest Electric Light Companies in the Country.**

February 5, 1895.

GENTLEMEN:—We have been in the local electric lighting business for more than thirteen years—being one of the oldest companies in the country—and have used, in our experience, nearly every style of arc dynamo and lamp placed on the market.

For the past two years we have been using Brush-Adams arc lamps, and our recent order to you for dynamos of 1500-2000 C. P. arc lamp capacity will indicate what we think of Brush apparatus.

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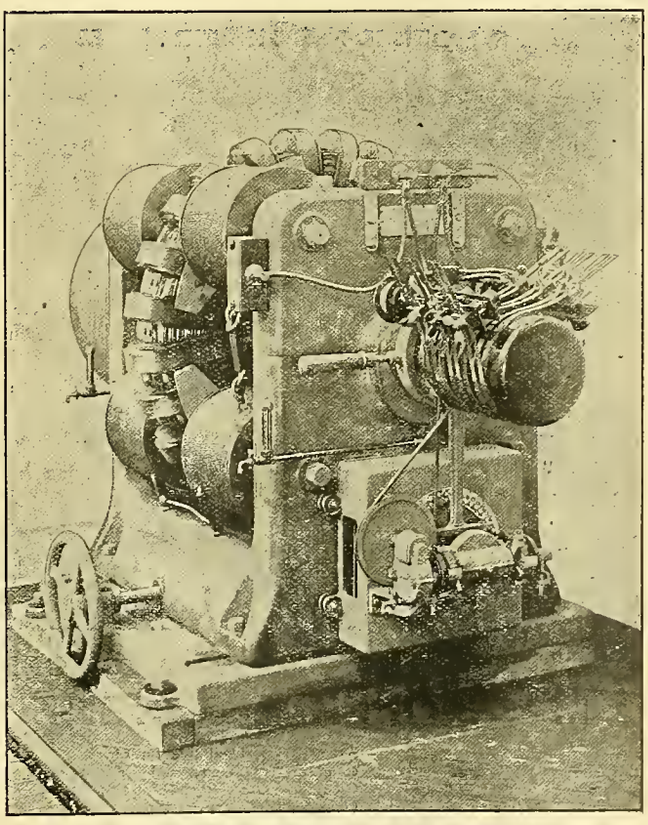

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Capacity 125 2000-C. P. Lamps.

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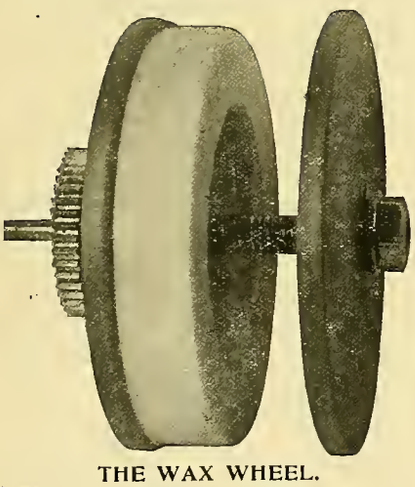

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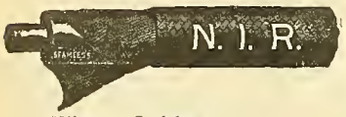

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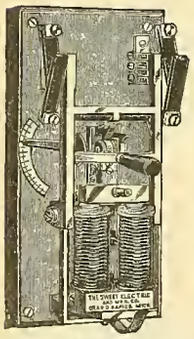

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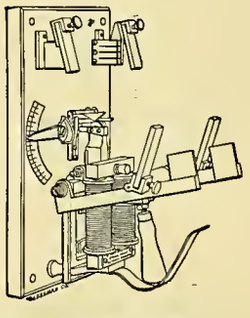

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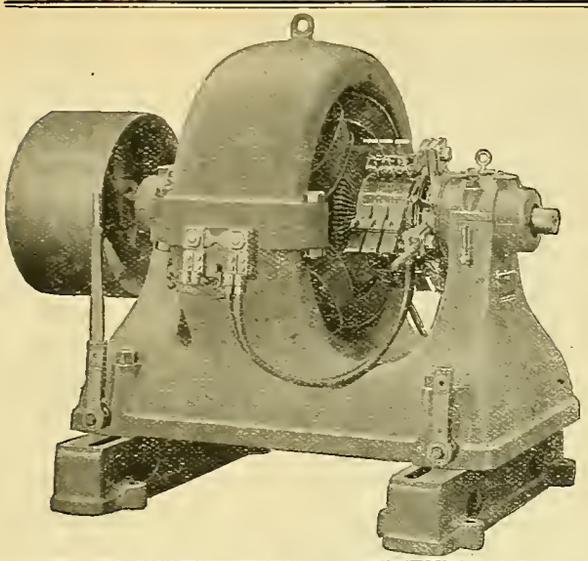

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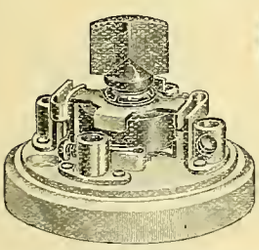

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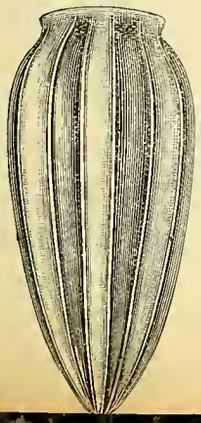

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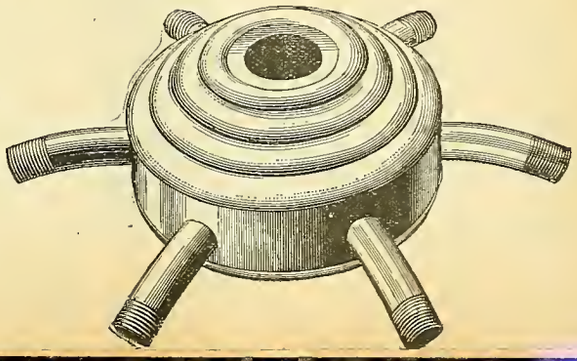

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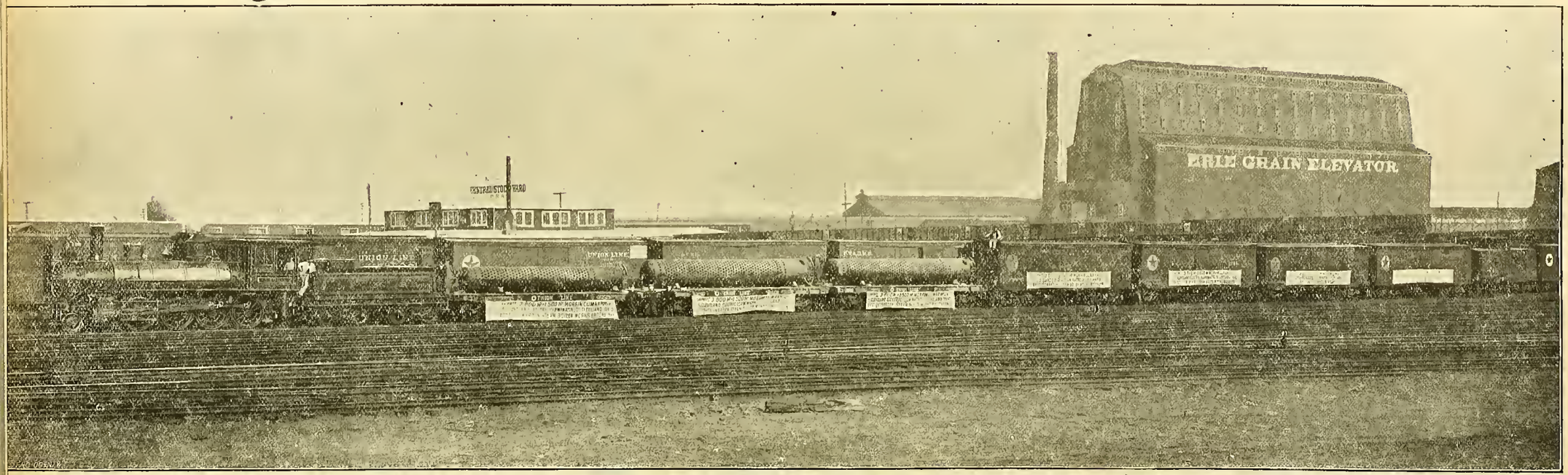


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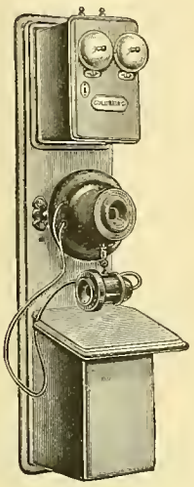

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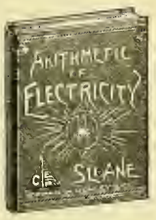

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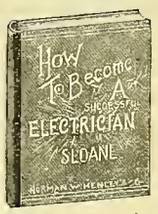

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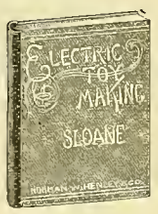

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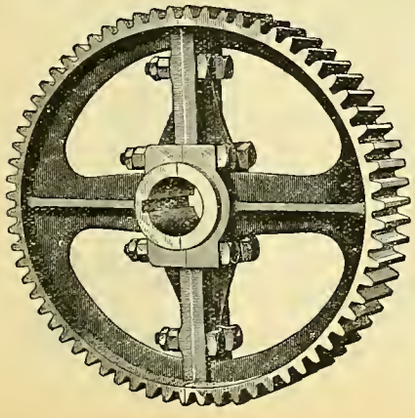

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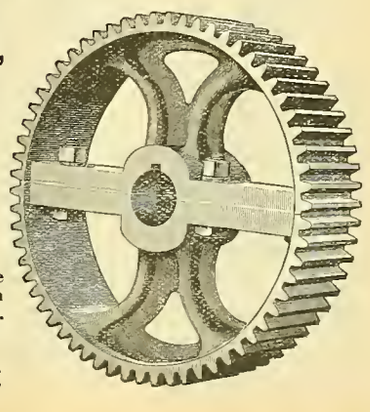

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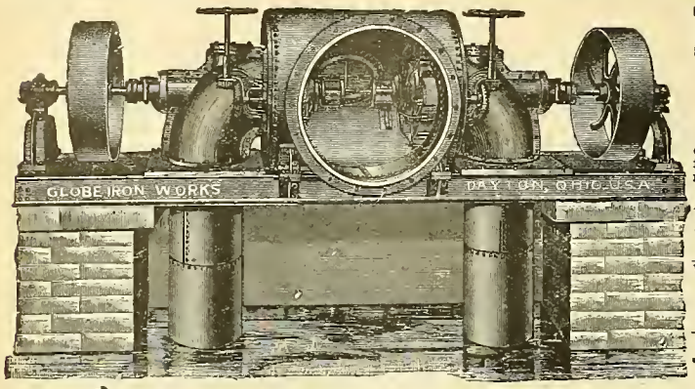


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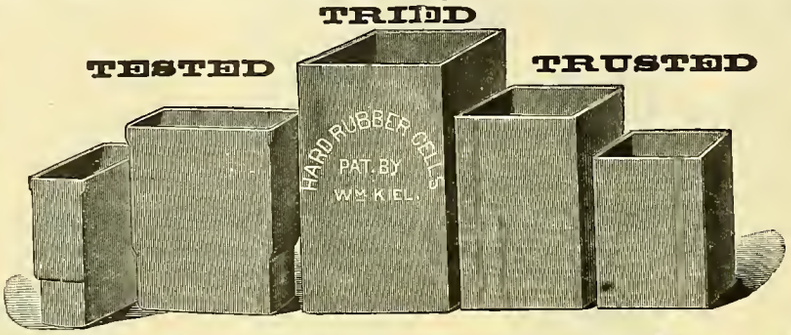


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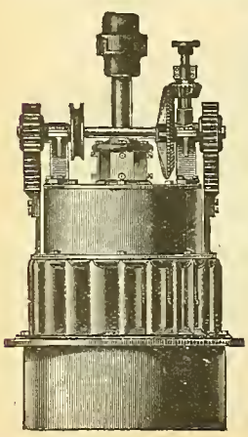

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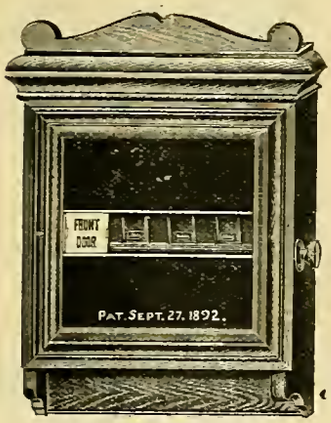


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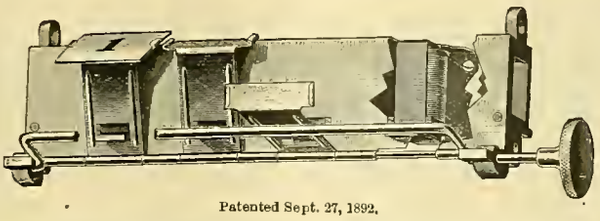

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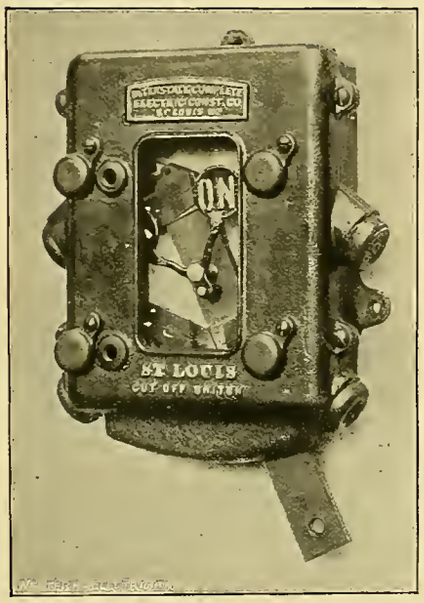


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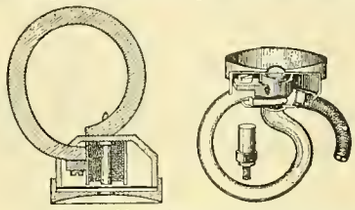
ductor. In the D'Arsonval receiver a curved permanent magnet is used, one pole of which terminates



FIGS. 27 AND 28. D'ARSONVAL RECEIVER.

in a soft iron polepiece that serves as the core of the coil, and the other in an iron box, or cylinder, that

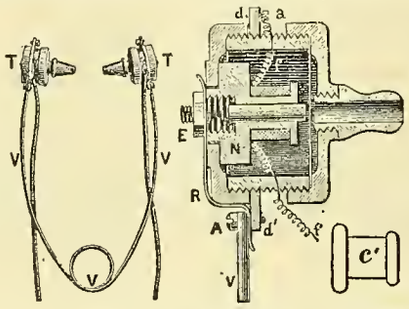



FIG. 29. MERCADIER'S BI-TELEPHONE. *T T* RECEIVERS, *V* SPRING, *N* MAGNET, *E* NUT, *R* STEEL STRIP, *A* SCREW CLAMPING *R* TO *V*, *d d'* METAL COLLAR CLAMPING *V* TO RECEIVER CASE, *f f* TERMINALS OF COIL *a* CONNECTING SCREW, *c'* SOFT RUBBER NIPPLE FOR EARPIECE.

completely encloses the coil. The two poles are magnetically insulated from each other by the wooden case, to the upper part of which the diaphragm is

48 TELEPHONE HAND BOOK.

appeared on the scene with an application for a patent on a microphonic transmitter, and according to the rules of the Patent Office no patent could be issued to any of the three until it was determined whether the Drawbaugh claim was valid or not. This was finally decided against Drawbaugh, as it was proved that the Edison carbon transmitter had been in public use for more than two years before Drawbaugh made his application for a patent, and his application was thrown out. A patent was then issued to Berliner on the broad

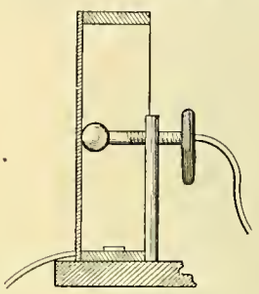


FIG. 44. BERLINER'S FIRST TRANSMITTER.

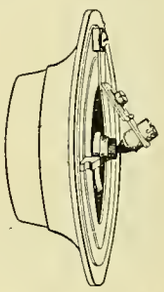


FIG. 45. BERLINER CARBON TRANSMITTER.

principle of the microphone transmitter in November, 1891. In May of the following year a patent was issued to Edison, so that both sides of the interference eventually got their patents—more than fourteen years after the filing of the original applications.

78. Both Berliner and Edison obtained in 1878 patents on special forms of transmitters designed in accordance with the principles laid down in their applications for the broad principle of battery telephones, and the Berliner transmitter especially has been modified out of all semblance to its original form. The broad claim in the Berliner patent is as follows: "The method of producing in a circuit electrical undulations similar in form to sound waves by caus-

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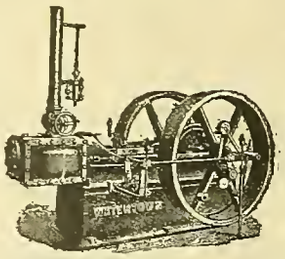

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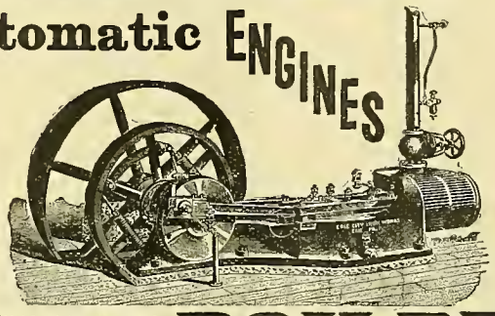

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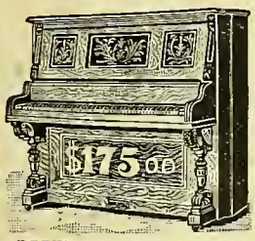


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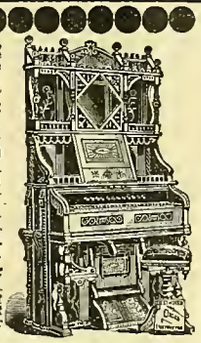

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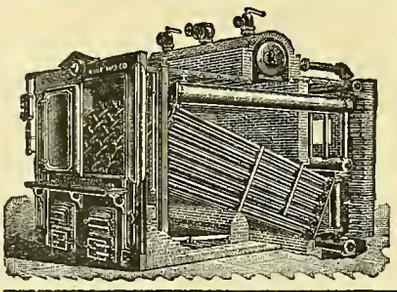

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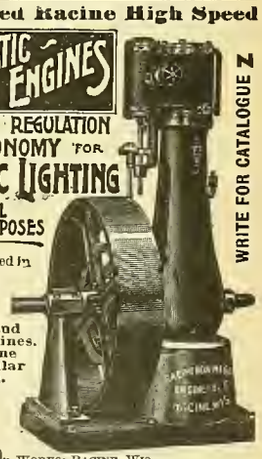

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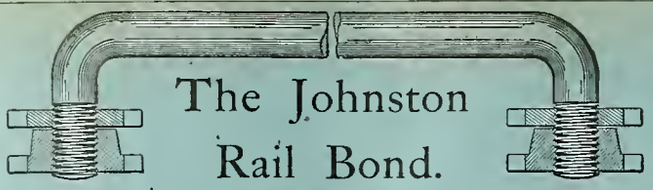

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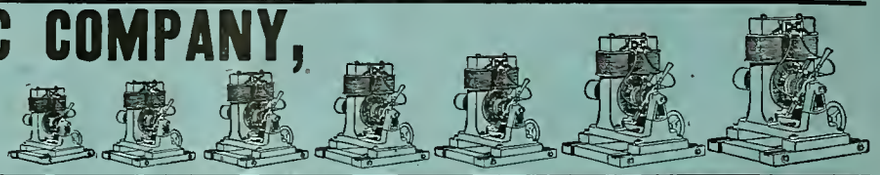

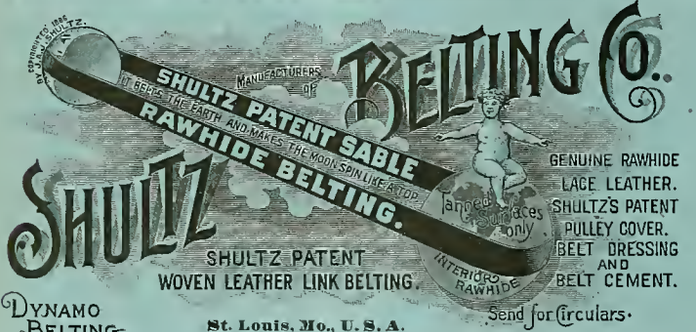


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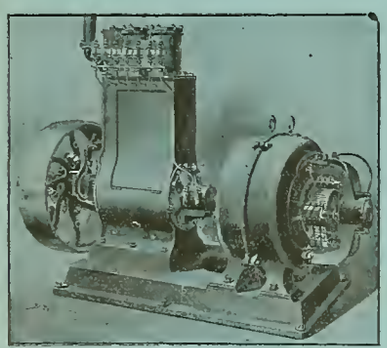

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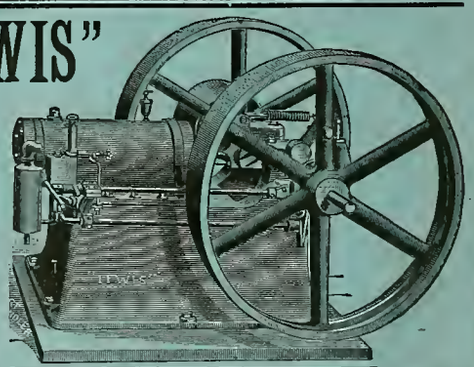

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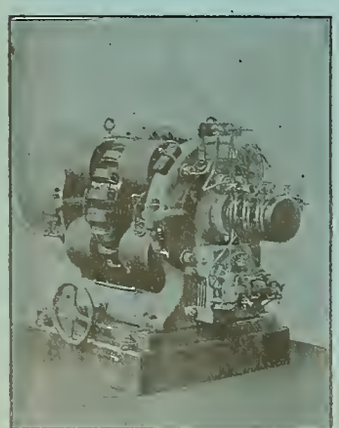

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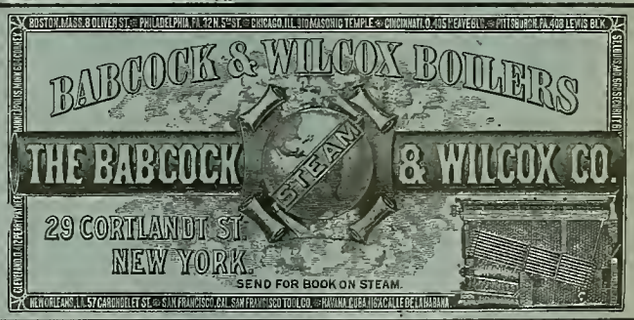


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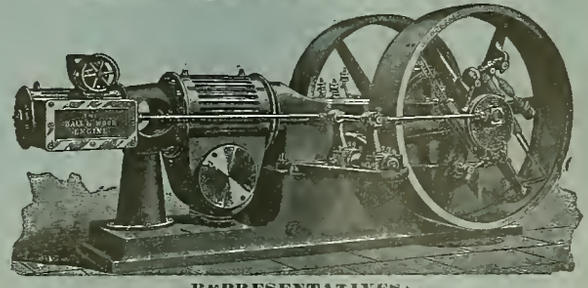

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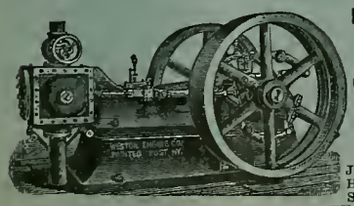

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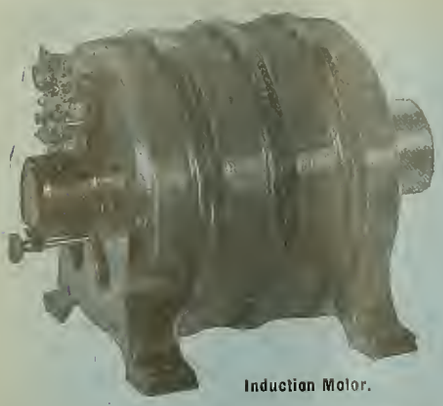

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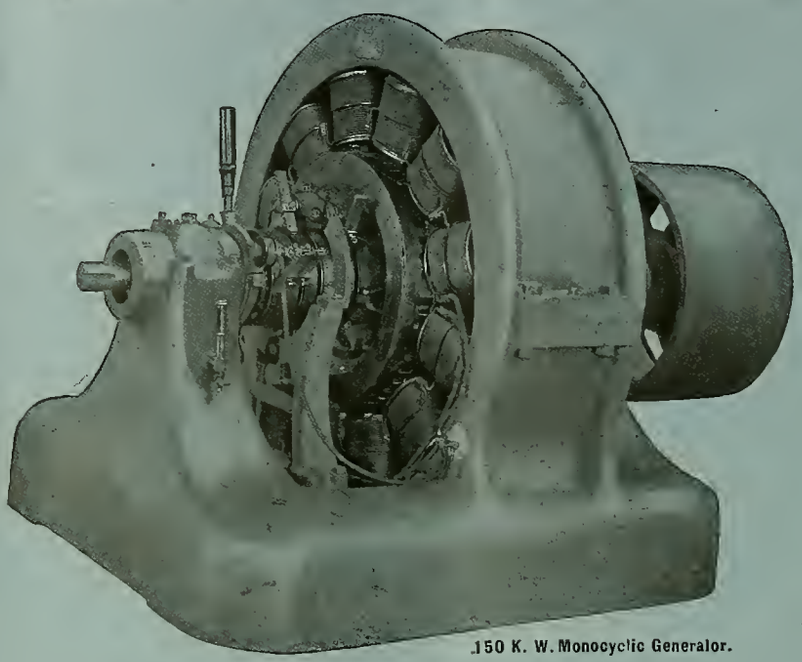

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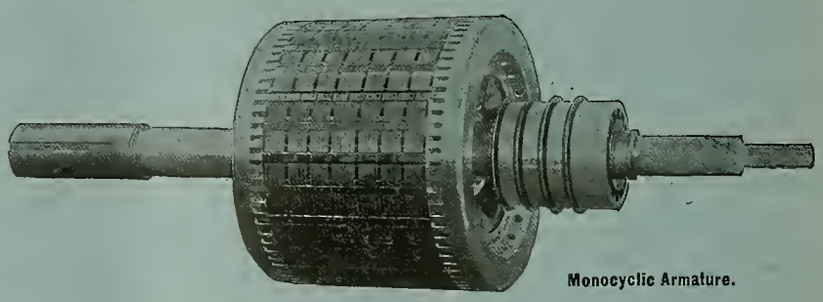

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Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Elliott-Lincoln Elec. Co.
Forest City Elec. Wks.
General Electric Co
Hays & Co., J. L.
High & Co., J. Grant.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Metropolitan Electric Co.
Morris & MacCurdy;
Nashold Cleat Co.
Now tny Electric Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Po'and, Lawrence.
Proctor-Raymond Elec. Co.
Sioux City Brass Works
Sweet Elec. & Mfg. Co.
Thayer Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Gleason, E. P Mfg. Co
Jaeger Mfg. Co., The.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods**
Butler Hard Rubber Co.

**Induction Coils**
Splitdorf, C. F.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Nowotny Electric Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling s Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co., J. H
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Am. Electrical Mfg. Co.
Beacon Vac Pump & Elec.Co.
Bernstein Electric Co.
Buckeye Electric Co.
Columbia Inc. Lamp Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Jaeger Mfg. Co., The.
New York & Onio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec & Mfg.Co.

**Lightning Arresters.**
Colgate Co , Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery**
Besly & Co , Chas. H.
Harrington, Son & Co., E.
Bine & Robertson Co.
Lukens Iron & Steel Co.
Nicholas & Barr.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

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Independent Electric Co.
Westinghouse El. & Mfg. Co.

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C & C Electric Co
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec, Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co,
Mather Electric Co.
Poland, Lawrence.
Royal Electric Co.
Roth & Eck.
Shawhan-Thresher El. Co.
Sioux City Brass Works
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg Co.
Wallace Electric Co.
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**Oil Filters.**
Phoenix Auto. Filter Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

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Morris & MacCurdy.

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Gooch, Chas. J.

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Phosphor Bronze Sm.Co. Ltd

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**Rheostats.**
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**Speaking Tubes.**
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Ostrander & Co., W. R.
Partrick & Carter Co

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Colgate Co., Geo. L.
Diamond Electric Co.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Steam Pumps.**
Worthington, Henry R.

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Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Haschke & Creelman.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

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Brixey, W. R.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

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Nowotny Electric Co.
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Williams & Abbott Elec. Co.

**Transformers.**
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Hornberger Elec. Mfg. Co.
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Royal Electric Co.
Stanley Electric Mfg. Co.
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**Universities.**
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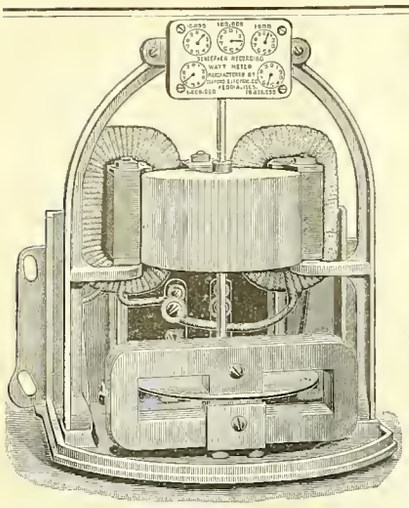
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Standard Underground C.Co.

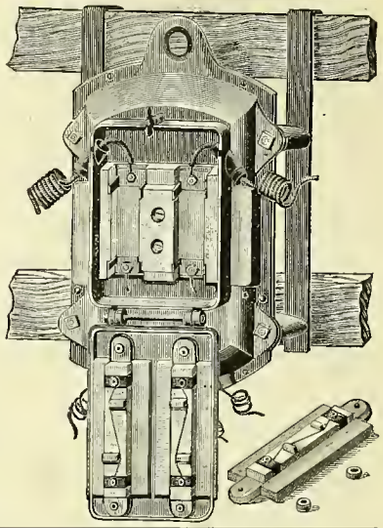


# SCHEEFFER'S RECORDING WATT-METER.

For Alternating Circuits. No Commutator. No Brushes.

Registers Direct Actual Power Consumed.

EASILY ADJUSTED. ABSOLUTELY RELIABLE.



# DIAMOND TRANSFORMER.

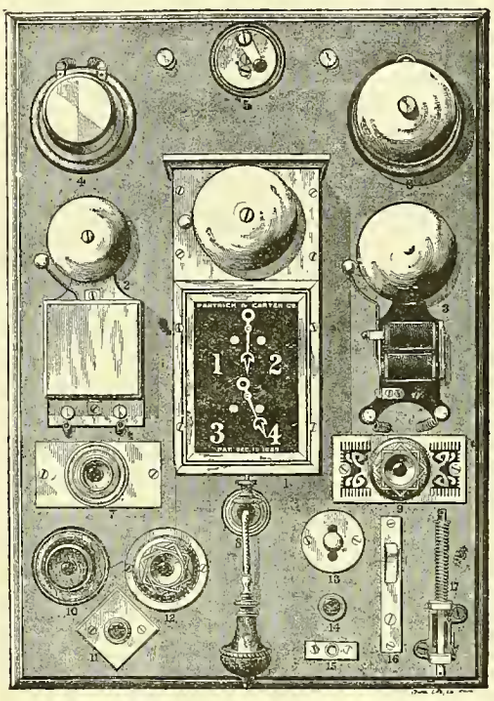
Simplest, Safest and Best.

FOR ANY VOLTAGE. FOR ALL SYSTEMS.

## DIAMOND ELECTRIC CO., Peoria, Ill.

Chicago Office, 1307 Manhattan Building, Central Electric Co., Selling Agents.

# Just a Few Samples



Of our leading specialties in practical operation will increase your sales of

**ELECTRICAL SUPPLIES**

FOR

**HOUSE WORK.**

**This Sample Board** has everything connected and in complete working order for exhibition. The board is hard wood. Size, 15x22 inches. Your name in gilt letters. Prices on application and mention of WESTERN ELECTRICIAN.

ESTABLISHED 1867 125 SOUTH 2D STREET

## PARTRICK & CARTER Co

*Electrical Supplies of all Kinds* *House Goods a Specialty*

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# WATERHOUSE-GAMBLE ARC LAMPS.

*Plain or Ornamental.*

For Direct Incandescent Circuits.

Write for CATALOGUE and PRICES

## The Most Economical Lamp Made.

WE MANUFACTURE

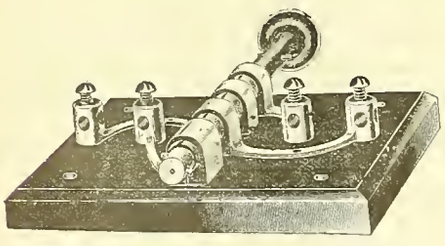
*Switches, Sockets, Rosettes, and Receptacles.*

## The Perkins Electric Switch Mfg. Co.,

HARTFORD, CONN.

| *CHICAGO,* | *PHILADELPHIA,* | *BOSTON,* |
|---|---|---|
| *1536 Monadnock.* | *806 Walnut St.* | *182 Summer St.* |
| C. W. Conover. Mgr. | O. D. Pierce, Mgr. | F. B. Smith, Mgr. |

# FOR SALE CHEAP.



KELSCH HANGER BOARD.

(See description in this paper January 19, 1895.)

PRICES ON APPLICATION.

A LOT OF 50 AND 100 VOLT

## SLATTERY ALTERNATING METERS,

10, 25, 50 and 100 LIGHT CAPACITY.

ALSO A LARGE QUANTITY OF **SERIES ARC LAMPS,** 1200 and 2000 C. P.

*AND SOME*

## HEINE BOILERS AND HIGH SPEED ENGINES,

*which were replaced by larger ones.*

## Chicago Edison Co., SUPPLY DEPARTMENT 139 Adams St., CHICAGO.

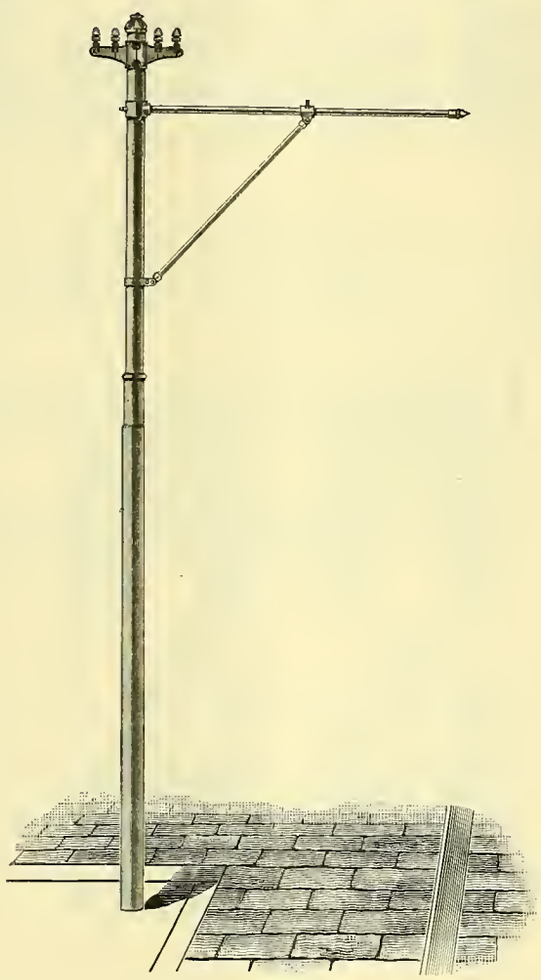
# ATTENTION, DELEGATES!!

1821. **Morris, Tasker & Co.,** 1888.

INCORPORATED.

**OFFICES: 222 and 224 South Third Street, PHILADELPHIA, PA.**

# OUR SPECIALTIES:



**Pascal Iron Works,**
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**Delaware Iron Works,**
NEW CASTLE, DEL.

# ELECTRIC LIGHT AND RAILWAY PIPE POLES.

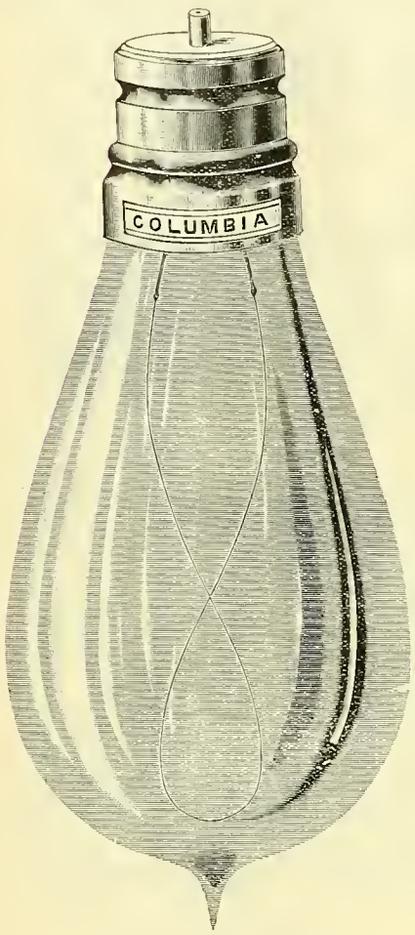
MANUFACTURERS OF

Boiler Tubes, Wrought Iron Pipe and Fittings.

**SPECIAL GUN METAL CASTINGS FOR POWER PLANTS.**

BRACKETS. CROSS ARMS. STRAPS.

# COLUMBIA!




## The Famous Bate Refrigerator Case has been decided.

## The Edison Lamp Patent is Dead.

IN PLACING YOUR ORDERS DO NOT FORGET THE

## Columbia Incandescent Lamp Company,

Who has guarded your interests during the past two years of patent litigation, and who is now prepared to furnish you incandescent lamps, the quality of which stands without an equal, at current prices.

---

# The Columbia Incandescent Lamp Co.,

**Main Office and Factory: 1910, 1912, 1914 Olive St., ST. LOUIS, MO.**

**New York Office, 1101 Havemeyer Building.**
**Chicago Office, 1564 Monadnock Building.**

**Boston Office, 15 Federal Street.**
**Paul Seiler Electrical Works, San Francisco, Cal.**

# OLD BEACON

## INCANDESCENT LAMP.

**16** Candle Power,
In Barrel Lots,

**22** **Cents.**

Special prices
will be made to
large consumers.

# Beacon Vacuum Pump & Elect'l Co.,

**HEADQUARTERS, IRVINGTON ST., BOSTON, MASS.**

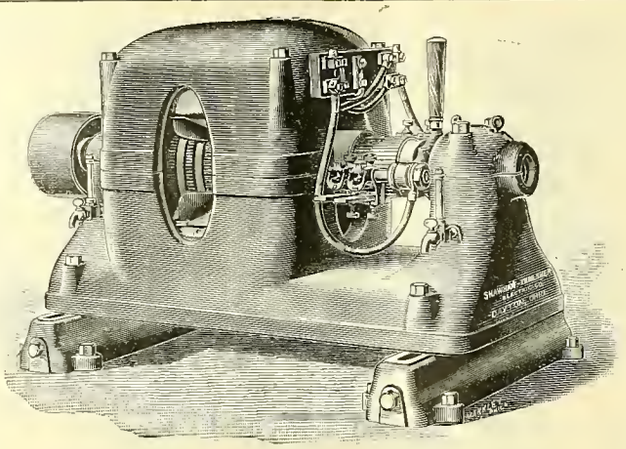
NEW YORK, 39 Cortlandt St.—**OFFICES**—213 S. 5th St., PHILADELPHIA.

OUR

# IRON CLAD TYPE

—OF—

# Dynamo and Motors.



*This type of machine embodies all the points of excellence demanded by modern practice.*

*Highest Efficiency.*
*Slow Speed.*
*Simplicity of Parts.*
*Noiseless Running.*
*No External Magnetism.*
*Perfect Ventilation.*

*Working parts entirely protected from moisture, dirt or abrasion.*

# SHAWHAN-THRESHER ELECTRIC CO.,

## DAYTON, OHIO.

MANUFACTURERS OF COMPLETE INSTALLATION OF

# ELECTRICAL MACHINERY

—FOR—

# ELECTRIC LIGHTING AND TRANSMISSION OF POWER.



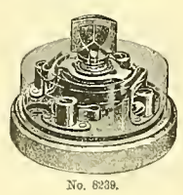
WESTERN ELECTRIC COMPANY. 17

No. 8237.

**Hart 10 Ampere Single Pole Switch.**

Diameter of Base, 2½ inches. Diameter of Cover, 2 inches. Height, to Base of Handle, 1½ inches. Total Height, 1¾ inches. Total Break, ⅜ inch. Binding Posts for Wire to No. 6 B. & S.

| Code Word. | List No. | | List Price. |
|---|---|---|---|
| *Excrement* | 8237 | With Nickel Plated Cover, each. | $0.80 |
| *Excremental* | 8238 | " Polished Brass " " | .80 |

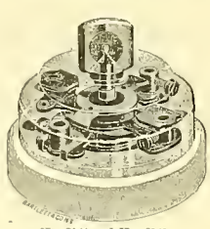


No. 8239.

**Hart 10 Ampere Double Pole Switch.**

Diameter of Base, 2½ inches. Diameter of Cover, 2 inches. Height, to Base of Handle, 1½ inches. Total Height, 1¾ inches. Total Break, 1½ inches. Binding Posts for Wire to No. 6 B. & S.

| | | | |
|---|---|---|---|
| *Excrescence* | 8239 | With Nickel Plated Cover, each. | 1.50 |
| *Excrescent* | 8240 | " Polished Brass " " | 1.50 |



No. 8241 and No. 8243.

**Hart 15 Ampere Double Pole Switch.**

Diameter of Base, 2¾ inches. Diameter of Cover, 2¾ inches. Height, to Base of Handle, 1¾ inches. Total Height, 2¼ inches. Total Break, 3 inches. Binding Posts for Wire to No. 5 B. & S.

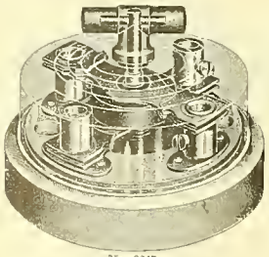
| | | | |
|---|---|---|---|
| *Excrete* | 8241 | With Nickel Plated Cover, each. | 2.00 |
| *Excreted* | 8242 | " Polished Brass " " | 2.00 |

**Hart 30 Ampere Double Pole Switch.**

Diameter of Base, 2¾ inches. Diameter of Cover, 2¾ inches. Height, to Base of Handle, 1¾ inches. Total Height, 2½ inches. Total Break, 3 inches. Binding Posts for Wire to No. 5 B. & S.

This Switch is the same as the 15 ampere double pole, except that the contacts and switch plates are made of phosphor bronze and hard rolled copper.

| | | | |
|---|---|---|---|
| *Excreting* | 8243 | With Nickel Plated Cover, each. | 2.50 |
| *Excretion* | 8244 | " Polished Brass " " | 2.50 |



No. 8245.

**Hart 50 Ampere Double Pole Switch.**

Diameter of Base, 4¼ inches. Diameter of Cover, 4 inches. Height, to Base of Handle, 2¾ inches. Total Height, 3½ inches. Total Break, 3½ inches. Binding Posts for Wire to No. 1 B. & S.

| | | | |
|---|---|---|---|
| *Excretive* | 8245 | With Nickel Plated Cover, each. | 7.00 |
| *Excretory* | 8246 | " Polished Brass " " | 7.00 |

A Sample Page from our Electric Light Supply Catalog.

The other 307 pages sent on request.

# HART SWITCHES AND FLUSH PLATES.

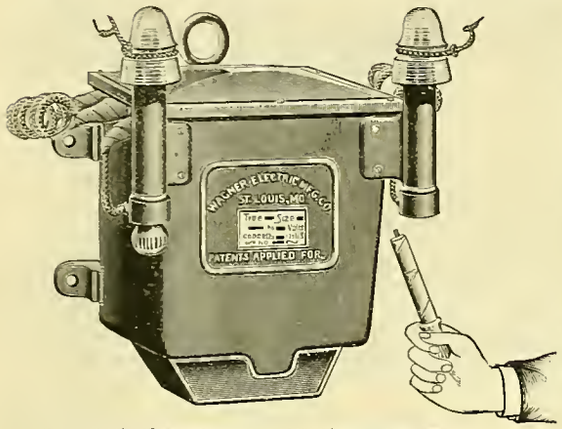
**A Full Stock at Chicago and New York.**

**WRITE FOR PRICES.**

# Western Electric Co.,

**CHICAGO. NEW YORK.**

# TRANSFORMERS.




Type "D" Transformer with Fuse Plug Removed.

***A New Type*** — *Transformer, Primary Cut-outs and Insulator Brackets all combined.*

No more brackets pulling off of walls.

With our wall or cross-arm hooks, transformer may be *Hung* and *Connected* in *Five minutes.*

Our new fuse plugs will not hold an arc with 5,000 volts.

*Our Transformers* are acknowledged by all experts to be the *Highest* in *Efficiency* ever made.

Adopted by the largest stations in the country.

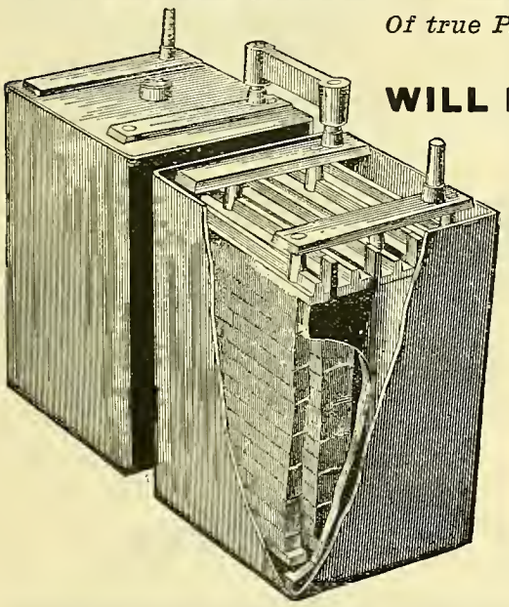
*We Challenge Competition* in any form of test, in laboratory or practical use.

Made in all sizes, 5 lights to 3,000 lights.

JOHN MUSTARD, Betz Building, Philadelphia, Pa.
1564 Monadnock Block, Chicago, Ill.

## Wagner Electric Mfg. Co., ST. LOUIS, MO.

# STANDARD PLANTE STORAGE BATTERIES



*Of true PLANTE Type and CRYSTALLINE FORMATION.*

Will give or receive without injury, currents that would destroy other batteries.

**WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.**

Contain no asbestos or other separating material to increase their internal resistance.

**ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.**

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

**Highest efficiency, largest delivery, lowest internal resistance.**

For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

**Cannot be damaged by excessive charge or discharge currents.**

A 400 ampere current has been taken from a 120 ampere hour cell.

☞ **CHALLENGE:** { We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

## ELECTRIC POWER STORAGE COMPANY,

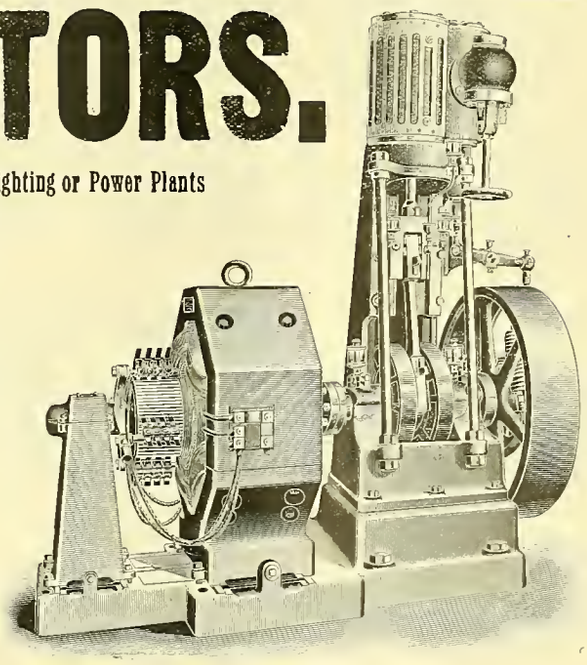
Room 1210 Havemeyer Building, 26 Cortlandt Street, New York.

# EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants

**EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.**

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*



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*WINDSOR, CONN.*

NEW YORK OFFICE, HAVEMEYER BLDG.

*REPRESENTED BY:*

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Western Electrical Supply Company, St. Louis, Mo.
F. P. Little Electrical Construction & Supply Co.
W. T. Osborn, Kansas City, Mo.

**All Our Apparatus Guaranteed as Represented.**

# THE C & C ELECTRIC COMPANY

MANUFACTURERS OF

## MULTIPOLAR DYNAMOS, BIPOLAR DYNAMOS,

Direct Driven or Belted, in sizes up to 250 H. P. Up to 100 H. P.

Electric Motors, Automatic or Hand Controlled.
Complete Plants for Power Transmission.
Isolated lighting plants, Central Station Apparatus.

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143 Liberty Street, NEW YORK.

Works: GARWOOD, N. J.
on CENTRAL R. R. of N. J.

BRANCH OFFICES: CHICAGO, 1020 and 1021 Monadnock Building. BOSTON, 63 Oliver St.
CLEVELAND, Cuyahoga Building. PHILADELPHIA, 633 Arch St.

## Low Potential Arc Lamps.

*Alternating-Helios, Old Type.*
*Spencer, New Type.*

*Direct Current-Helios, Old Type.*
*Spencer, New Type.*

FOR STREET, PAVEMENT AND INSIDE LIGHTING.

Our Alternating Lamps have reflector plates. Our new Direct Current Lamps do not see-saw when running in series.

Our Focusing Lamps, both direct and alternating, are adapted for stereopticon and photo-engraving work.

We also make direct current lamps to be used on street railway circuits.

## HELIOS ELECTRIC COMPANY,

1310 Filbert St., PHILADELPHIA, PA.

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MOUNTAIN ELECTRIC CO., Denver, Col., Agents for Colorado, Utah, Wyoming and New Mexico.
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CANADIAN GENERAL ELECTRIC CO., Toronto, Canada, Agents for Canada.
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Alternating Current

## ARC LAMPS.

## The Kester '95

IS THE LAMP YOU HAVE HOPED FOR.

It is the only perfected Arc Lamp for the alternator, either high or low frequency.

It comprises all that is desired in an Arc Lamp.

Write for pamphlet and prices to

## THE F. P. LITTLE

Electrical Construction & Supply Company,

135 SENECA STREET,
BUFFALO, N. Y.

# THAYER ELECTRIC CO.,

1027 GARFIELD BUILDING, CLEVELAND, OHIO.

# ELECTRICAL SUPPLIES OF ALL KINDS.

Perfect Satisfaction Guaranteed in all kinds of Engineering and Construction Work.

## WRITE FOR PRICES.

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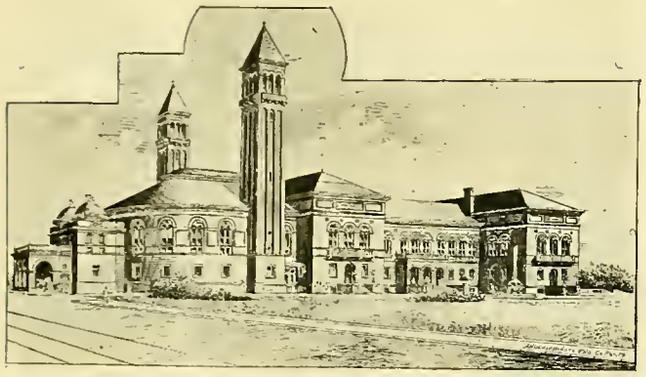

Presented by Andrew Carnegie to the city of Pittsburgh, cost one million dollars, and nothing but the best material obtainable was permitted in its co struction.

**THE ELECTRICAL WORK**

Is of the finest throughout, and includes two large marble switchboards on which are mounted nearly fifty double-pole knife switches, ranging from 100 to 500 amperes. Also more than forty distribution boards, on which over fifty switches were mounted. This work was all constructed by J. L. Hays & Co., Pittsburgh, Pa., all the knife switches used being of their make, and everything is giving perfect satisfaction.

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This class of work is our specialty, and we think we can save you money. An illustrated price list of switches, distribution boards, cut-outs, etc., is in course of preparation, and will be mailed upon application.

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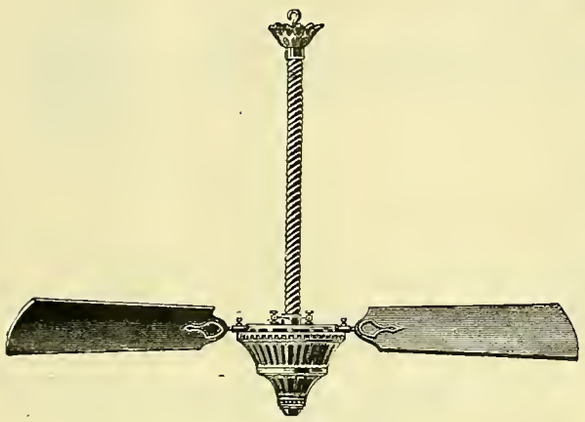

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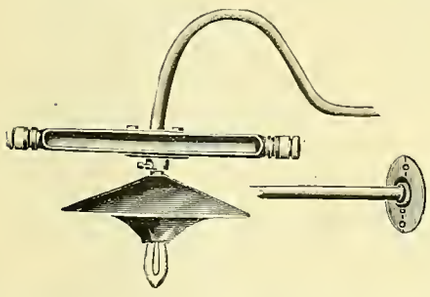

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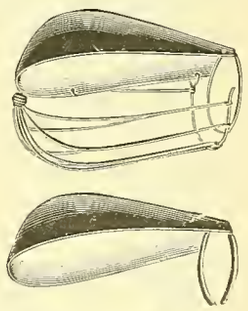

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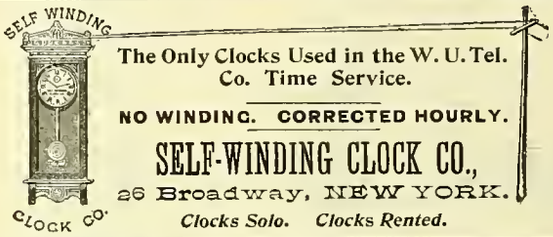


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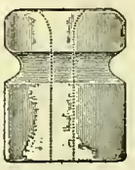

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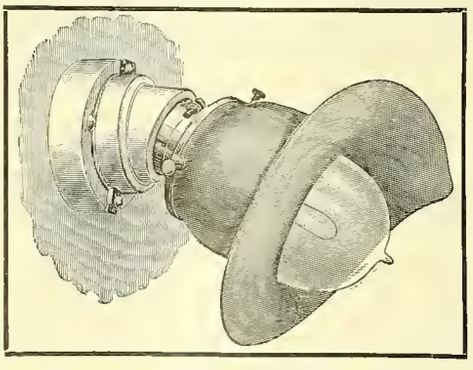

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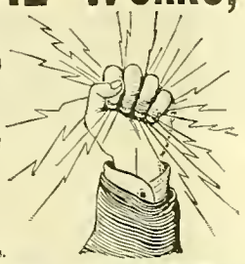

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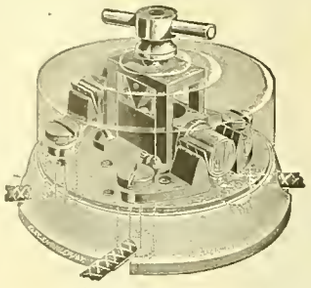

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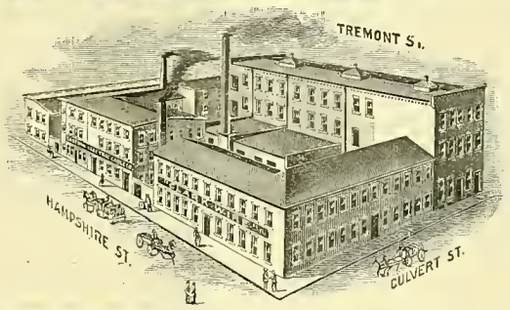


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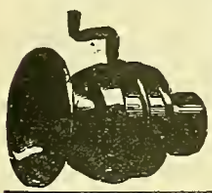

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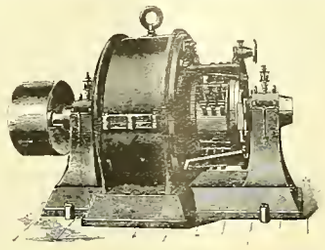

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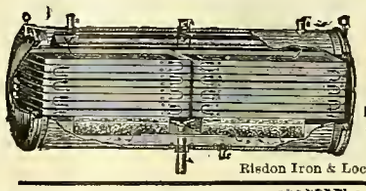

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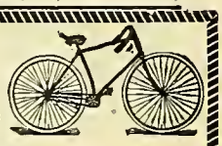

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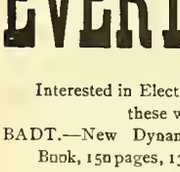

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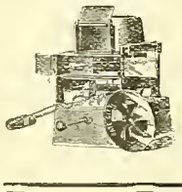

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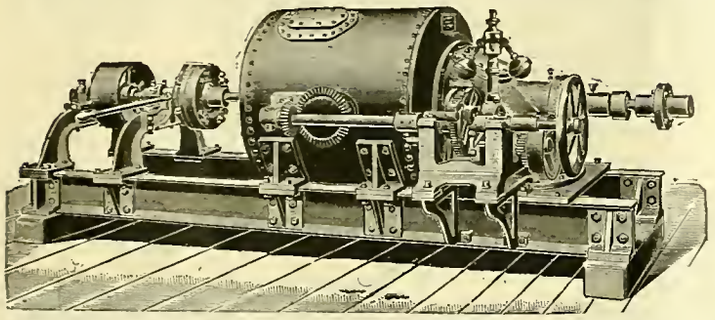

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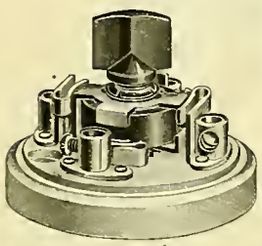

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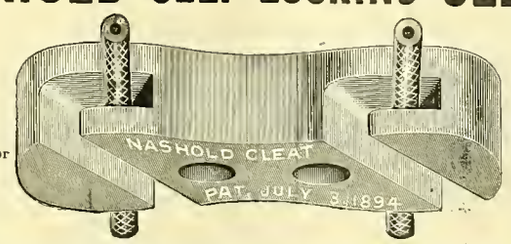


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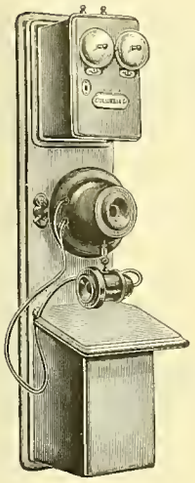

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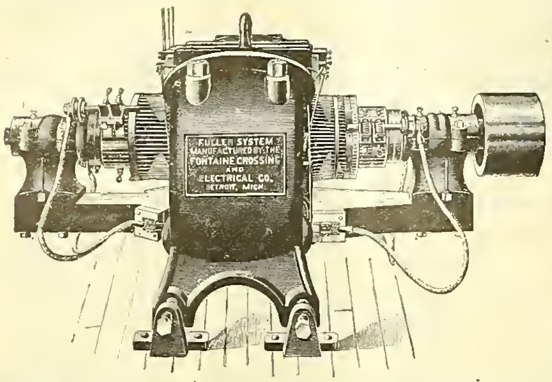


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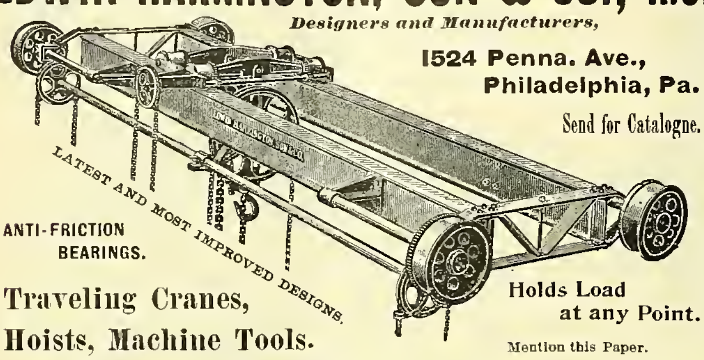

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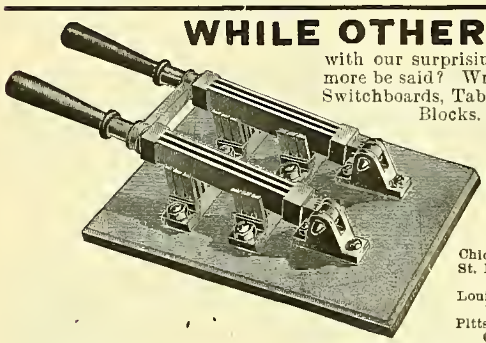

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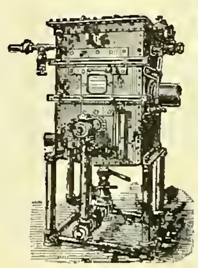

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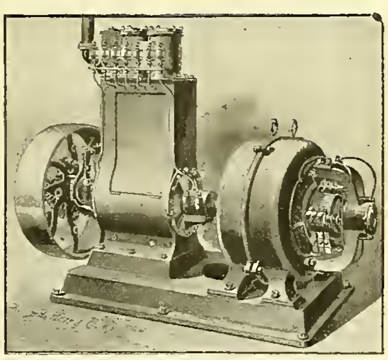

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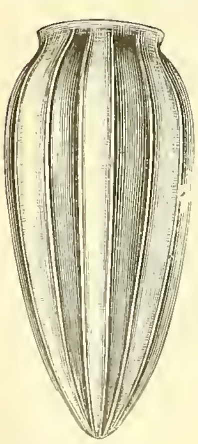

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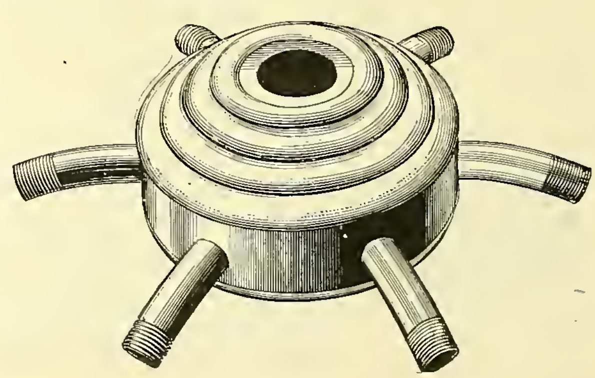

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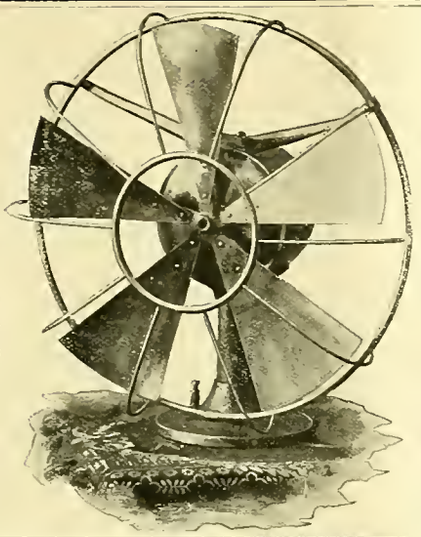

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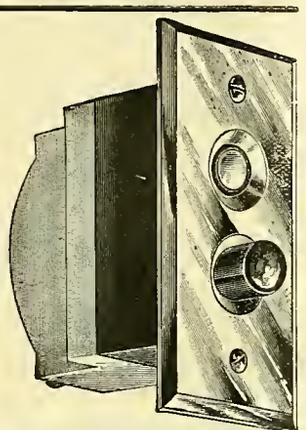

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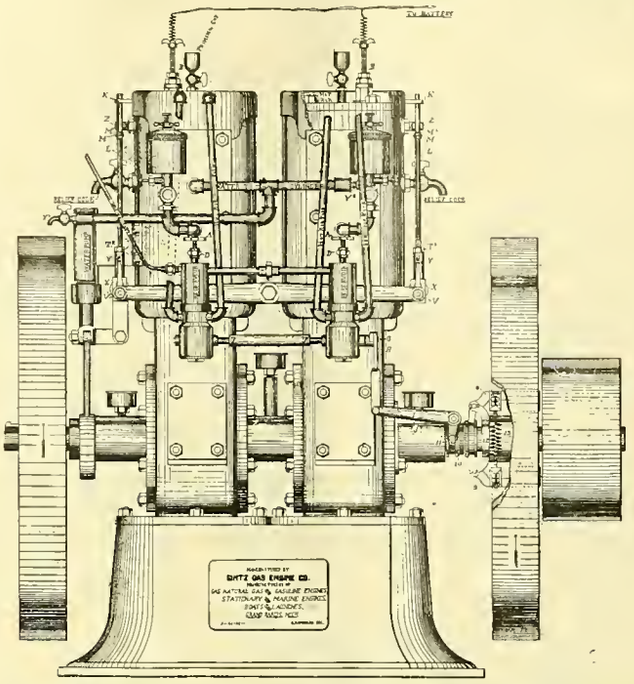

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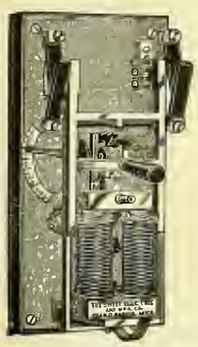

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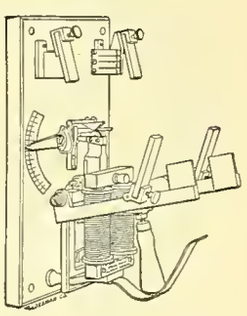

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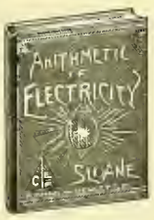

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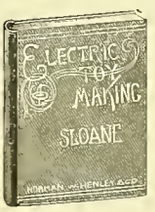

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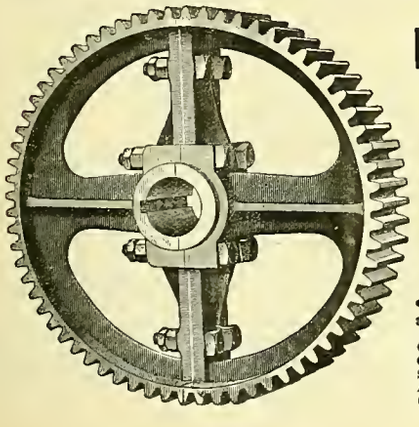

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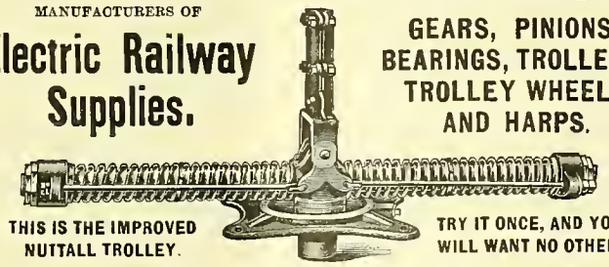

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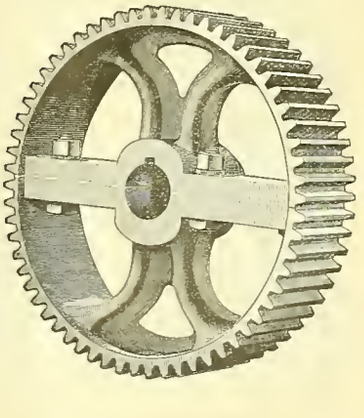

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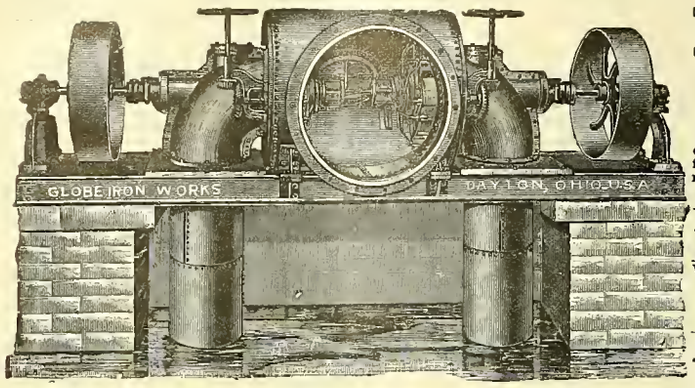


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| Whole Gate | 16.06 | 119.17 | 141.68 | 205.27 | 79 76 |
| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.58 |
| ¾ " | 16.78 | 117.33 | 112.60 | 176.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118.40 | 76.52 |

Test of a 42-inch Wheel July 14, 1894.

| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.33 | 128.00 | 134.18 | 199.56 | 80.50 |
| ⅞ " | 16.56 | 134.80 | 120.85 | 188.14 | 83.09 |
| ¾ " | 16.69 | 129.33 | 104.85 | 162.89 | 82.77 |
| ⅝ " | 17.13 | 126.25 | 92 76 | 142 40 | 79 21 |
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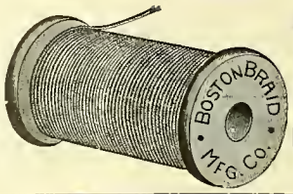


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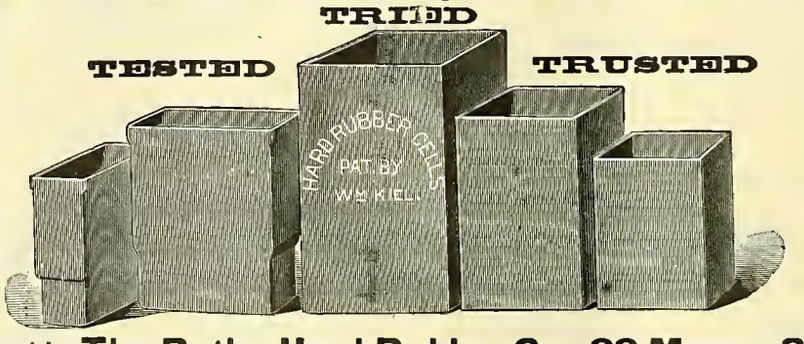


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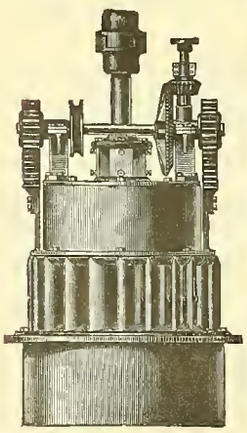

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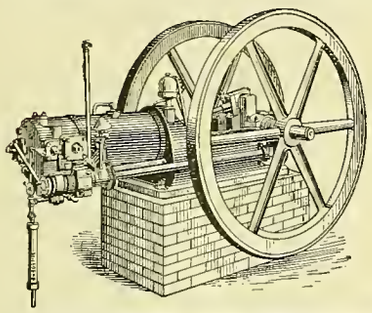

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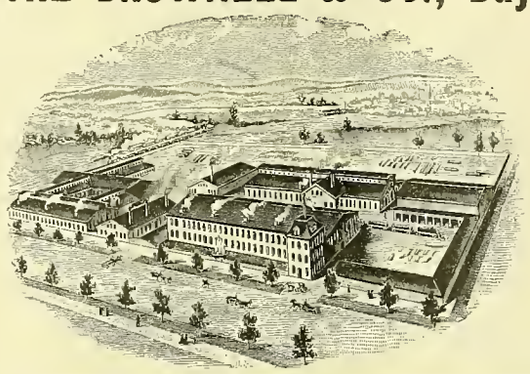

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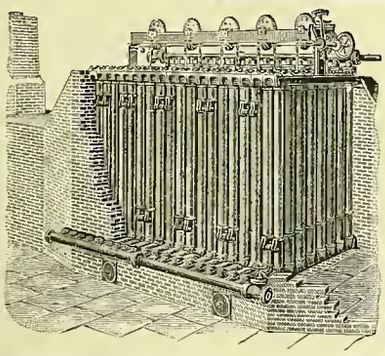

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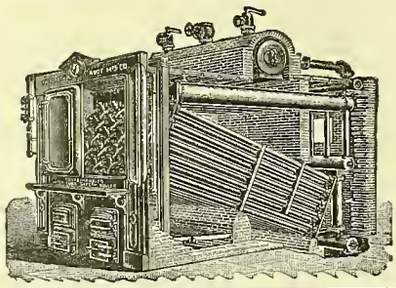

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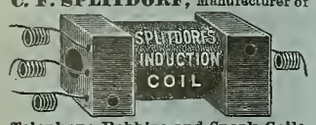


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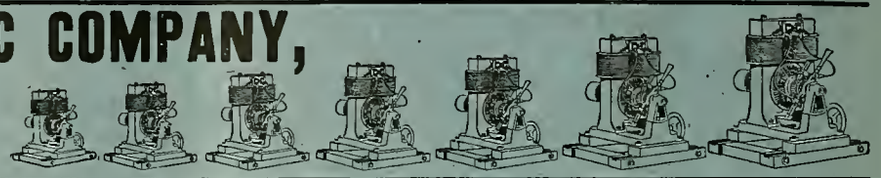

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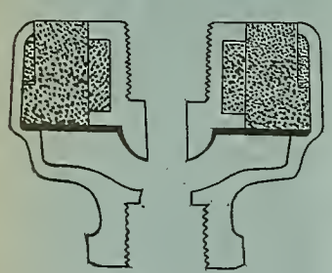

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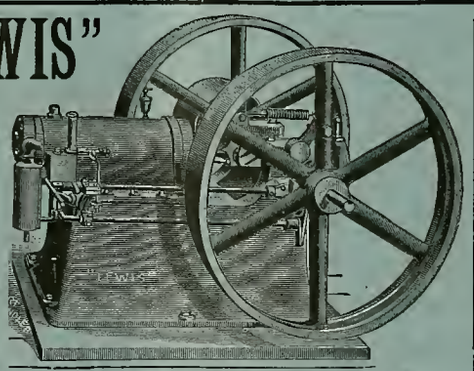

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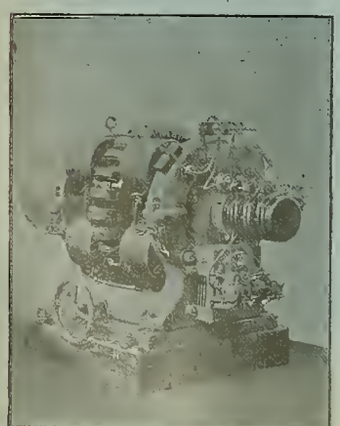

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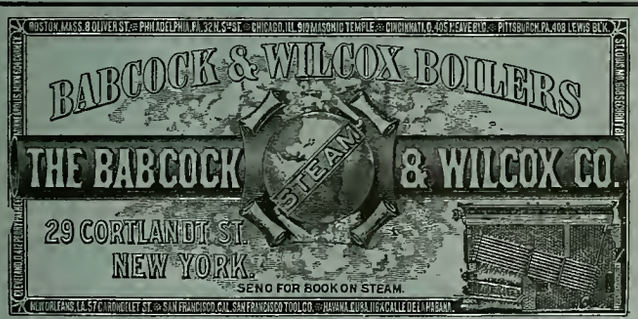


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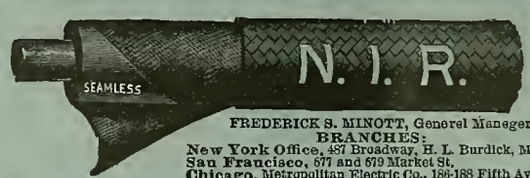


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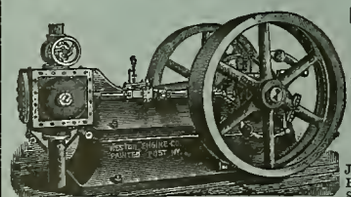

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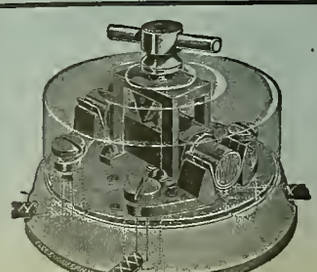

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Foreign Dept. { Schenectady, N. Y. / New York Office, 44 Broad St.

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## CLASSIFIED LIST.


**Accumulators.**
Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
Dearborn Electric Co.
Electric Appliance Co.
Nowotny Electric Co.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.

**Arc Lamps.**
C & C Electric Co.
Clark Electric Co.
Crocker-Wheeler Elec. Co,
Ft. Wayne Elec. Corporation.
General Electric Co.
General Inc'd'cent Arc Lt. Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Mather Electric Co.
Perkins El. Switch Mfg. Co.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Nowotny Electric Co.
Partrick & Carter Co.
Phœnix Carbon Mfg. Co.
Wallace Electric Co.
Western Electric Co.

**Bells.**
Dearborn Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Brownell & Co., The.
Clonbrock Steam Boiler Wks.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co., Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Partridge Caroon Co
Phœnix Carbon Mfg. Co.

**Burglar Alarms.**
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)
**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Bishop Gutta Percha Co.
Brixey, W. R.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Carbons, Points & Plates.**
General Electric Co.
Partridge Carbon Co.
Phœnix Carbon Mfg. Co.
Reisinger, Hugo.
Washington Carbon Co.
Wertheim, Ed.
Western Electric Co.

**Clocks, Electric.**
Self-Winding Clock Co.

**Compound.**
Eureka Compound Co

**Conduits.**
Interior Conduit & Ins Co.
National Conduit Mfg. Co.

**Construction & Repairs.**
Allen-Hussey Co.
Amstutz, N. S.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El. Const. Co.

**Contractors and Electric Light Plants.**
Allen-Hussey Co.
Amstutz, N. S.
Armstrong, Chas. G.
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Clark Electric Co.
Consolidated Engineering Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Goltz & Sinclair.
Interior Conduit & Ins. Co.
Mather Electric Co.
Onondaga Dynamo Co.
Siemens & Balske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. B.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co., J. H.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard U derground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Barrington, Son & Co , E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Brownlee & Co.
Electric Appliance Co.
Fiberite Co., The.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Bryant Electric Co.
Bunnell & Co., J. H.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec, Mfg. Co.
Electric Appliance Co.
Elec. Selec. & Signal Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
High & Co., J. Grant.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Desks.**
Montgomery Ward & Co.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Clark Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Onondaga Dynamo Co,
Roth & Eck.
Royal Electric Co.
Siemens & Halske Elec. Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg.Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Allen-Hussey Co.
Amstutz, N. S.
Armstrong, Chas. G.
Arnold, B. J
Bain, Foree.
Bryan, Wm. H
Consolidated Eng. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg, Co,
Ford, Owen.
Goltz & Sinclair.
Thayer Electric Co.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bunnell & Co., J. H.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Norton, Chas. E.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O S
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Electrical Specialties.**
Allen, L. B.
Clark El. Specialty Mfg. Co.
Interstate Com. El. Const Co.
Nashold Cleat Co
Proctor-Raymond Elec. Co.

**Electroliers, etc.**
Edwards, W. S. Mfg. Co.
Gleason, E. P. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.
Sintz Gas Engine Co.
Webster Mfg. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Brownell & Co., The.
Chase & Co., J. F.
Erie City Iron Wks.
Racine Hardware Co.
Sioux City Eng. & Iron Wks.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Davis Elec. Co., W. J.
Diehl & Co.
Interior Conduit & Ins. Co.

**Feed Water Heaters.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Butler Hard Rubber Co.
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Chicago Ins. Wire Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gauges.**
Reliance Gauge Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Besly & Co., Chas. B.
Bryant Electric Co.
Bunnell & Co., J. H.
Butler Mfg. Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Elliott-Lincoln Elec. Co.
Forest City Elec. Wks.
General Electric Co
High & Co., J. Grant.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Metropolitan Electric Co.
Morris & MacCurdy;
Nashold Cleat Co.
New York Insulated Wire Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Proctor-Raymond Elec. Co.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Thayer Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Gleason, E. P. Mfg. Co.
Jaeger Mfg. Co., The.

**Graphite Specialties.**
Besly & Co., Chas. B.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co.. The.

**Induction Coils.**
Splitdorf, C. F.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Fiberite Co., The.
Bart & Begeman Mfg. Co.
High & Co., J. Grant.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co.. Eugene.
Nashold Cleat Co.
National India Rubber Co.
Nowotny Electric Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co.. J. H.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Aetna Electric Works.
Am. Electrical Mfg. Co.
Beacon Vac Pump & Elec.Co.
Bernstein Electric Co.
Buckeye Electric Co.
Columbia Inc. Lamp Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Jaeger Mfg. Co., The.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg.Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Hine & Robertson Co.
Lukens Iron & Steel Co.
Nicholas & Barr.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Brush Electric Co.
C & C Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec, Mfg, Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Onondaga Dynamo Co.
Royal Electric Co.
Roth & Eck.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm.Co. Ltd

**Pianos and Organs.**
Beethoven Piano & Organ Co.

**Platinum.**
Baker & Co.

**Poles.**
Brownlee & Co.
Morris, Tasker & Co.
Nuttall Co., R. D.
Valentine-Clark Co.

**Porcelain.**
Empire China Works.
General Electric Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Electric Appliance Co.
Partrick & Carter Co.

**Rheostats.**
General Electric Co.

**Separators**
Goubert Mfg. Co.
Bine & Robertson Co.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Steam Pumps.**
Worthington, Henry R.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones**
Nowotny Electric Co.
Partrick & Carter Co.
Western Electric Co.
Western Tel. Const. Co.
Williams & Abbott Elec. Co.

**Transformers.**
Diamond Electric Co.
General Electric Co.
Bornberger Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
Royal Electric Co.
Stanley Electric Mfg Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Trolley Cord.**
Samson Cordage Wks

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Int. Corr. Schools.
Scientific Machinist Co.

**Water Wheels.**
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The
Phillips Insulated Wire Co.
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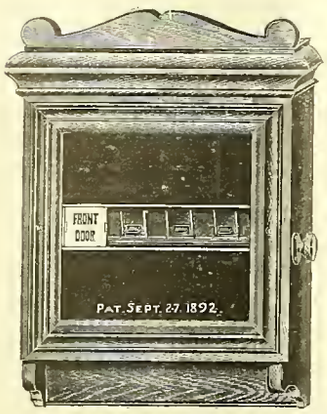
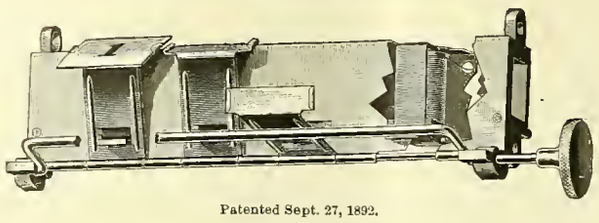
Standard Underground C.Co.




"C" STYLE.
Made in Sizes from 4 to 20 Drops.

# ANNUNCIATORS

That never fail to Annunciate.



Patented Sept. 27, 1892.

This illustrates the inside construction of our Gravity-Drop Annunciator as applied to the 4 Drop "Eclipse" Case.

No Springs. No Screws. Nothing to get out of adjustment. Simplicity itself.

*Our other Specialties:*

**REX** Wood-box Bells,
**ECLIPSE** Iron-box Bells,
**SPARK** Coils,
**WOOD** Push Buttons,
Floor Pushes,
Door Connections, etc., etc.

## PROCTOR-RAYMOND ELECTRIC CO.,

Rochester, N. Y.

# To pay dividends, save them.

**Fact 1**—The **Reliance Columns** prolong the life of steam boilers. How much would it be worth to you to have your boilers last, say, five years longer than they will otherwise last?

**Fact 2**—The **Reliance Columns** save repair bills. Leaky tubes and burned crown sheets are unknown where they are used.

**Fact 3**—The **Reliance Columns** save fuel. 5c a day pays 75% per annum on their cost.

**Fact 4**—The **Reliance Columns** protect life and property. What would be the cost in life, money and stoppage of an explosion in your plant?

**Fact 5**—The **Reliance Columns** are not an expense, but an investment paying phenomenal returns. The saving of fuel, saving of repairs, and prolonged life of the boilers aggregates several times their cost every year.

**Fact 6**—The **Reliance Columns** turn loss into profit. Unless you are rich you cannot afford to operate boilers without them.

**WRITE FOR CIRCULARS** and determine the matter for yourself. You need not buy unless you wish to.

*The Reliance Gauge Company,*
SOLE MANUFACTURERS,
85 to 95 East Prospect Street, CLEVELAND, OHIO.

# WATERHOUSE-GAMBLE ARC LAMPS.

*Plain or Ornamental.*

For Direct Incandescent Circuits.

Write for CATALOGUE and PRICES.

## The Most Economical Lamp Made.

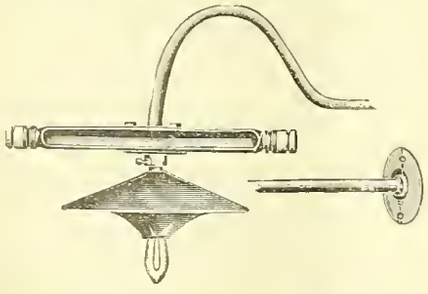
WE MANUFACTURE
*Switches, Sockets, Rosettes, and Receptacles.*

## The Perkins Electric Switch Mfg. Co.,

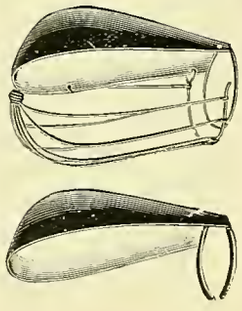
HARTFORD, CONN.

| *CHICAGO,* | *PHILADELPHIA,* | *BOSTON,* |
|---|---|---|
| *1536 Monadnock.* | *806 Walnut St.* | *182 Summer St.* |
| G. W. Conover, Mgr. | O. D. Pierce, Mgr. | F. B. Smith, Mgr. |

# WE MAKE MANY OTHER SPECIALTIES!



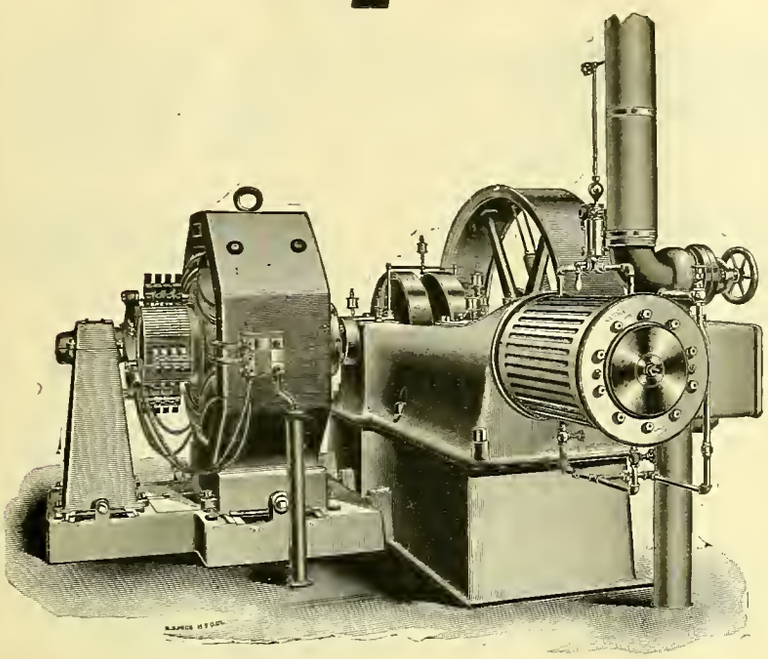
## WHAT ARE THEY?



*Send for Catalogue 894 and see.*

## BUTLER MANUFACTURING CO., 46 S. Clinton Street, CHICAGO.

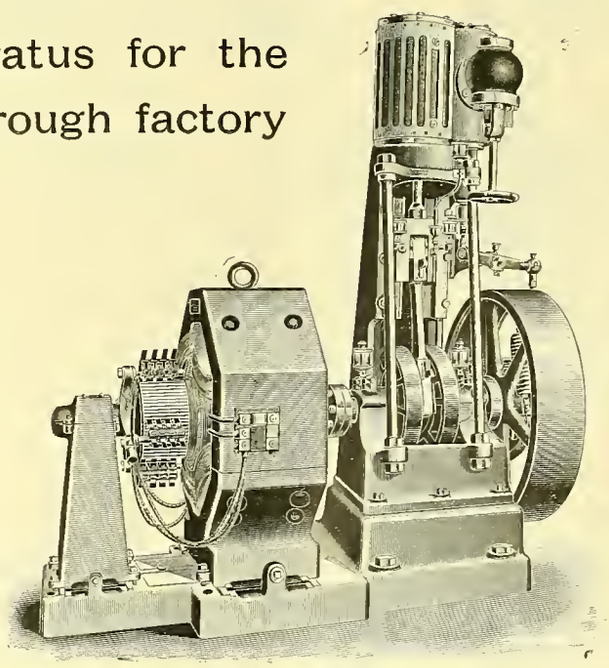
# Eddy Generators



DIRECT CONNECTED OR BELTED
FOR
ELECTRIC RAILWAYS,
CENTRAL STATIONS,
ISOLATED LIGHTING
OR
POWER PLANTS.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.



## All Our Apparatus Guaranteed As Represented.

## The Eddy Electric Manufacturing Company,

NEW YORK OFFICE,
HAVEMEYER BUILDING.

WINDSOR, CONN.

REPRESENTED BY:

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Western Electrical Supply Company, St. Louis, Mo.
F. P. Little Electrical Construction & Supply Co., Buffalo, N.Y.
W. T. Osborn, Kansas City, Mo.

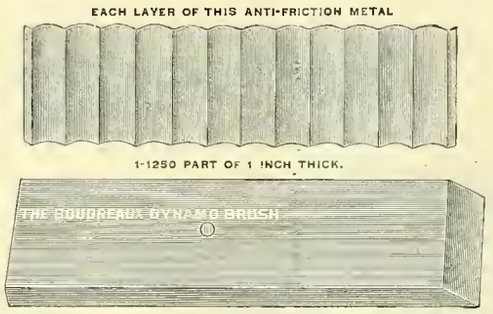
# The Boudreaux Dynamo Brush Co.,

(INCORPORATED)

226 and 228 LA SALLE ST., CHICAGO.

**NO COPPER.**

**NO WOVEN WIRE.**




**NO GAUZE.**

**NO CARBON.**

## Something Infinitely Better.

# TO TRY IS TO ADOPT IT.

## RICH—BRILLIANT—LASTING.

### Lacquer Radiant.

**For Coloring Incandescent Lamps.**

| | | | |
|---|---|---|---|
| 8983 | Ruby, per bottle | ..... | $1.50 |
| 8984 | Amber, " | ..... | 1.50 |
| 8985 | Blue, " | ..... | 1 50 |
| 8986 | Green, " | ..... | 1.50 |
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| 8988 | Violet, " | ..... | 1.50 |

Full directions with each bottle.

### Frosting Varnish.

**For Frosting Incandescent Lamps.**

| | | | |
|---|---|---|---|
| 8989 | Per bottle | ..... | $1.50 |

## LACQUER.

Gives a **DEEP**, **RICH** and **BRILLIANT** color to the ordinary incandescent lamp.

Easily and quickly applied, and quickly removed if desired.

## FROSTING VARNISH.

Quickly applied, and gives a **PERFECT IMITATION OF GROUND GLASS.**

Contains **NO ACID** and is perfectly harmless.

A FULL STOCK AT

**New York and Chicago.**

# WESTERN ELECTRIC COMPANY,

**NEW YORK,**
Greenwich and Thames Streets.
**CHICAGO,**
227 to 275 South Clinton Street.

# BATE'S REFRIGERATOR CASE HAS NOTHING TO DO WITH OUR CASE.

We are still offering the **BEST LAMP** in the market, at **LOWEST PRICES**, in all candle powers and voltages, and have never stopped selling the same, waiting for **UNITED STATES SUPREME COURT DECISIONS.**

We are satisfied with our **CUSTOMERS' DECISION.** Our **COMPETITORS** do not say which **PATENT** is **DEAD.** There are one hundred and nine patents on **EDISON LAMPS,** which date from September 16th, 1879, to June 14th, 1892.

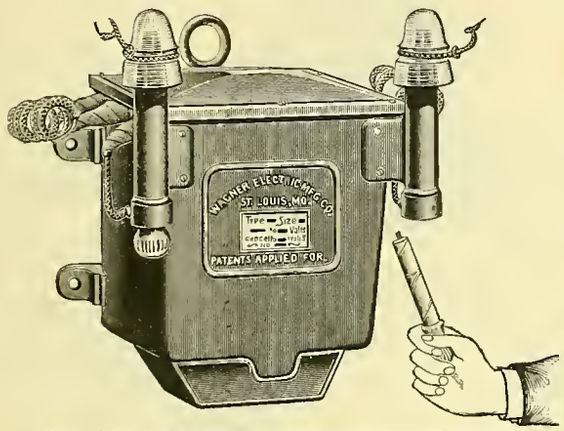
We are not selling old style lamps, but the new type **EDISON.**

Prices on application to

## CHICAGO EDISON COMPANY,

*Supply Department Offices, 575 Rookery Building, Warehouse, 250 East Washington Street,* } CHICAGO.

# TRANSFORMERS.




Type "D" Transformer with Fuse Plug Removed.

***A New Type*** — *Transformer, Primary Cut-outs and Insulator Brackets all combined.*

**No more brackets pulling off of walls.**

**With our wall or cross-arm hooks, transformer may be *Hung* and *Connected* in *Five minutes.***

**Our new fuse plugs will not hold an arc with 5,000 volts.**

***Our Transformers* are acknowledged by all experts to be the *Highest* in *Efficiency* ever made.**

**Adopted by the largest stations in the country.**

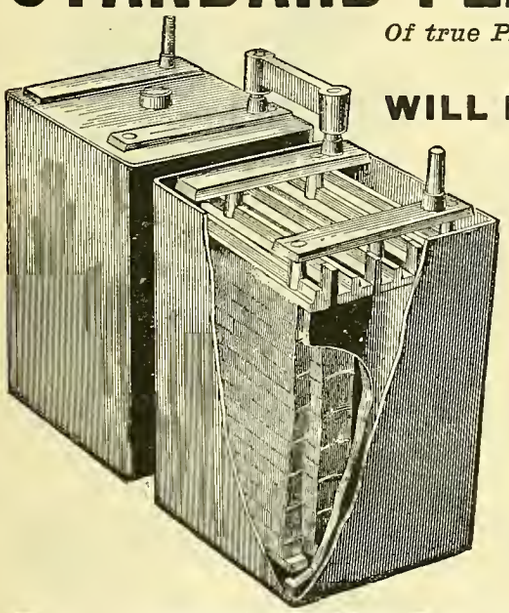
***We Challenge Competition* in any form of test, in laboratory or practical use.**

**Made in all sizes, 5 lights to 3,000 lights.**

JOHN MUSTARD, Betz Building, Philadelphia, Pa.
1564 Monadnock Block, Chicago, Ill.

## Wagner Electric Mfg. Co., ST. LOUIS, MO.

# STANDARD PLANTE STORAGE BATTERIES



*Of true PLANTE Type and CRYSTALLINE FORMATION.*

Will give or receive without injury, currents that would destroy other batteries.

**WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.**

Contain no asbestos or other separating material to increase their internal resistance.

**ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.**

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

**Highest efficiency, largest delivery, lowest internal resistance.**

For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

**Cannot be damaged by excessive charge or discharge currents.**

A 400 ampere current has been taken from a 120 ampere hour cell.

☞ **CHALLENGE:** We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

## ELECTRIC POWER STORAGE COMPANY,

Room 1210 Havemeyer Building, 26 Cortlandt Street, New York.

If You Want

# "A GOOD THING"

In the Book Line,

ORDER A COPY OF

## WEBB'S TELEPHONE HAND-BOOK.

Price $1.00, Postage Prepaid.

Published and for sale by

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## MULTIPOLAR DYNAMOS,

Direct Driven or Belted, in sizes up to 250 H. P.

## BIPOLAR DYNAMOS,

Up to 100 H. P.

Electric Motors, Automatic or Hand Controlled.
Complete Plants for Power Transmission.
Isolated lighting plants, Central Station Apparatus.

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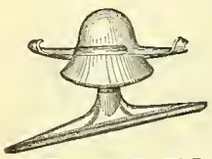
CLEVELAND, Cuyahoga Building. PHILADELHIA, 633 Arch St.



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## TROLLEY LINE INSULATORS.

*Hangers, Pull-Overs, Bracket Arm Insulators, Guard Wire, Feed Wire, Giant Strain and Section Insulators, Frogs, Crossings, Rail Bonds, Etc., Etc.*

**VULCABESTON** Heat-proof Insulation for Magnet Spools, Bushings, Controller Parts, Etc.
**ASBESTOS** for Fire-Proofing and Electrical Purposes.

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*240 and 242 Randolph Street, CHICAGO, ILL.*
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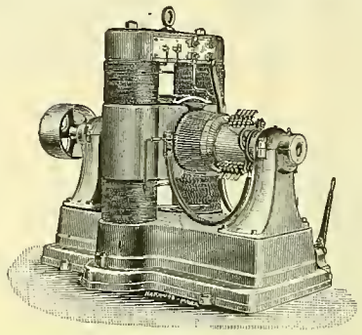
MANUFACTURERS OF **DYNAMOS AND MOTORS.**

SPECIAL ATTENTION GIVEN TO EQUIPPING MILLS AND FACTORIES.

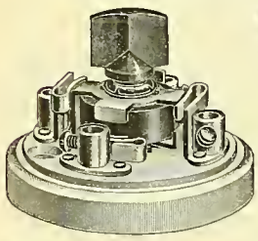


ELECTRICAL APPARATUS, WIRE, LAMPS, ETC.

**SYRACUSE, N. Y., U. S. A.**
**Western Office, 1105 Monadnock Building, - CHICAGO.**
LESLIE W. COLLINS, Manager.

## HART SNAP SWITCHES!

STANDARD SWITCHES, 5 and 10 ampere S. P.
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



## FLUSH SWITCHES

Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

**SEND FOR CATALOGUE.**

**THE HART & HEGEMAN MFG. COMPANY,**
Hartford, Conn.

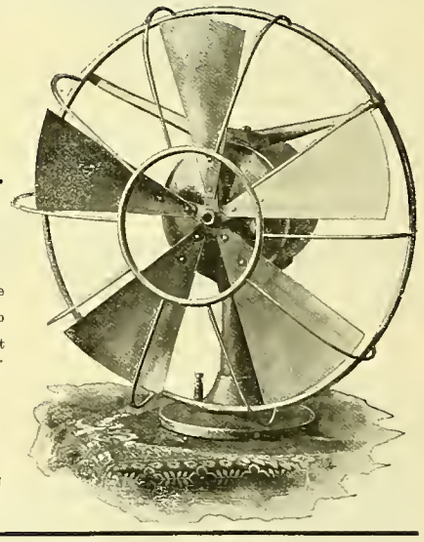
## THE BEST ELECTRIC FAN On the Market.

**For Alternating Current. Wound for 50 or 100 volts.**

The Fan is 14 inches in diameter.
Will always start when current is on
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

Agents Wanted in Different Localities.

For further information address
THE
**W. J. Davis Electric Co.,**
PITTSFIELD, MASS.



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Expert Electrical Engineers.

Electric Railway Construction. Complete Electric Light Installations.

Drafting. Specifications.

## ELECTRICAL SUPPLIES OF ALL KINDS.

**Fan Motors. Street Railway Material.**

WRITE FOR PRICES.

**1027 GARFIELD BLDG., TELEPHONE 2910, CLEVELAND, OHIO.**

# BUCKEYE

QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

## INCANDESCENT LAMPS

Monadnock Building, Chicago. **THE BUCKEYE ELECTRIC CO., Cleveland, O.**

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CONTRACTORS FOR COMPLETE SUBWAY SYSTEMS FOR ELECTRIC RAILWAYS AND ELECTRIC LIGHT, TELEPHONE AND TELEGRAPH COMPANIES.

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JAS. P. McQUAIDE, Sec. & Treas.

## THE NATIONAL CONDUIT MANUFACTURING CO.,

### MANUFACTURERS OF WROUGHT-IRON CEMENT-LINED TUBES FOR ELECTRIC SUBWAYS.

Works, HASTINGS-ON-HUDSON. New York Office, TIMES BUILDING.

We own Patent No. 395,584, covering Wrought-Iron Cement-Lined Pipe for Subways and the method of Laying. Also, Patents Nos. 416,234 and 416,235 for Distributing Boxes. Over 9,000,000 feet of this Subway Constructed by us *now in use in the United States and Canad*

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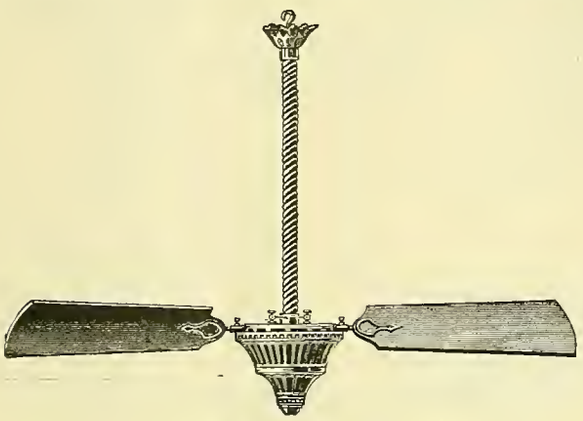

**AN EMPHATIC SUCCESS!**
**THE DIEHL ELECTRIC FANS**
**WIRED IN A SERIES OF**
**TWO OR MORE ON A**
**STREET RAILWAY CURRENT.**

**DIEHL & COMPANY, 385 BROADWAY, NEW YORK.**

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1821. 1888.

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**INCORPORATED.**

Offices, 222-224 S. Third St., Philadelphia, Pa.

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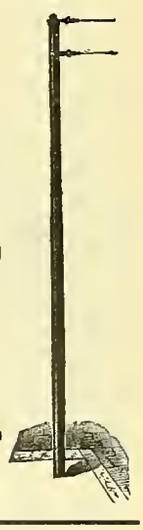
Manufacturers of

## Boiler Tubes, Wrought Iron Pipes and Fittings.

ELECTRIC LIGHT and RAILWAY PIPE POLES A SPECIALTY.



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# HELIOS CORED CARBONS For Alternating and Direct Currents.

Attempts have been made in this country to produce a satisfactory cored carbon, but failure resulted in every case. We can now assure the Electric Light Companies that our "HELIOS" CARBON is made of the same ingredients, in precisely the same way,

**By the man who made them in Germany.**

We shall be glad to hear from the Electric Light interests of the country in relation to carbons for both alternating and Direct Currents. A memorandum book, with tables showing the relation between millimeters and inches, with a list of ordinary sizes of "HELIOS" CARBONS of our manufacture will be sent on application. **Reduced Prices on Solid Carbons for Series Arc Lighting.**

## A · Departure · In · Business · Methods!

***NOTE THIS OFFER:—Let us know by telegraph the price you are now paying, stating yearly consumption, and we will guarantee to beat it from 50 cents to $2.00 per thousand.***

## THE WASHINGTON CARBON COMPANY, - PITTSBURG, PA.

# "A COLD DEAL."

(THE BATES REFRIGERATOR CASE DECISION.)

That is, it was cold for the other people. As for ourselves and the trade in general it is balmy and salubrious as it enables us to be in the market again with the

# Old Reliable Packard Lamp

With platinum leading-in wires, which in the roseate days of the lamp business (before the appearance of "Hydra-headed monopoly")

**LED THE WORLD.**

We are now filling orders for the Old Original Packard Lamp, made better than ever before, and at prices that get the business. Take advantage at once of the results of the most important decision ever rendered in electrical litigation.

**ELECTRIC APPLIANCE COMPANY,**

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SEND FOR SAMPLES AND PRICES OF

**SAMSON SPOT CORD**

For Arc Light and Trolley Cord.

SAMSON CORDAGE WORKS, - BOSTON, MASS.

The Only Clocks Used in the W. U. Tel. Co. Time Service.

NO WINDING. CORRECTED HOURLY.

**SELF-WINDING CLOCK CO.,**

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*Clocks Sold. Clocks Rented.*

# GRAPHITE SPECIALTIES

**FOR ELECTRICAL USES:**

Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the Inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.

**JOS. DIXON CRUCIBLE CO., Jersey City, N. J.**

—OF—

All Colors and Descriptions.

**Automatic Mercurial Pumps**

OF LATEST DESIGN

For Incandescent Lamp Companies.

Scientific glass apparatus for Laboratories, Colleges, etc. Reliable workmanship and lowest prices. Agents wanted in Western Cities. **Send for new Catalogue.**

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**OCTAGONAL PINE POLES, NORWAY PINE CROSS-ARMS, WHITE OAK PINS.**

It will pay you to get our prices.

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**GOOD PATENTS**

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**Boswell Storage Battery.**

For Traction Work, Electric Lighting, Electric Launch, Telegraph, Phonograph, Surgical, and for all purposes where Light and Power are required.

Prices on Application.

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**IMPERIAL DRY BATTERY.**

Guaranteed the best Dry Battery ever made. Internal short circuiting or local action is eliminated. Will not deteriorate when not doing work. Will hold its first value over long periods of time. Internal resistance small; high and constant E. M. F. Will not run down or die on the shelf. No bursting of seale or oozing of salts from the top.

**Burnley Cartridge Battery.**

Cartridge or Porous Cups made of especially prepared paper. One-half the size and one-third the weight of other porous cups. Guaranteed to be equal to any Salammoniac battery made. The cheapest battery now on the market.

**TEMPERED COPPER.**

All patterns of tempered copper segments guaranteed true to gauge, free from defects; no alloy; finish and temper equaled by none. Exclusively used by some of the largest companies in the country.

All Batteries Guaranteed. Send for Catalogue

**PHOENIX RUBBER INSULATING PAINT.**

Water, Acid and Practically Fire Proof.

A strictly first-class insulating paint for armatures, fields, switchboards, conduits, iron and wood poles, connections, mouldings, wires, cut-out boxes, lamp hoods and all other kinds of electrical appliances where high insulation is desired.

Write for further particulars.

**Morris & MacCurdy,**

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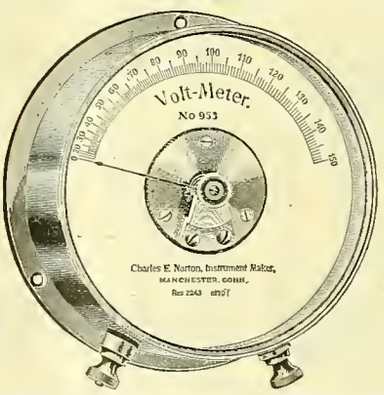
# "THE NORTON" Ammeters and Voltmeters.




A standard instrument.
Perfect in construction.
The best instrument made for general work.
Satisfaction guaranteed.
New catalogue.
Agents wanted in leading cities.
Write us for prices and you will purchase.

**Charles E. Norton,**

INSTRUMENT MAKER,

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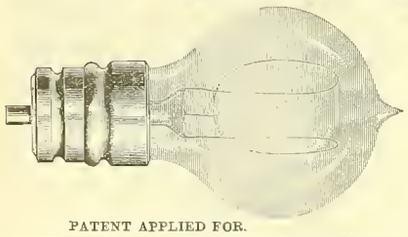
# THE NEW ÆTNA LAMP.

YOU DON'T SEE THE TWIST IN THE FILAMENT.



PATENT APPLIED FOR.

*THIS LAMP is specially adapted to street and general railway and steamboat use, because it is absolutely non-vibratable, and we guarantee for it 50 per cent. longer life and better service than any other lamp now on the market. The filament will not droop or get out of shape while in use, no matter at what angle it is burned. A good lamp at a fair price. Ordinary lamps at ordinary prices*

AGENTS WANTED IN LEADING CITIES.

WRITE US. **Ætna Electric Works, Hartford, Conn.**

# INCANDESCENT STREET LIGHTING FROM ALTERNATING CURRENT DYNAMOS.

**Series Lamps. Series Sockets. Street Fixtures.**

Incandescent Lamps for Arc and Multiple Circuits.

Trial orders mean permanent business. Correspondence solicited.

**BERNSTEIN ELECTRIC CO., - Boston, Mass.**

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# AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.

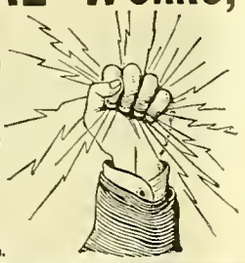
BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,

Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

CABLES FOR AERIAL AND UNDERGROUND USE.



NEW YORK STORE, P. C. Ackerman, 10 Cortlandt St.
CHICAGO STORE, F. E. Donohoe, 241 Madison St.
MONTREAL BRANCH Eugene F. Phillips' Electrical Works.

# NOTICE OF REMOVAL!

## Interior Conduit & Insulation Company

Beg to announce that on and after March 15th, 1895, the general offices of the company will be located at their works,

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New York City.

THE

# "CLARK" WIRE.

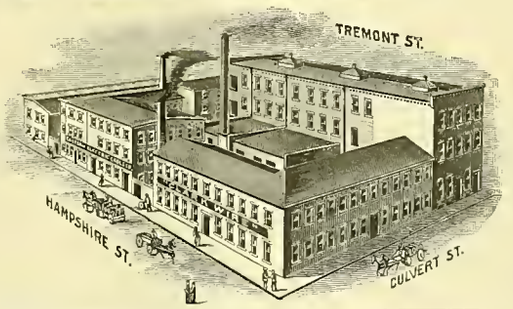
TRADE MARK

For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

HENRY A. CLARK, Treas. and Gen'l Mgr.

HERBERT H. EUSTIS, Prest. and Electrician.




**In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."**

The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire.

We shall be pleased to mail Catalogues with Terms and Discounts for Quantities.

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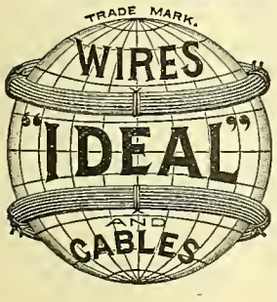


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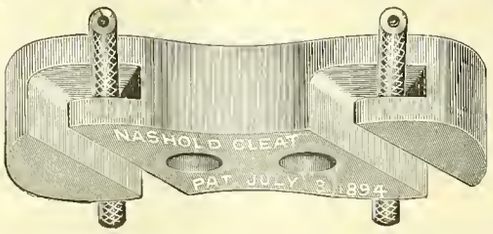


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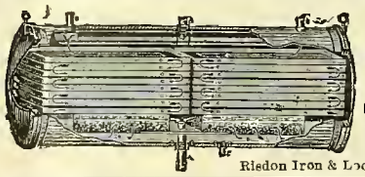

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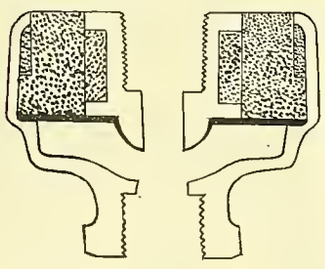

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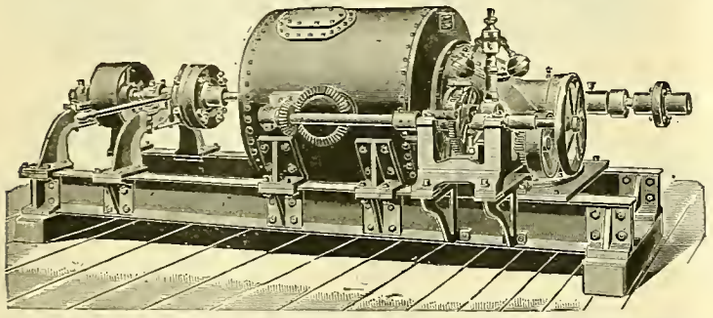

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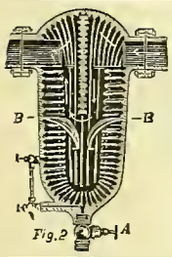


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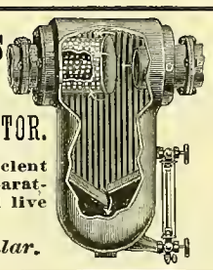

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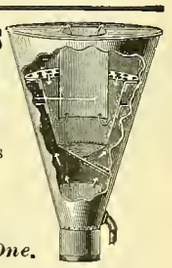

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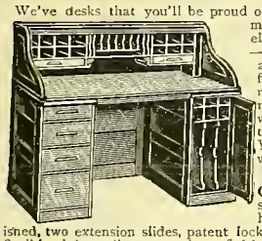

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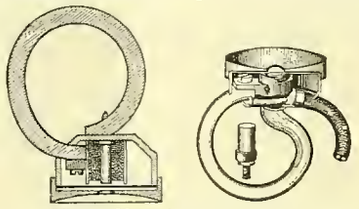
ductor. In the D'Arsonval receiver a curved permanent magnet is used, one pole of which terminates



FIGS. 27 AND 28. D'ARSONVAL RECEIVER.

in a soft iron polepiece that serves as the core of the coil, and the other in an iron box, or cylinder, that

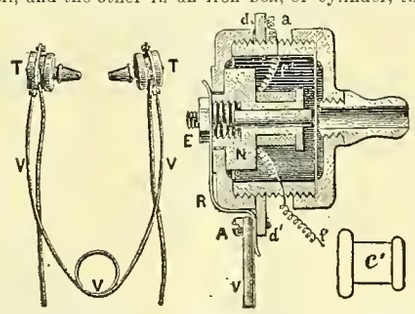



FIG. 29. MERCADIER'S BI-TELEPHONE. *T T* RECEIVERS, *V* SPRING, *N* MAGNET, *E* NUT, *R* STEEL STRIP, *A* SCREW CLAMPING *R* TO *V*, *d d'* METAL COLLAR CLAMPING *V* TO RECEIVER CASE, *f f* TERMINALS OF COIL *a* CONNECTING SCREW, *c'* SOFT RUBBEB NIPPLE FOR EARPIECE.

completely encloses the coil. The two poles are magnetically insulated from each other by the wooden case, to the upper part of which the diaphragm is



appeared on the scene with an application for a patent on a microphonic transmitter, and according to the rules of the Patent Office no patent could be issued to any of the three until it was determined whether the Drawbaugh claim was valid or not. This was finally decided against Drawbaugh, as it was proved that the Edison carbon transmitter had been in public use for more than two years before Drawbaugh made his application for a patent, and his application was thrown out. A patent was then issued to Berliner on the broad

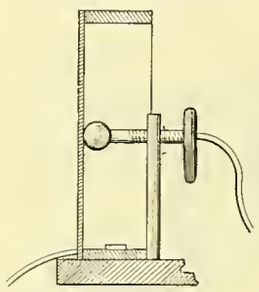


FIG. 44. BERLINER'S FIRST TRANSMITTER.

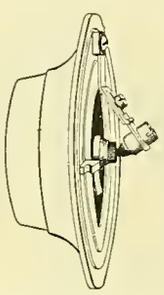


FIG. 45. BERLINER CARBON TRANSMITTER.

principle of the microphone transmitter in November, 1891. In May of the following year a patent was issued to Edison, so that both sides of the interference eventually got their patents—more than fourteen years after the filing of the original applications.

78. Both Berliner and Edison obtained in 1878 patents on special forms of transmitters designed in accordance with the principles laid down in their applications for the broad principle of battery telephones, and the Berliner transmitter especially has been modified out of all semblance to its original form. The broad claim in the Berliner patent is as follows: "The method of producing in a circuit electrical undulations similar in form to sound waves by caus-

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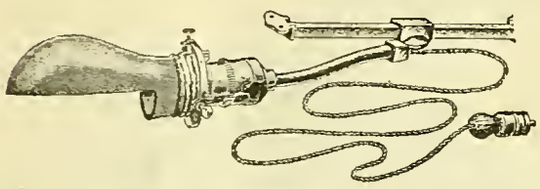

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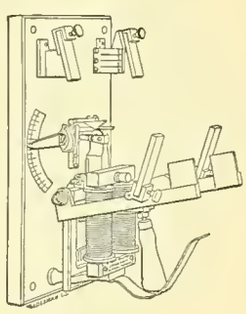

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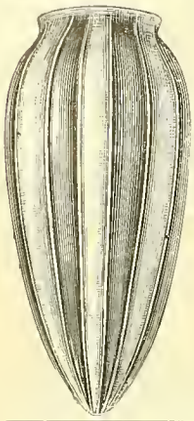

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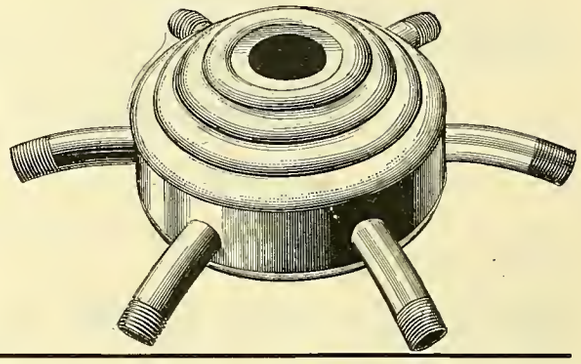

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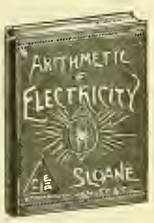

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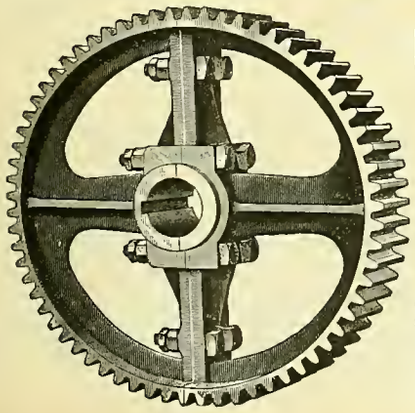

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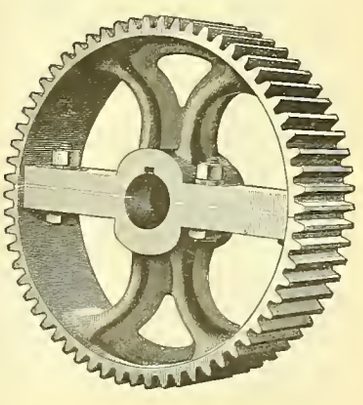

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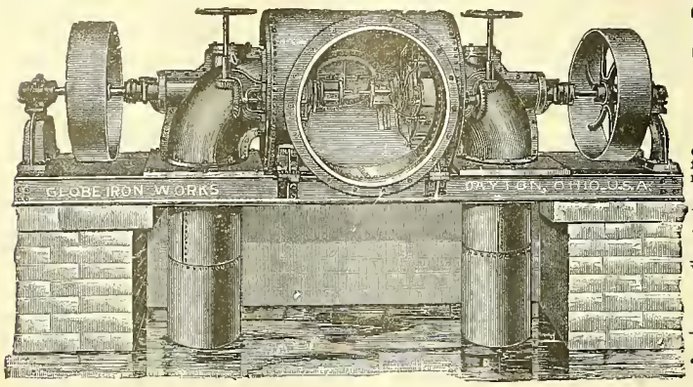


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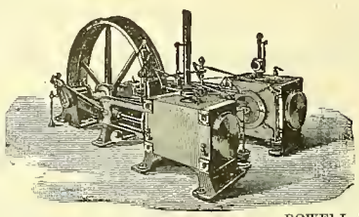

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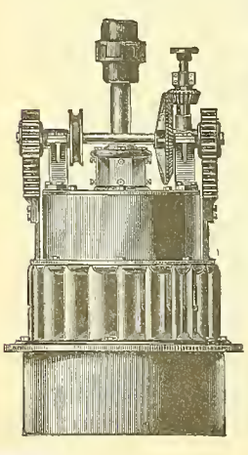

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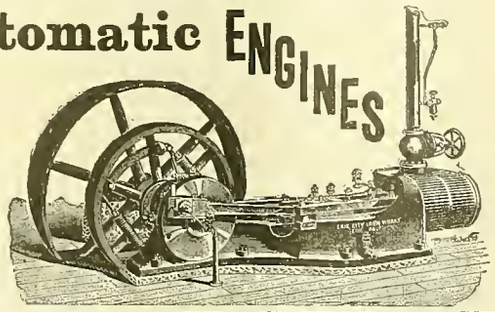

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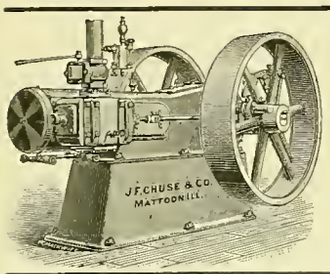


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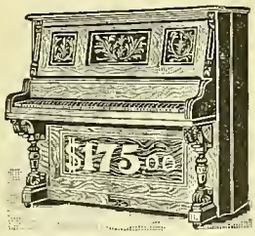


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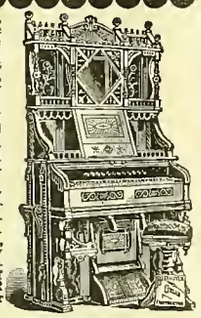

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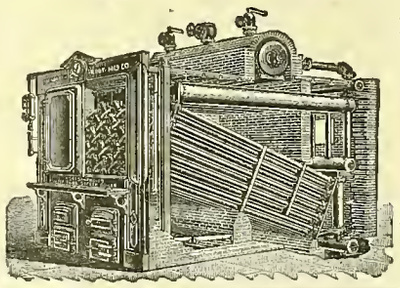

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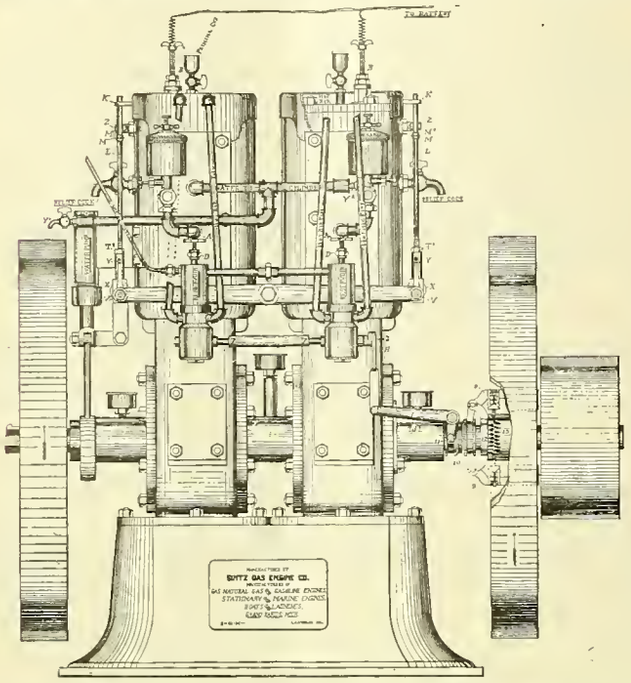

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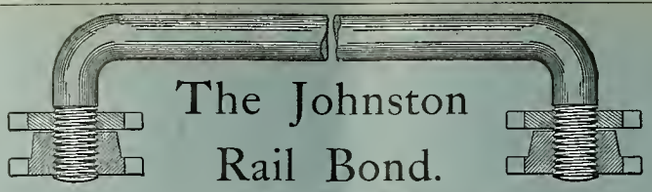

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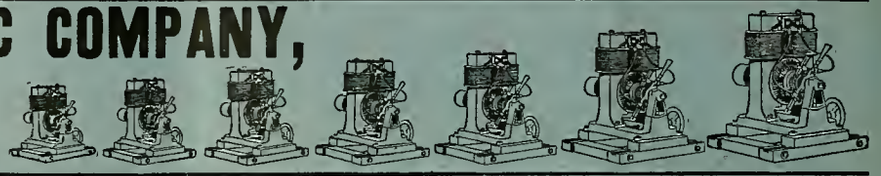

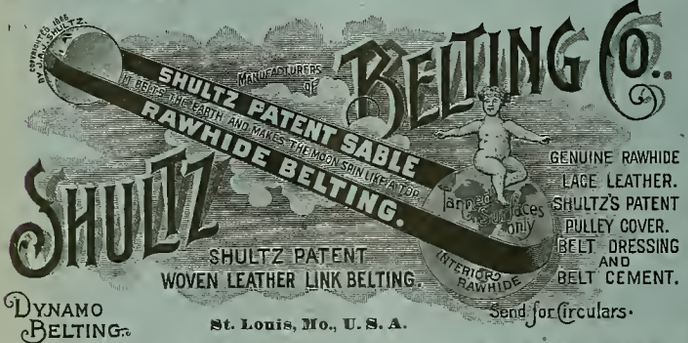


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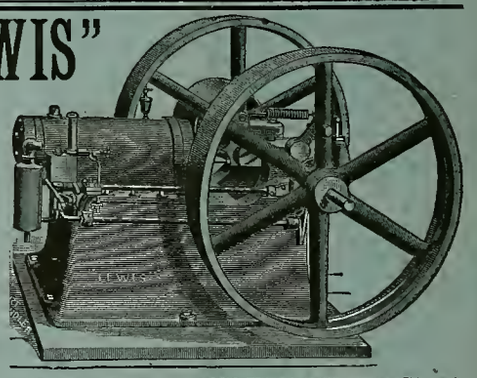

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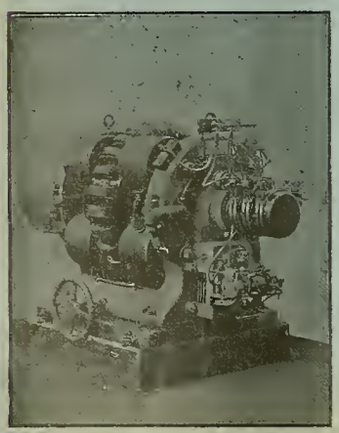

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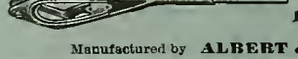

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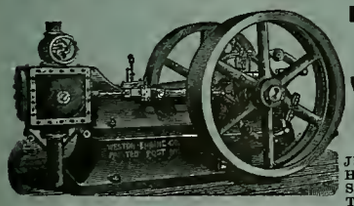

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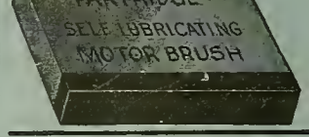


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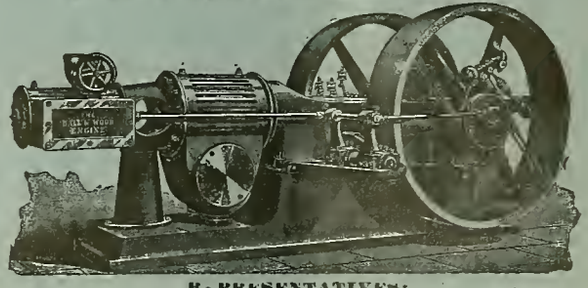

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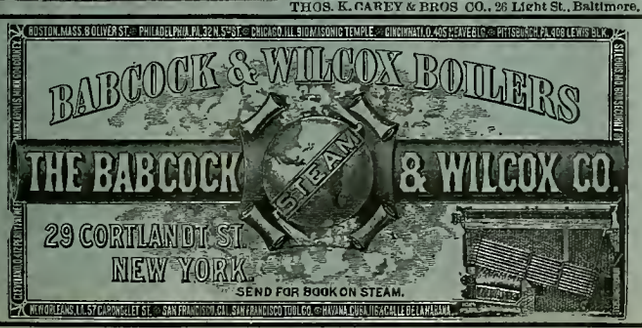


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Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co., J. H.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co, The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co , E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Brownlee & Co.
Electric Appliance Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Bryant Electric Co.
Bunnell & Co., J. H.
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Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Selec. & Signal Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
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**Desks.**
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Brush Electric Co.
C & C Electric Co.
Clark Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Onondaga Dynamo Co,
Roth & Eck.
Siemens & Halske Elec. Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

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**Electric Railways.**
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General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

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Amstutz, N. S.
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg, Co,
Ford, Owen.
Goltz & Sinclair.
Thayer Electric Co.

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Anderson, Albert & J. M.
Bunnell & Co., J. H.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Norton, Chas. E.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

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Clark El. Specialty Mfg. Co.
Interstate Com. El. Const Co.
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Proctor-Raymond Elec. Co.

**Electroliers, etc.**
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Gleason, E. P. Mfg. Co.

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Besly & Co., Chas. H.
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**Engines, Steam.**
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Fiberite Co., The.
General Electric Co.
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Bunnell & Co., J. H.
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Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
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Electric Appliance Co.
Elliott-Lincoln Elec. Co.
Forest City Elec. Wks.
General Electric Co
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Nashold Cleat Co.
Nowotny Electric Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
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Electric Appliance Co.
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Johns Mfg. Co., H. W.
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Munsell & Co.. Eugene.
Nashold Cleat Co.
National India Rubber Co.
Newton Rubber Wks.
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New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
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Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
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Standard Underground C.Co.
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**Insulated Wires and Cables—Magnet Wire.**
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Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co.. J. H.
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Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
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Mather Electric Co.
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Nuttall Co., R. D.
Okonite Co., The.
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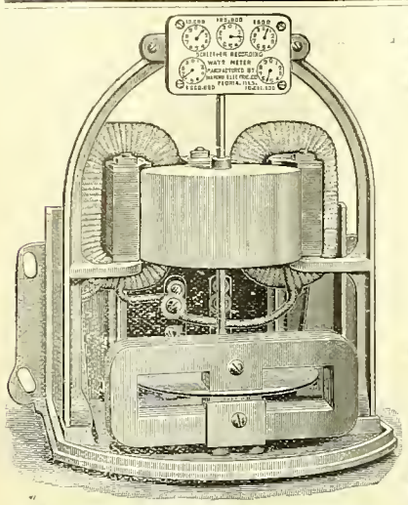

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For Alternating Circuits. No Commutator. No Brushes.

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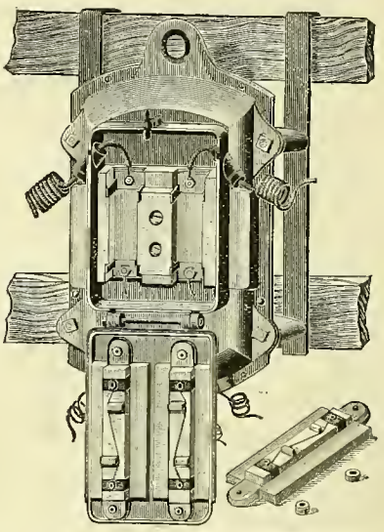

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**IS THE LAMP YOU HAVE HOPED FOR.**

It is the only perfected Arc Lamp for the alternator, either high or low frequency.

It comprises all that is desired in an Arc Lamp.

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## THE F. P. LITTLE Electrical Construction & Supply Company,

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# Low Potential Arc Lamps.

*Alternating-Helios, Old Type.*
*Spencer, New Type.*

*Direct Current-Helios, Old Type.*
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**FOR STREET, PAVEMENT AND INSIDE LIGHTING.**

Our Alternating Lamps have reflector plates. Our new Direct Current Lamps do not see-saw when running in series.

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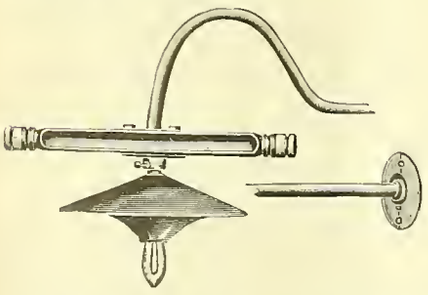
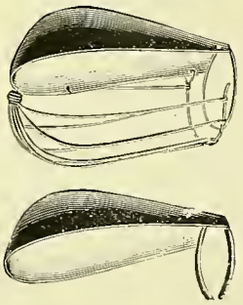


# WHAT ARE THEY?



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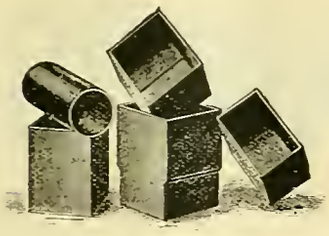

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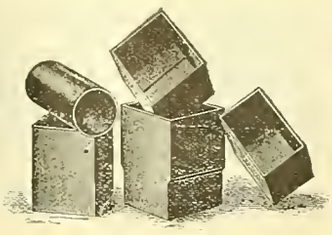
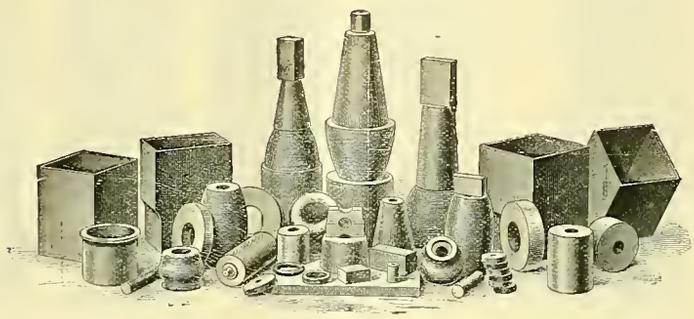


*Estimates Furnished on Application.*



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The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplished, providing additional strength to such an extent that this cell can be used where no other would be practical.

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**Write us for information and catalogue.**

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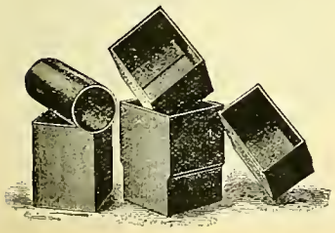
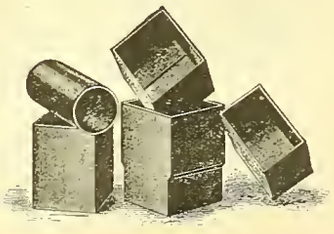


Newton Upper Falls,

**MASS.**



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## LIFE AND EFFICIENCY GUARANTEED.

*New Process of Exhaustion by Mechanical Vacuum Pump.*
*Absolutely Dry Vacuum.*

Samples and Prices Furnished on Application. Correspondence Solicited.

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*No Sparking.*
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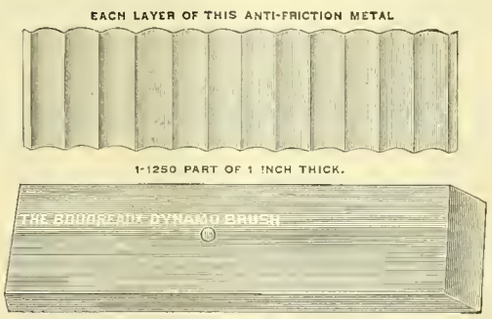
*No High Resistance.*




*No Woven Wire.*
*No Copper.*
*No Carbon.*

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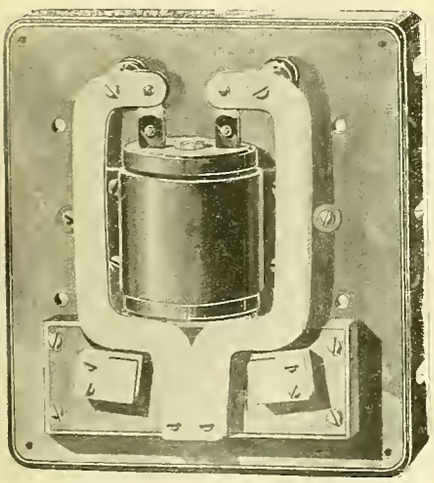

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**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{\text{On}}{\text{Out}}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

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General Electrical Supplies.
47 & 49 State St. Detroit February 25th, 1895

Perkins Electric Switch Mfg. Co.

Hartford, Ct.

Gentlemen:-

Saturday we received notice that our last order had been shipped.

And then we are arraigned for our sins of omission and commission - to which, of course, we plead guilty - but notwithstanding our wickedness and the just indignation of our esteemed friend the undersigned he is so good as to close his indictment as follows and desire to say that if we did not consider you have an exceptionally good switch our orders for such goods would go elsewhere in the future.

We trust that nothing of this kind will occur in the future.

Yours truly,

MICHIGAN ELECTRIC COMPANY.

Geo. A. Mansfield.
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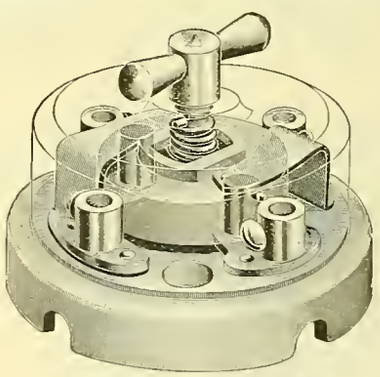

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*REFERRED TO IN THE LETTER.*

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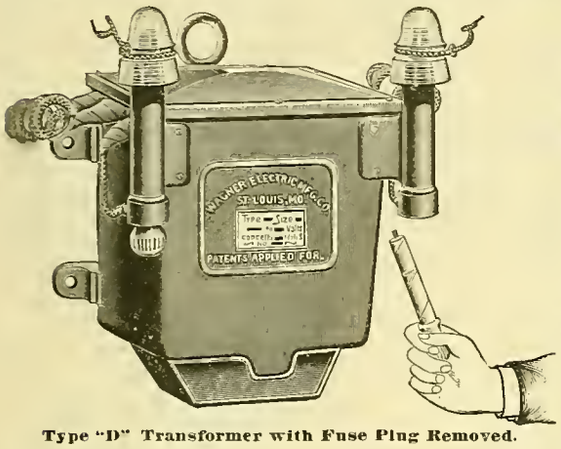


Type "D" Transformer with Fuse Plug Removed.

**A New Type**—*Transformer, Primary Cut-outs and Insulator Brackets all combined.*

No more brackets pulling off of walls.

With our wall or cross-arm hooks, transformer may be *Hung* and *Connected* in *Five minutes.*

Our new fuse plugs will not hold an arc with 5,000 volts.

*Our Transformers* are acknowledged by all experts to be the *Highest* in *Efficiency* ever made.

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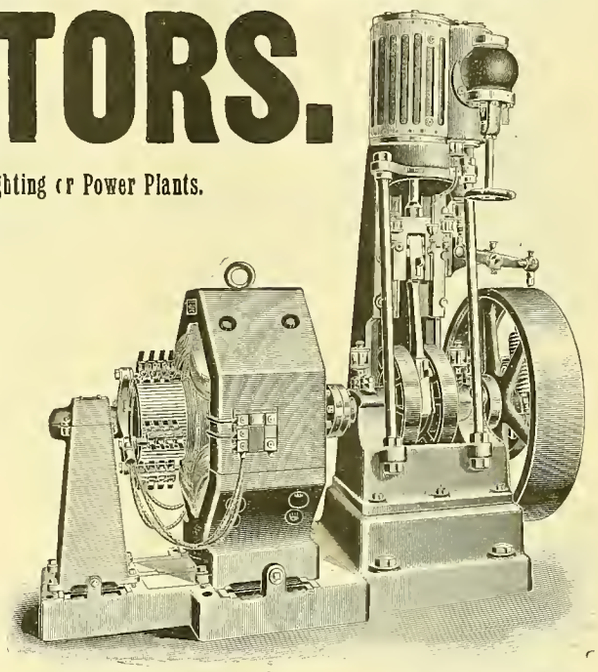
Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.



## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*

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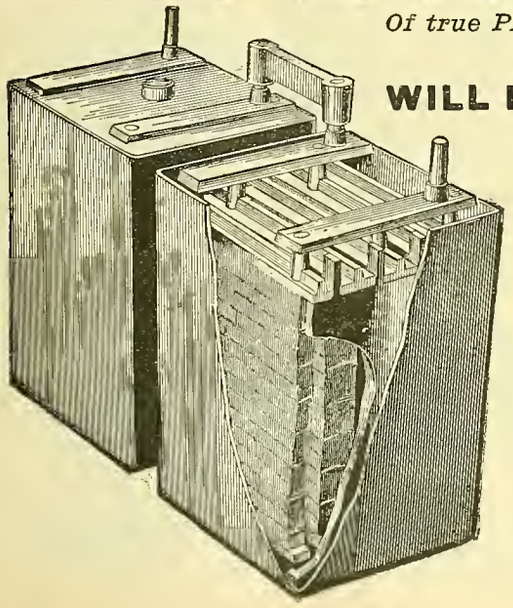
All Our Apparatus Guaranteed as Represented.

# STANDARD PLANTE STORAGE BATTERIES



*Of true PLANTE Type and CRYSTALLINE FORMATION.*

Will give or receive without injury, currents that would destroy other batteries.

**WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.**

Contain no asbestos or other separating material to increase their internal resistance.

**ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.**

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

**Highest efficiency, largest delivery, lowest internal resistance.**

For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

**Cannot be damaged by excessive charge or discharge currents.**

A 400 ampere current has been taken from a 120 ampere hour cell.

☞ CHALLENGE: We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

## ELECTRIC POWER STORAGE COMPANY,

Room 1210 Havemeyer Building, 26 Cortlandt Street, New York.

DO YOU WANT
The best made?
To be up to time?
Quick results from a 'phone?
To save time?
The most efficient?
The most durable? Then
Buy the "Gerson"

These 'phones are used on private lines between Boston and Chicago.

TELEPHONE
LONG DISTANCE AND INTERIOR.

SATISFACTION GUARANTEED.
U. S. Government gives the "Gerson" 99 per cent. for efficiency—highest given.

WRITE
W. D. Jameson & Co.,
150 Broadway, NEW YORK,
Sole Agents for
The Gerson Electrical Mfg. Co,
INCORPORATED,
of PHILADELPHIA, PA.

If You Want
"A GOOD THING"
In the Book Line,

ORDER A COPY OF
WEBB'S TELEPHONE HAND-BOOK.
Price $1.00, Postage Prepaid.
Published and for sale by
ELECTRICIAN PUBLISHING CO., 6 Lakeside Building, CHICAGO.

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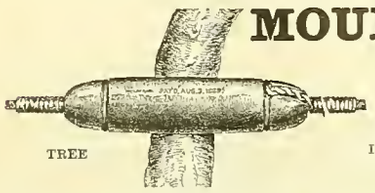
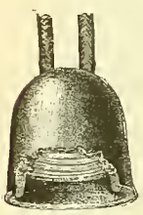


TREE INSULATORS.

Wall Socket for Sign Work, etc.

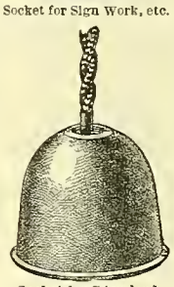
Weatherproof Sockets.
For use outdoors and in damp situations.



Regular Edison, Thomson-Houston & Westinghouse Base.

TROLLEY LINE INSULATORS,
VULCABESTON.

H. W. JOHNS MFG. CO.,
240 & 242 Randolph Street,
CHICAGO.
NEW YORK, PHILADELPHIA. BOSTON.



Socket for Standard ⅛-inch Pipe Bracket Fixtures.

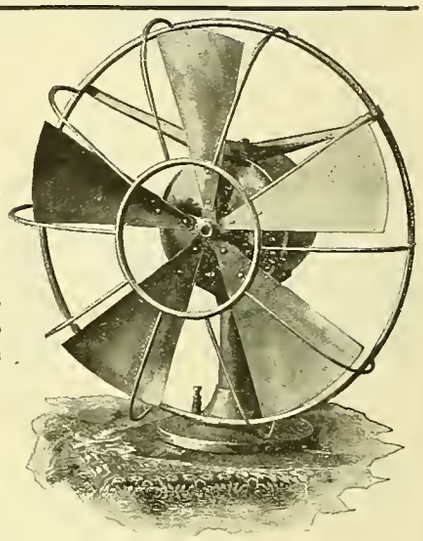
THE BEST ELECTRIC FAN On the Market.

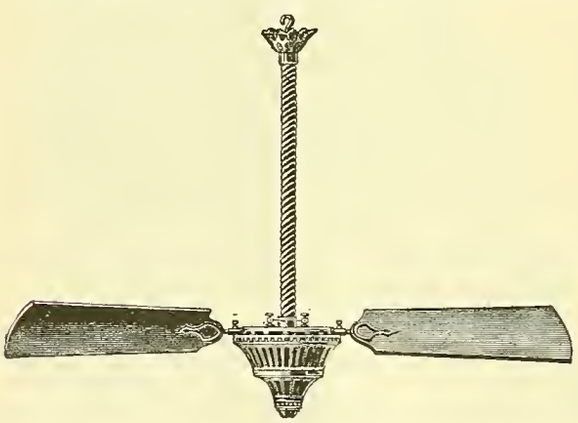
For Alternating Current, Wound for 50 or 100 volts.

The Fan is 14 inches in diameter.
Will always start when current is on
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

Agents Wanted in Different Localities.

For further information address
THE
W. J. Davis Electric Co.,
PITTSFIELD, MASS.





AN EMPHATIC SUCCESS!
THE DIEHL ELECTRIC FANS
WIRED IN A SERIES OF
TWO OR MORE ON A
STREET RAILWAY CURRENT.

DIEHL & COMPANY, 385 BROADWAY, NEW YORK.

THAYER ELECTRIC COMPANY,
Expert Electrical Engineers.
Electric Railway Construction. Complete Electric Light Installations.
Drafting. Specifications.
ELECTRICAL SUPPLIES OF ALL KINDS.
Fan Motors. Street Railway Material.
WRITE FOR PRICES.
1027 GARFIELD BLDG., TELEPHONE 2910, CLEVELAND, OHIO.

# GOOD NEWS.

WIRES AND CABLES

WIRES AND CABLES

WIRES AND CABLES

WIRES AND CABLES

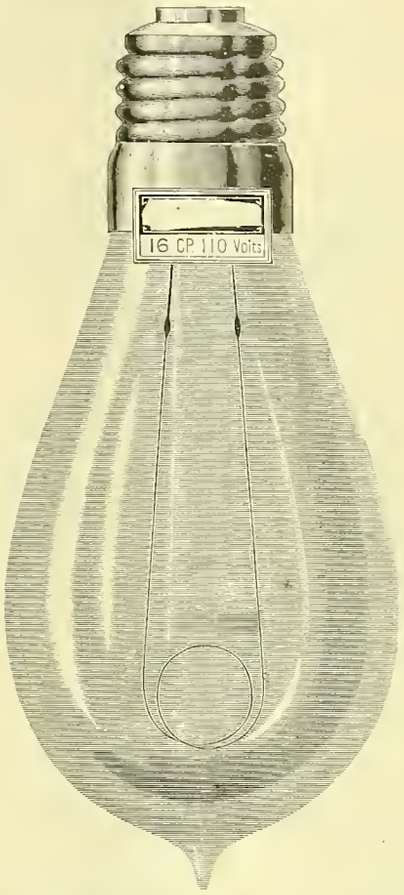
WIRES AND CABLES

We are again prepared to furnish the

## OLD ORIGINAL AND RELIABLE

**PACKARD LAMP** with platinum leading in wires as it was made two years ago when it practically held the field against all competitors. We have, however, made one improvement securing results that no other manufacturer has ever attained, viz:

They increase in Candle Power during their life ! ! !




They increase in Efficiency during their life ! ! !

**WE ARE PREPARED TO SHIP PROMPTLY FROM CHICAGO STOCK.**

Although we are furnishing a better lamp than ever before, we are nevertheless **prepared to meet all honest competition.** We can state very positively that efficiency, life and first cost considered, we have by far the

## MOST ECONOMICAL LAMP

that has ever been offered.

# Electric Appliance Company,

ELECTRICAL SUPPLIES.

**242 MADISON STREET, CHICAGO.**

GENERAL WESTERN AGENTS

Paranite Wires and Cables, "O. K." Weatherproof Wires and Cables.

AND REPRESENTING

NEW YORK & OHIO COMPANY, Warren, Ohio,

MANUFACTURERS OF THE PACKARD LAMP;

PACKARD ELECTRIC COMPANY, Warren, Ohio,

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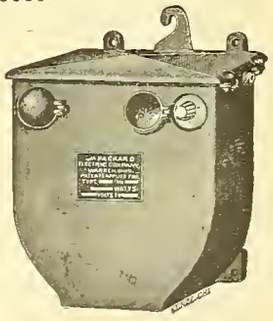

WIRES AND CABLES

WIRES AND CABLES

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WIRES AND CABLES

The Only Clocks Used in the W. U. Tel. Co. Time Service.

NO WINDING. CORRECTED HOURLY.

SELF-WINDING CLOCK CO.,
26 Broadway, NEW YORK.
*Clocks Sold. Clocks Rented.*

**PHOENIX RUBBER INSULATING PAINT.**
Water, Acid and Practically Fire Proof.

A strictly first-class insulating paint for armatures, fields, switchboards, conduits, iron and wood poles, connections, mouldings, wires, cut-out boxes, lamp hoods and all other kinds of electrical appliances where high insulation is desired.
Write for further particulars.

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SOLE MANUFACTURERS,
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**Automatic Mercurial Pumps**
OF LATEST DESIGN
For Incandescant Lamp Companies.

Scientific glass apparatus for Laboratories, Colleges, etc. Reliable workmanship and lowest prices. Agents wanted in Western Cities. **Send for new Catalogue.**

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It will pay you to get our prices
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For the WESTERN ELECTRICIAN,
—$1.00.—

**GOOD PATENTS**
Procured, **30 Years' Practice. GRANT INSURED.** Pamphlet, references and advice **free.**
CHAS. J. GOOCH, Washington, D. C.

**Boswell Storage Battery,**
For Traction Work, Electric Lighting, Electric Launch, Telegraph, Phonograph, Surgical, and for all purposes where Light and Power are required.
Prices on Application.
D. E. BOSWELL & CO.,
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# PINS AND BRACKETS

Should always be made of good material. We make a specialty of first-class Pins and Brackets, both Oak and Locust, and we would ask you to bear this in mind when ordering for your Spring construction. We also carry a full line of

# CONSTRUCTION MATERIAL,

Including Weatherproof and Underwriters' Wires, and particularly

**BISHOP WHITE CORE RUBBER COVERED WIRES AND CABLES.**

# Dearborn Electric Company,

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☞SEND FOR CATALOGUE.

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**SAMSON SPOT CORD**

For Arc Light and Trolley Cord.
SAMSON CORDAGE WORKS, - BOSTON, MASS.

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**FOR ELECTRICAL USES.**

**Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.**

**JOS. DIXON CRUCIBLE CO., Jersey City, N. J.**

# The BISHOP GUTTA-PERCHA CO.

THE BEST GRADES OF

# Wire and Cables

For under ground, under water, and all other conditions.

**Address 420-426 East 25th Street, - - NEW YORK.**
**HENRY A. REED, Secretary and Manager.**

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AGGREGATING IN CAPACITY
**260,425 Horse Power,**
ARE NOW IN USE.

**HENRY R. WORTHINGTON,**
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Philadelphia, 607 Arch St.,
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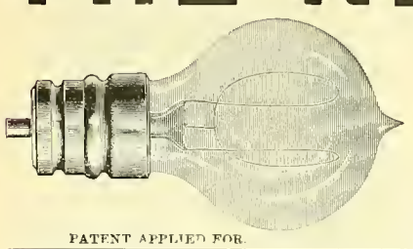
Chicago, 165 t 189 Van Buren St.,
St. Louis, Eighth and St. Charles St.

# THE NEW ÆTNA LAMP.



PATENT APPLIED FOR.

**YOU DON'T SEE THE TWIST IN THE FILAMENT.**

*THIS LAMP is specially adapted to street and general railway and steamboat use, because it is absolutely non-vibratable, and we guarantee for it 50 per cent. longer life and better service than any other lamp now on the market. The filament will not droop or get out of shape while in use, no matter at what angle it is burned.*
*A good lamp at a fair price. Ordinary lamps at ordinary prices*

**AGENTS WANTED IN LEADING CITIES.**

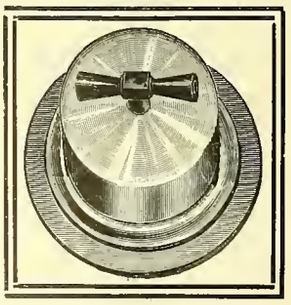
**WRITE US.** **Ætna Electric Works, Hartford, Conn.**

THIS IS A

# Cleveland Snap-Switch.

FOR 500 VOLTS.

Ask your dealer for them.



Dealers, send us your Business Card.

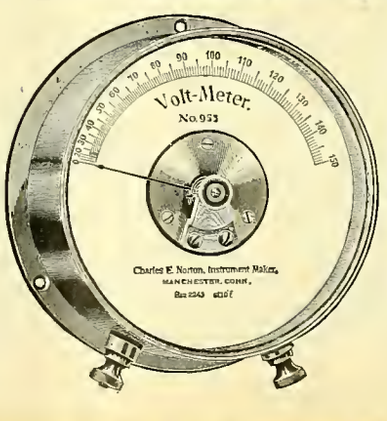
**BRYANT ELECTRIC COMPANY,**
Bridgeport, Conn., and Chicago, Ill.

We represent
R. Thomas & Sons Co.

**PORCELAIN.**

THOS. G. GRIER, EDWARD R. GRIER, } GRIER BROTHERS.
Managers Western Office.

# "THE NORTON" Ammeters and Voltmeters.




A standard instrument.
Perfect in construction.
The best instrument made for general work.
Satisfaction guaranteed.
New catalogue.
Agents wanted in leading cities.
Write us for prices and you will purchase.

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INSTRUMENT MAKER,
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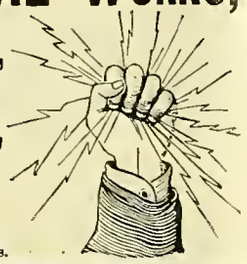
BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.



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CHICAGO STORE, F. E. Donohoe, 241 Madison St.
MONTREAL BRANCH Eugene F. Phillips' Electrical Works.

# IRON ARMORED INSULATING CONDUITS.

Two Wires in a Single Tube, the Standard Method of Electric Wiring.

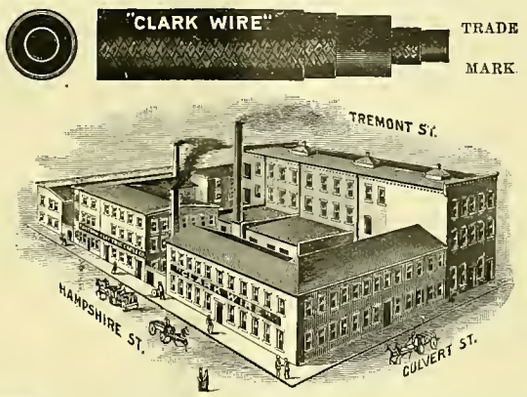
INTERIOR CONDUIT & INSULATION CO.,
527 West Thirty-fourth Street, New York.

THE
# "CLARK" WIRE.

For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

HENRY A. CLARK, Treas. and Gen'l Mgr.
HERBERT H. EUSTIS, Prest. and Electrician.




TRADE MARK.

In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."

The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first class Insulated Wire.

We shall be pleased to mail Catalogues with Terms and Discounts for Quantities.

EASTERN ELECTRIC CABLE CO.,
61 and 63 Hampshire St., Boston, Mass.

**Send for Catalogue.**

Clark Electric Specialty Mfg. Co.,
606 Temple Ct., Minneapolis, Minn.,
MANUFACTURERS OF
Switch Boards, Battery Boxes, Push Buttons, Rosette Mouldings, Etc.
Correspondence solicited.

THE CONSOLIDATED ELECTRIC STORAGE COMPANY.
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SPEAKING TUBES AND WHISTLES.
Oral, Electric, Pneumatic and Mechanical
ANNUNCIATORS AND BELLS.
Full Line Always in Stock.
W. R. OSTRANDER & CO.,
204 Fulton St., New York.
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Send for NEW CATALOGUE. Out August 1st.

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S. G. BOOKER, Supt.
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# Electric Light Carbons

*We make a specialty of MOTOR and DYNAMO BRUSHES and BATTERY MATERIAL.*

It will pay you to see our product and get our prices before placing your orders.

# The "ELECTRA" CARBONS.

A highly EFFICIENT and ECONOMICAL Arc Light Service depends on the quality of the Carbons.

**THE BEST QUALITY IS THE CHEAPEST.**

TRADE MARK

Highest Award at the World's Columbian Exposition, Chicago, 1893.

## High Grade Nuernberg Carbons

For direct and alternating current Arc Lamps, are the most economical and efficient manufactured. They produce a very brilliant and absolutely steady light.

TRADE MARK

Highest Award at the World's Columbian Exposition, Chicago, 1893.

SEND FOR NEW PRICE LISTS AND SAMPLES TO
**HUGO REISINGER,**
No. 38 BEAVER STREET, NEW YORK,
Sole Importer for the United States, Canada, Etc

**NOTICE!**—It has come to my knowledge that inferior carbons are offered to the trade under the name of "Electra," which name has been properly registered by me as my trade-mark, and therefore cannot be used by anybody else without infringing on my rights. Beware of imitations, and see that every packet of carbons bears the label with my trade-mark, "Electra."

CHICAGO AGENTS:
Electric Appliance Company.

# PHILLIPS INSULATED WIRE COMPANY,

PAWTUCKET, R. I.,

MANUFACTURERS OF

## "O. K." INSULATED WEATHERPROOF WIRE

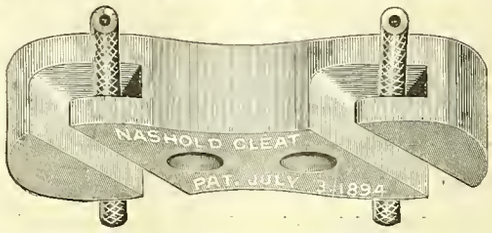
For Electric Railway and Electric Light Work.

Superior Quality. Perfect Insulation. Handsome Finish.

New York Office, 39 and 41 Cortlandt St.

# NASHOLD SELF-LOCKING CLEAT.

Patented in U. S., Canada, England, France, And Applied for In Germany.




FOR SALE BY ALL ELECTRICAL SUPPLY HOUSES.

**It is the most practical Cleat made.**
**It is made of finest glazed porcelain.**
**It is in one piece.**
**It has the strength.**

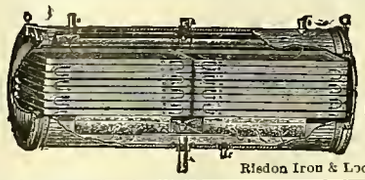
**It will lock the wire firmly.**
**It will NOT break in putting up.**
**It will NOT hold moisture.**
**It will NOT hurt the insulation.**

The wire can easily be put in place or removed without loosening the Cleat. It is a great saver in Time and Labor over any other Cleat in use for putting up Electric Light or other Wires.

## The Nashold Cleat Company,

Telephone, Harrison 636. 934-935 Monadnock Bldg., CHICAGO, ILL.

# Stilwell's Patent Live Steam-Feed Water Purifier.



**Removes all Impurities.**

Entirely prevents *scale* in Steam Boilers. Catalogue on application.

The Stilwell-Bierce & Smith-Vaile Co.,
DAYTON, OHIO.

Risdon Iron & Loc'tive Wks, San Francisco, Cal., Pacific Coast Agt.

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On and after December 1st, Baggage Agents of the B. & O. R. R. Co. will accept coupons from mileage books issued by B. & O. R. R., P. & W. R'y, B. & O. S.-W. R'y and Valley R'y of Ohio, in payment for excess baggage charges, at their face value, 2 cents each. This arrangement will not include B. & O. Mileage Books endorsed "good only on B. & O.," B. & O. Southwestern Mileage Advertising Books, nor books older than one year from date of issue.

## Cheap Trans= portation.

One-twentieth of a cent a mile, on the **Imperial Wheel.** Cheaper than other bicycles because less repairs are needed. Our convincing catalogue for the asking.

AMES & FROST COMPANY
CHICAGO, ILL.

## FOR SALE, VERY CHEAP,

Or will exchange for other material.

**8** 20-arc light U. S. E. L. Co.'s dynamos; **4** 15-arc light Hochhausen dynamos; **40** 500-volt T. H. street car motors; **100** arc lamps; **3** steam fire engines; lot new magnet wire; **2** double hoisting engines; **2** large Ferracute circular shears; **1** Hennett air compressor, 18-20x30; **1** 50-ton truck scale; **23** new electric car wheels.

WALSH'S SONS & CO., Newark, N. J.
Dealers in Scrap Iron and Metals.

## FOR SALE.

15,000 sixteen candle power genuine Edison lamps, made by the General Electric Co. All voltages from 106 to 112. Edison base only. In barrel lots 21 cents.

E. G. BRUCKMAN,
Equitable Bldg., St. Louis, Mo.

## WANTED.

First-class man to attend engine and dynamos. None but practical men need apply.

Address "H. B."
Care WESTERN ELECTRICIAN,
6 Lakeside Bldg., Chicago.

## Position Wanted

A thoroughly competent construction superintendent and general electrician of seven years' experience with T.-H. and Edison lighting and power apparatus, desires position as superintendent of lighting or railway station. Best of references furnished. Address "Superintendent,"
Care WESTERN ELECTRICIAN,
6 Lakeside Building, Chicago.

## The Brady Mast Arms.

T. H. Brady, New Britain, Conn., U. S. A.,

Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work. — *Catalogues and Prices furnished on application.*

# PROPOSALS.

The city of Knoxville, Tennessee, is about to install its own light plant. Its light committee invites persons or firms dealing in electric lighting machinery and electrical supplies to correspond with them in reference to the immediate installation of an up-to-date electric light plant of not less capacity than 250 arc lamps of standard candle power.

J. R. WADE, Chairman.

THE
## Allen Soldering Stick.

NON CORROSIVE,
CONVENIENT and EFFECTIVE.

*Price, 25 Cents.*

Agencies:
The E. S. Greeley & Co., N. Y. & Boston.
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# CEDAR POLES, STREET R. R. TIES.

*The Valentine-Clark Co.,*
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# Dynamos and MOTORS.

½ H. P. and upward.

25 to 800 Lights.

The Elliott-Lincoln Electric Co.,
1124 Payne Avenue,
CLEVELAND, OHIO.

# HIGH-GRADE TELEPHONES

We make a strictly first-class instrument for exchange service and private lines. It is a **BATTERY TELEPHONE** and is guaranteed not to infringe. Write for catalogue and prices.

THE WILLIAMS & ABBOTT ELECTRIC CO.,
46 South Water Street, CLEVELAND, OHIO.

## The NOWOTNY Telephone

Gives service equal to the best long-distance Bell telephone, and are noted for their wonderful volume of sound and clear articulation of speech.

We also **Manufacture Batteries** for every known purpose, which have a world-wide reputation.

THE NOWOTNY ELECTRIC CO., CINCINNATI, OHIO.

# BINDERS —FOR THE— WESTERN ELECTRICIAN, ONE DOLLAR.

# TELEPHONES!!

This company is manufacturing **A Compound Magneto Telephone**

Which it sells outright under a guarantee both as to efficiency and as against infringement of patents.

It talks as well over one hundred miles as any other Telephone talks over one mile.

This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists

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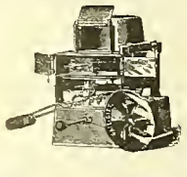
*(Stationary, Locomotive or Marine); Mechanics; Mechanical Drawing; Electricity; Architecture; Architectural Drawing and Designing; Masonry; Carpentry and Joinery; Ornamental and Structural Iron Work; Railroad Engineering; Bridge Engineering; Municipal Engineering; Plumbing and Heating; Coal and Metal Mining; Prospecting, and the English Branches.* Students make rapid progress in learning to Draw and Letter. The Steam Engineering course is intended to qualify engineers to secure Licenses. Send for free Circular, stating the subject you wish to study, to

The International Correspondence Schools, Scranton, Pa.



## NICHOLAS & BARR,

MANUFACTURERS OF
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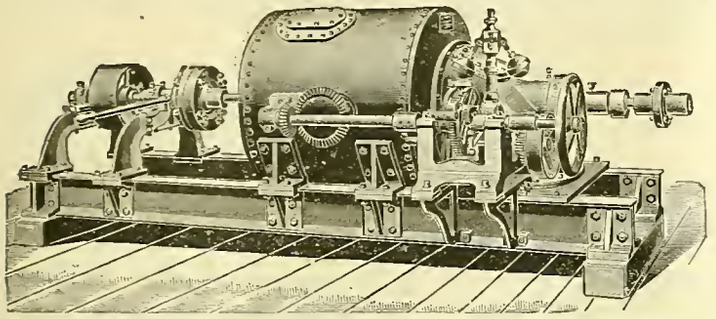

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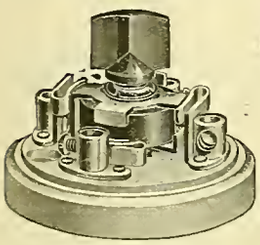

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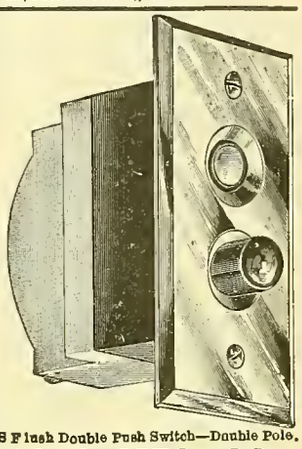

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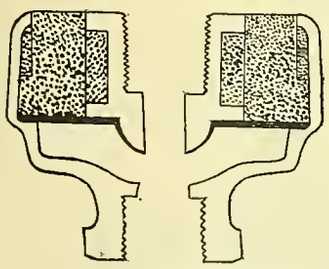

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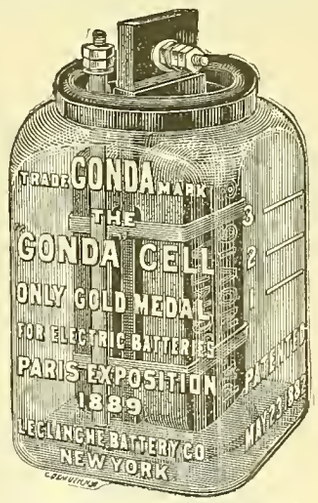


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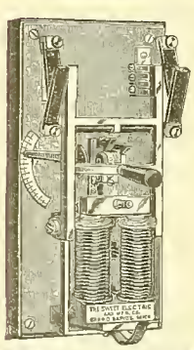

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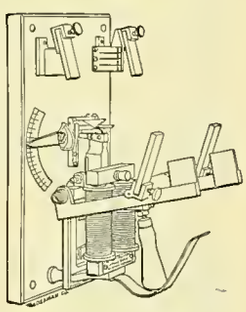

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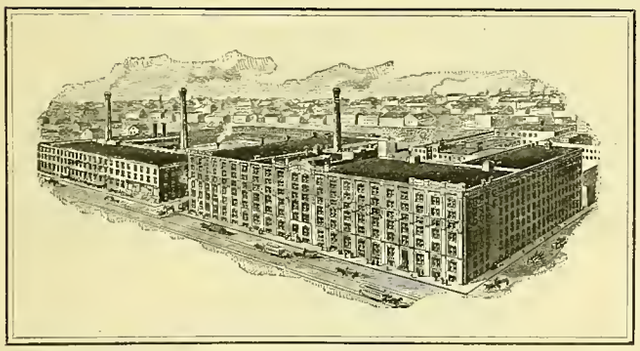

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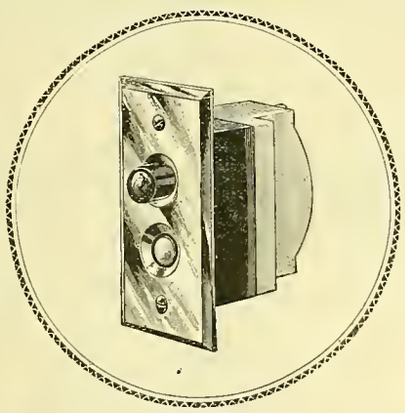

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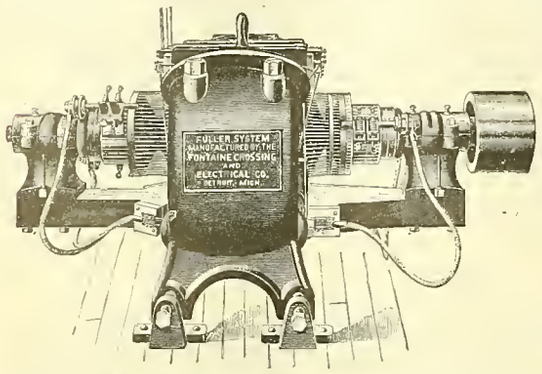

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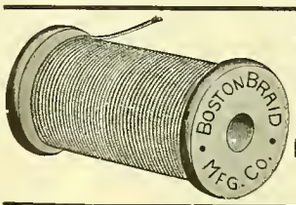


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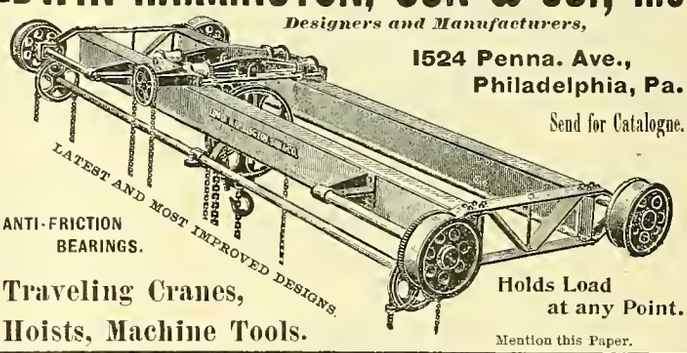


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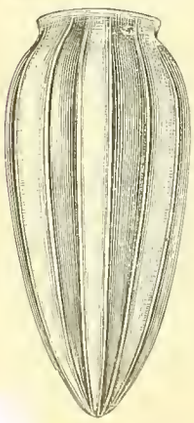

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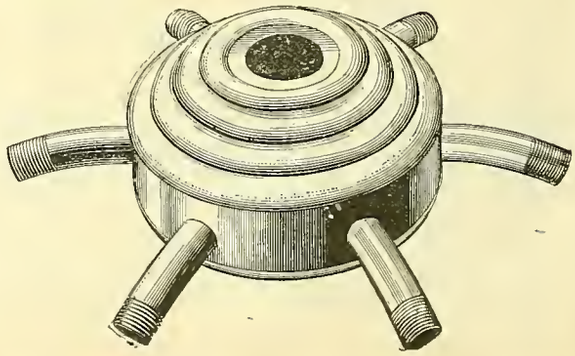

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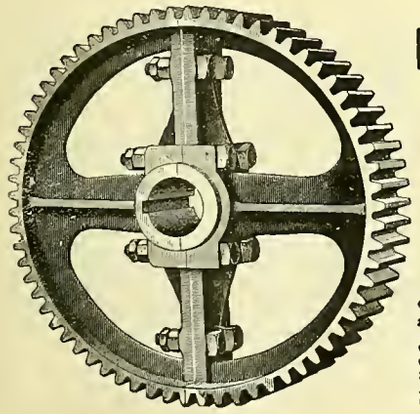

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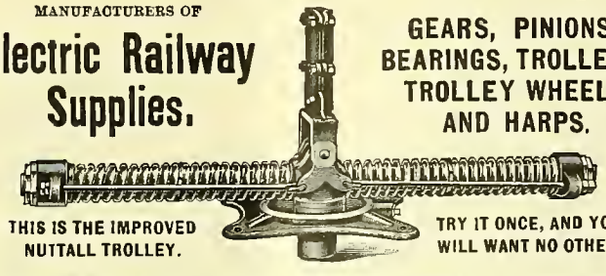

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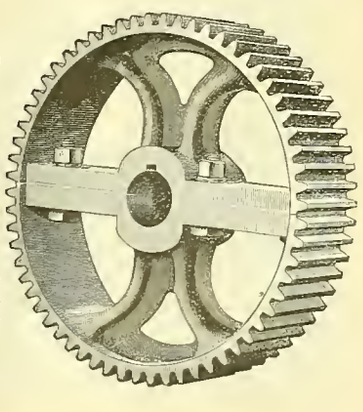

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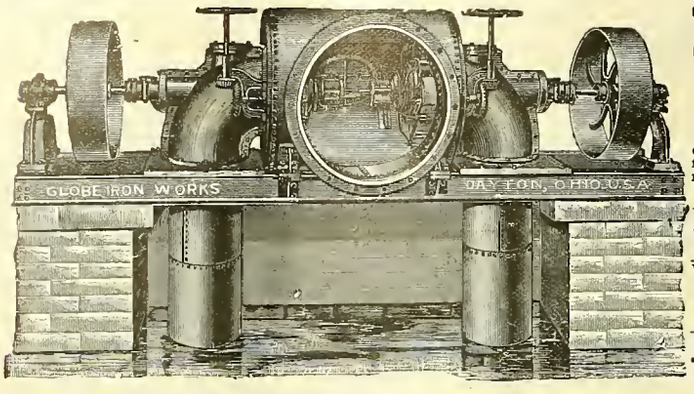


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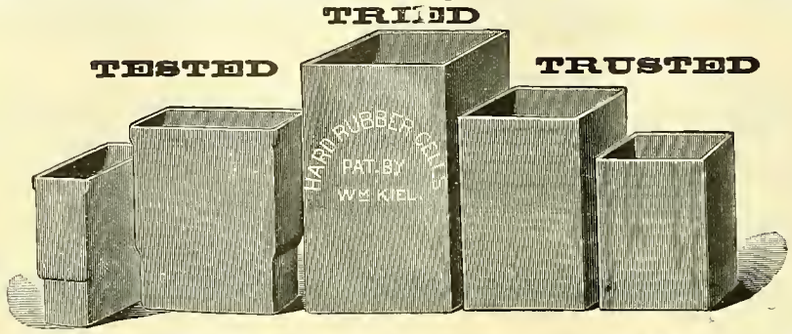


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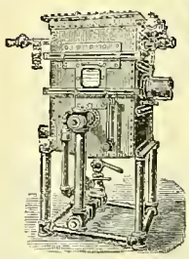

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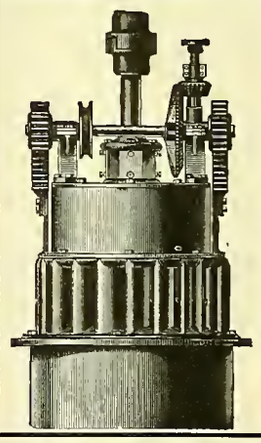

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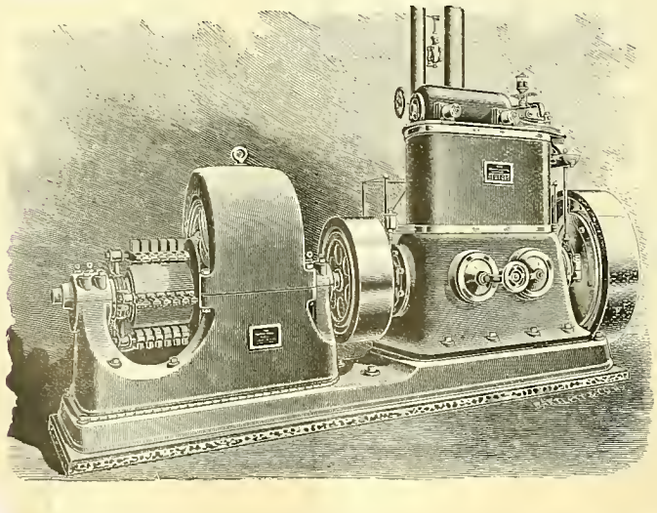

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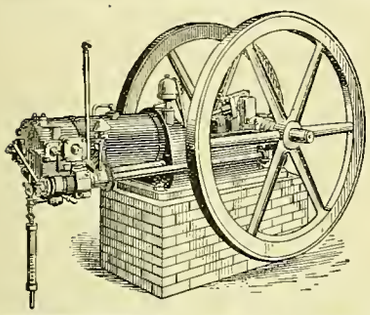

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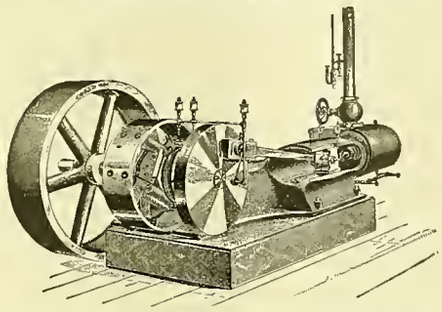

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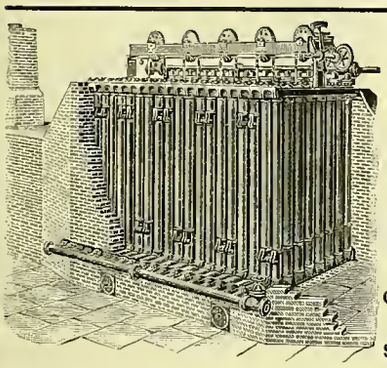

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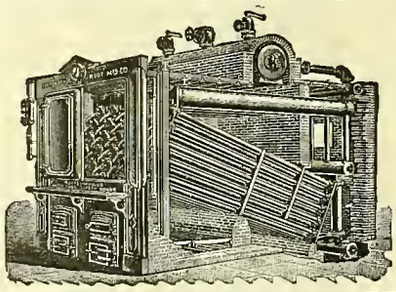

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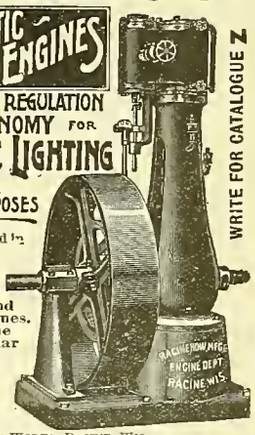

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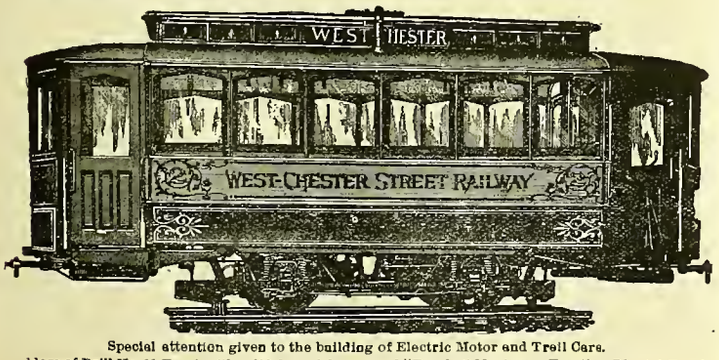


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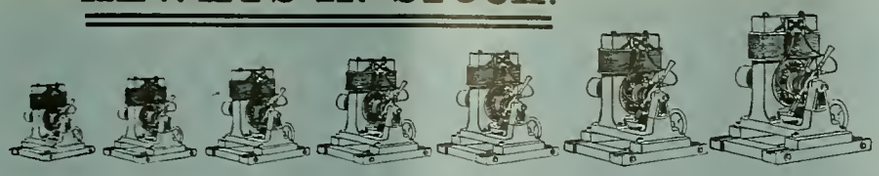

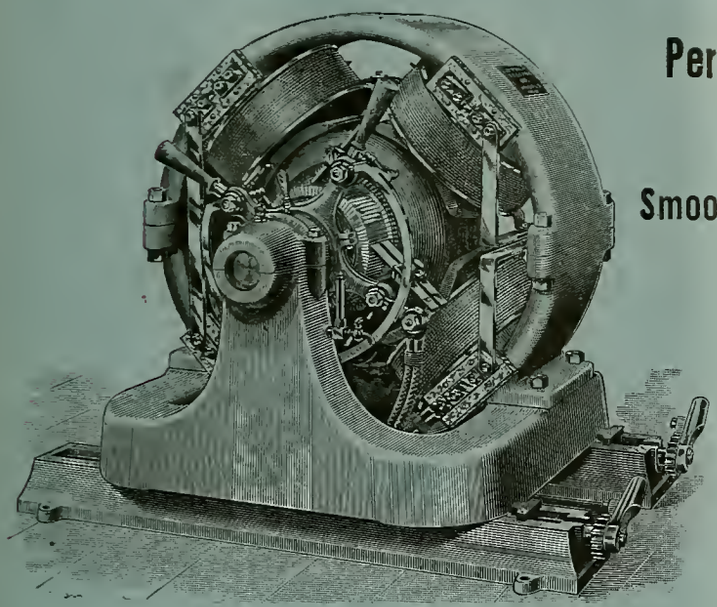

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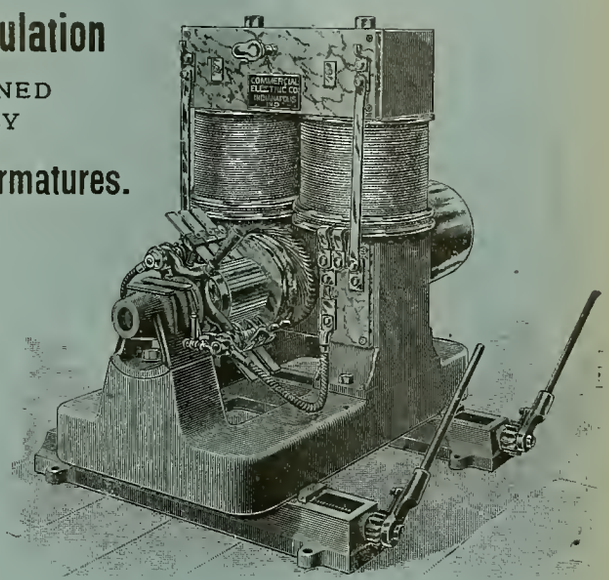

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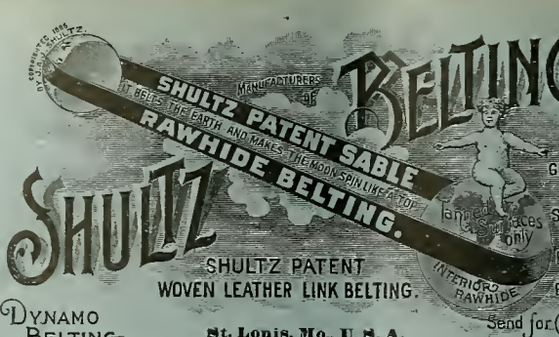


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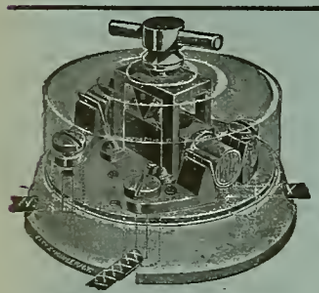

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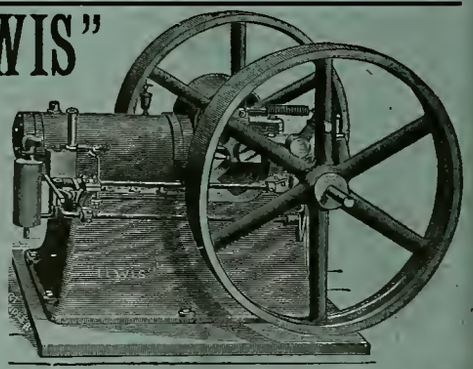

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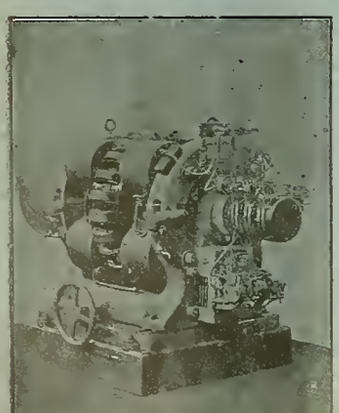

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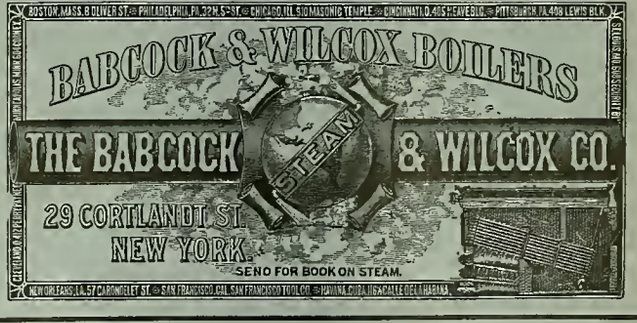
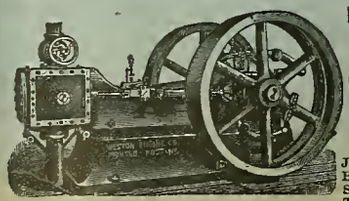



**WESTON ENGINES.**



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Estimates and Drawings Submitted.

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SCRANTON SUPPLY & MACH'Y CO., - Scranton, Pa.
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NewYork Office, 44 Broad St.

Canada, Canadian General Electric Company, Ltd., Toronto, Ont.

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## CLASSIFIED LIST.


**Accumulators.**
Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Nowotny Electric Co.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.

**Arc Lamps.**
C & C Electric Co.
Central Electric Co.
Clark Electric Co.
Corey, R. B.
Crocker-Wheeler Elec. Co,
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Mather Electric Co.
Perkins El. Switch Mfg. Co.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Central Electric Co.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Nowotny Electric Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Huebel & Manger
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Brownell & Co., The.
Clonbrock Steam Boiler Wks.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co., Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.
Phoenix Carbon Mfg. Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Bishop Gutta Percha Co.
Brixey, W. R.
Central Electric Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Corey, R. B.
General Electric Co.
Partridge Carbon Co.
Reisinger, Hugo.
Wasnington Carbon Co.
Wertheim, Ed.
Western Electric Co.

**Compound.**
Eureka Compound Co.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins Co.
National Conduit Mfg. Co.

**Construction & Repairs.**
Allen-Hussey Co.
Amstutz, N. S.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El. Const. Co.

**Contractors and Electric Light Plants.**
Allen-Hussey Co.
Amstutz, N. S.
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Clark Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Goltz & Sinclair.
Interior Conduit & Ins. Co.
Mather Electric Co.
Onondaga Dynamo Co.
Siemens & Halske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.
Copper Wires.
American Electrical Works.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co., J. R.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard U derground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co , E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Brownlee & Co.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec, Mfg. Co.
Electric Appliance Co.
Elec. Selec. & Signal Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Mason Elec. Equip. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Desks.**
Montgomery Ward & Co.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Clark Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Onondaga Dynamo Co,
Roth & Eck.
Siemens & Halske Elec. Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Allen-Hussey Co.
Amstutz, N. S.
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg, Co,
Ford, Owen.
Goltz & Sinclair.
Thayer Electric Co.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bunnell & Co., J. H.
Central Electric Co.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Norton, Chas. E.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Electrical Specialties.**
Allen, L. B.
Clark El. Specialty Mfg. Co.
Interstate Com. El. Const Co.
Nashold Cleat Co
Proctor-Raymond Elec. Co.

**Electrollers, etc.**
Edwards, W. S. Mfg. Co.
Gleason, E. P. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.
Webster Mfg. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Brownell & Co., The.
Chuse & Co., J. F.
Erie City Iron Wks.
Racine Hardware Co.
Sioux City Eng. & Iron Wks.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Central Electric Co.
Davis Elec. Co., W. J.
Diehl & Co.

**Feed Water Heaters.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Butler Hard Rubber Co.
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gauges.**
Reliance Gauge Co.

**Gears**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Bryant Electric Co.
Bunnell & Co., J. H.
Butler Mfg. Co.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Elliott-Lincoln Elec. Co.
Forest City Elec. Wks.
General Electric Co
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Mason Elec. Equip. Co.
Metropolitan Electric Co.
Morris & MacCurdy;
Nashold Cleat Co.
Nowotny Electric Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Proctor-Raymond Elec. Co.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Thayer Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Gleason, E. P. Mfg. Co.
Jaeger Mfg. Co., The.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Induction Coils.**
Splitdorf, C. F.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Mason Elec. Equip. Co.
Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Newton Rubber Wks.
Nowotny Electric Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Aetna Electric Works.
Am. Electrical Mfg. Co.
Beacon Vac Pump & Elec.Co.
Bernstein Electric Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
Jaeger Mfg. Co., The.
Mason Elec. Equip Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg. Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.
Magnet Wire.

**Mechanical Machinery.**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Hine & Robertson Co.
Lukens Iron & Steel Co.
Nicholas & Barr.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Andrae & Sons, J.
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec, Mfg, Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Onondaga Dynamo Co.
Roth & Eck.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm.Co. Ltd

**Pianos and Organs.**
Beethoven Piano & Organ Co.

**Platinum.**
Baker & Co.

**Poles.**
Brownlee & Co.
Morris, Tasker & Co.
Nuttall Co., R. D.
Valentine-Clark Co.

**Porcelain.**
Empire China Works.
General Electric Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Separators**
Goubert Mfg. Co.
Hine & Robertson Co.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Steam Pumps.**
Worthington, Henry R.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones**
Andrae & Sons, J.
Central Electric Co.
Jameson & Co., W. D.
Nowotny Electric Co.
Partrick & Carter Co.
Western Electric Co.
Western Tel. Const. Co.
Williams & Abbott Elec. Co.

**Transformers.**
Central Electric Co.
Diamond Electric Co.
General Electric Co.
Hornberger Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Trolley Cord.**
Samson Cordage Wks

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Int. Corr. Schools.
Scientific Machinist Co.

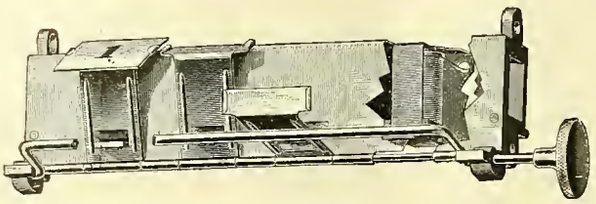
**Water Wheels.**
Smith, S. Morgan.

**Wire, Bare**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J.

"C" STYLE.
Made in Sizes from 4 to 20 Drops.

# ANNUNCIATORS

That never fail to Annunciate.



Patented Sept. 27, 1892.

This illustrates the inside construction of our Gravity-Drop Annunciator as applied to the 4 Drop "Eclipse" Case.

No Springs. No Screws. Nothing to get out of adjustment. Simplicity itself.

*Our other Specialties:*

**REX** Wood-box Bells,
**ECLIPSE** Iron-box Bells,
**SPARK** Coils,
**WOOD** Push Buttons,
Floor Pushes,
Door Connections, etc., etc.

## PROCTOR-RAYMOND ELECTRIC CO.,

Rochester, N. Y.

# To pay dividends, save them.

**Fact 1**—The **Reliance Columns** prolong the life of steam boilers. How much would it be worth to you to have your boilers last, say, five years longer than they will otherwise last?

**Fact 2**—The **Reliance Columns** save repair bills. Leaky tubes and burned crown sheets are unknown where they are used.

**Fact 3**—The **Reliance Columns** save fuel. 5c a day pays 75% per annum on their cost.

**Fact 4**—The **Reliance Columns** protect life and property. What would be the cost in life, money and stoppage of an explosion in your plant?

**Fact 5**—The **Reliance Columns** are not an expense, but an investment paying phenomenal returns. The saving of fuel, saving of repairs, and prolonged life of the boilers aggregates several times their cost every year.

**Fact 6**—The **Reliance Columns** turn loss into profit. Unless you are rich you cannot afford to operate boilers without them.

**WRITE FOR CIRCULARS** and determine the matter for yourself. You need not buy unless you wish to.

*The Reliance Gauge Company,*
SOLE MANUFACTURERS,
85 to 95 East Prospect Street, CLEVELAND, OHIO

# Low Potential Arc Lamps.

*Alternating–Helios, Old Type.*
*Spencer, New Type.*

*Direct Current–Helios, Old Type.*
*Spencer, New Type.*

**FOR STREET, PAVEMENT AND INSIDE LIGHTING.**

Our Alternating Lamps have reflector plates. Our new Direct Current Lamps do not see-saw when running in series.

Our Focusing Lamps, both direct and alternating, are adapted for stereopticon and photo-engraving work.

We also make direct current lamps to be used on street railway circuits.

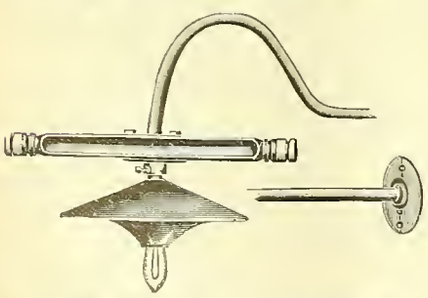
## HELIOS ELECTRIC COMPANY,

1310 Filbert St., PHILADELPHIA, PA.

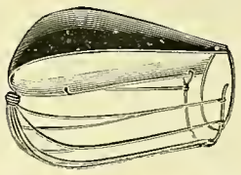
**AGENTS:**

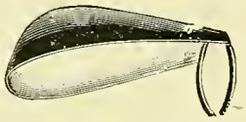
Eastern Agents: STANLEY ELECTRIC MFG. CO., Pittsfield, Mass.
Western Agents: CENTRAL ELECTRIC CO., Chicago, Ill.
Southwestern Agents: ST. LOUIS ELECTRICAL SUPPLY CO., St. Louis, Mo.
New York City Agents: GLOBE ELECTRICAL SUPPLY & CONSTRUCTION CO., Vaodam and Greenwich Streets.
MOUNTAIN ELECTRIC CO., Denver, Col., Agents for Colorado, Utah, Wyoming and New Mexico.
MACHINERY SUPPLY CO., Los Angeles, Cal., Agents for Lower California and Arizona.
CANADIAN GENERAL ELECTRIC CO., Toronto, Canada, Agents for Canada.
Agent for Texas: W. T. M. MOTTRAM, Dallas, Texas.

# WE MAKE MANY OTHER SPECIALTIES!



# WHAT ARE THEY?





*Send for Catalogue 894 and see.*

## BUTLER MANUFACTURING CO., 46 S. Clinton Street, CHICAGO.

RAMESES II. gazed thoughtfully at a decorated calendar which flapped against the embellished walls of his private office. It hung over an unused stove-pipe opening. The lazy haze of summer already permeated the air; it was the middle of June, and very hot. Rameses had discarded as much of his royal raiment as possible, without making a living picture of himself, but still he felt oppressed. A favorite valet disturbed the somnolent ether in a fitful fashion; his fan was made of double-eyed peacock feathers especially imported from the house of the great Hi Lang, China. The long handle was fashioned out of a rhinoceros tusk and inlaid with pure aluminum and incrusted with amethysts and precious stones. It was very costly. Iras, the confidential stenographer, kneeled conveniently near with a fresh tablet and a newly sharpened stylus. Rameses divided his attention between the calendar and a memorandum on his desk. He was trying to determine how it might be possible for him to raise the mortgage on his best pyramid and yet indulge in a new luxury that he had, that very morning, read of in the *Daily Papyrus*. It was a difficult problem, because the Imperial Treasurer had folded his tent intentionally and decamped with an hundred talents. He was a talented man although a thief. Things were in pretty much of a muddle, and cotton had dropped two points the day before. Suddenly a gleam of hope illumined the swarthy countenance of the king. Bringing down his fist with a bang that shook the sugar bowl on the table, he exclaimed: "This is terrible! terrible! (I wish I had that villainous Treasurer!) but I must keep cool. By Isis! I have it. Iras, take a cablegram—write '*Central Electric Company, Chicago: Send two dozen Lundell Fan Motors by first dahabiyeh, via Suez Canal, C. O. D. Rameses.*' And Iras did so and called a messenger. Then to his valet Rameses continued: "Go pawn that antequated flim-flam for a thousand denarii, and take those fan-motors out of the express office when they arrive, and—and be sure you bring me the change." And the servant departed sorrowfully, for he felt that his occupation was gone; remembering the parting injunction he muttered sotto-voice: "Y-e-s, I will, won't I?"

## What will be the next step?

Is a next step necessary? or possible?

AS IT STANDS TO-DAY.

**Iron Armored Conduit** is a concrete expression of the greatest advance yet made in the art of interior wiring. Whether there are other steps to be taken in the forward direction the future will tell; *to-day* it is all sufficient and ahead of every possible demand.

The fittings, couplings, junction boxes, the tools, all the accessories, are in keeping with this central idea of perfection.

***Conductors absolutely protected and insulated, and at the same time accessible for inspection, renewals or changes.***

Our large Chicago stock enables us to make prompt and complete shipments of Interior Conduit (iron or brass armored and plain) and all other Electrical Supplies for Central Stations, Electric Railways or Isolated Plants.

**Correspondence solicited and promptly answered.**

GENERAL WESTERN AGENTS:

**Okonite Wires and Products,**

**Interior Conduit Supplies.**

**Helios Arc Lamps**

**for Direct or Alternating Currents.**

**LUNDELL FAN MOTORS.**

# Central Electric Company,

**173-175 Adams Street,**

**CHICAGO.**

BRANCHES: Kansas City, Mo.: Gate City Electric Co.
St. Louis: Southern Electric Supply Co.

# INCANDESCENT LAMPS.

## WE MANUFACTURE THE

# "GLOBE"

## Life and Efficiency Guaranteed.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum.
Samples and Prices Furnished on Application. Correspondence Solicited.

# GLOBE ELECTRIC LIGHT CO.,

**General Offices: Carter Building, BOSTON, MASS.**

**AGENTS WANTED. WRITE US.**



Geo. E. Lockwood, President

Geo. A. Mansfield, Treas. & Manager

Michigan Agents for
Siemens & Halske Electric Co
Cutter Electrical & Mfg. Co
Simplex Electrical Co.
Automatic Switch Co.
Buckeye Electric Co.
Penn Electric Mfg. Co

Michigan Electric Company
Manufacturers of and Dealers in
General Electrical Supplies.

47 & 49 State St. Detroit February 25th, 1895

Perkins Electric Switch Mfg. Co.

Hartford, Ct.

Gentlemen:-

Saturday we received notice that our last order had been shipped.

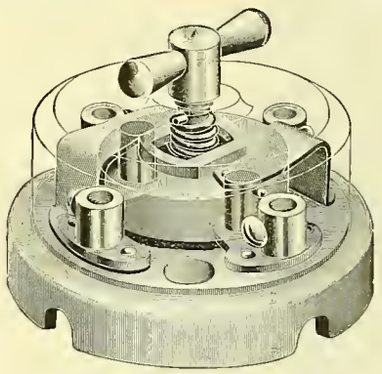
And then we are arraigned for our sins of omission and commission - to which, of course, we plead guilty - but notwithstanding our wickedness and the just indignation of our esteemed friend the undersigned he is so good as to close his indictment as follows and desire to say that if we did not consider you have an exceptionally good switch our orders for such goods would go elsewhere in the future.

We trust that nothing of this kind will occur in the future.

Yours truly.

MICHIGAN ELECTRIC COMPANY.
Geo. A. Mansfield.
Treas. &Mgr.

# GIBBS SWITCH!



## THIS IS THE "EXCEPTIONALLY GOOD SWITCH"

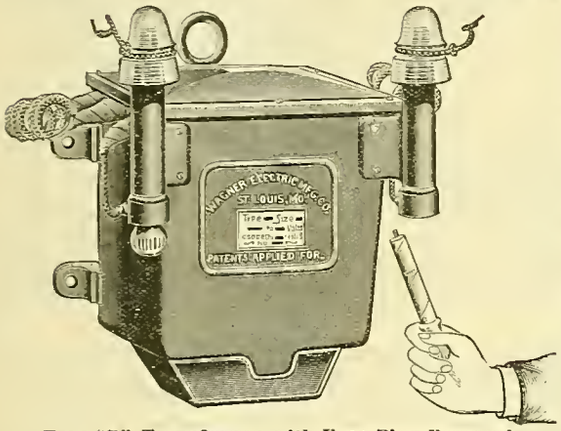
*REFERRED TO IN THE LETTER.*

## The Perkins Electric Switch Mfg. Co.,

**HARTFORD, CONN.**

| CHICAGO, | PHILADELPHIA, | BOSTON, |
|---|---|---|
| *1536 Monadnock,* | *806 Walnut St.* | *182 Summer St.* |
| G. W. Conover, Mgr. | O. D. Pierce, Mgr. | F. B. Smith, Mgr. |

# TRANSFORMERS.




Type "D" Transformer with Fuse Plug Removed.

***A New Type*** — *Transformer, Primary Cut-outs and Insulator Brackets all combined.*

No more brackets pulling off of walls.

With our wall or cross-arm hooks, transformer may be *Hung* and *Connected* in *Five minutes.*

Our new fuse plugs will not hold an arc with 5,000 volts.

*Our Transformers* are acknowledged by all experts to be the *Highest* in *Efficiency* ever made.

Adopted by the largest stations in the country.

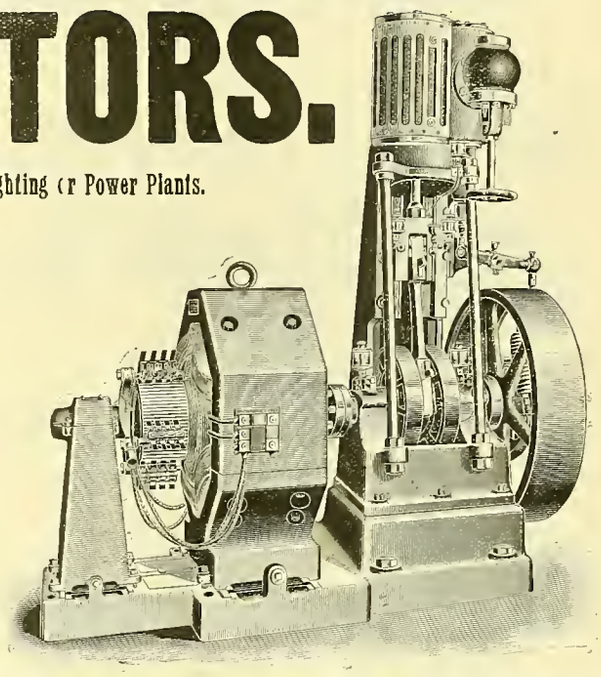
*We Challenge Competition* in any form of test, in laboratory or practical use.

Made in all sizes, 5 lights to 3,000 lights.

JOHN MUSTARD, Betz Building, Philadelphia, Pa.
1564 Monadnock Block, Chicago, Ill.

## Wagner Electric Mfg. Co., ST. LOUIS, MO.

# EDDY GENERATORS.



Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*

## THE EDDY ELECTRIC MFG. CO.,

*WINDSOR, CONN.*

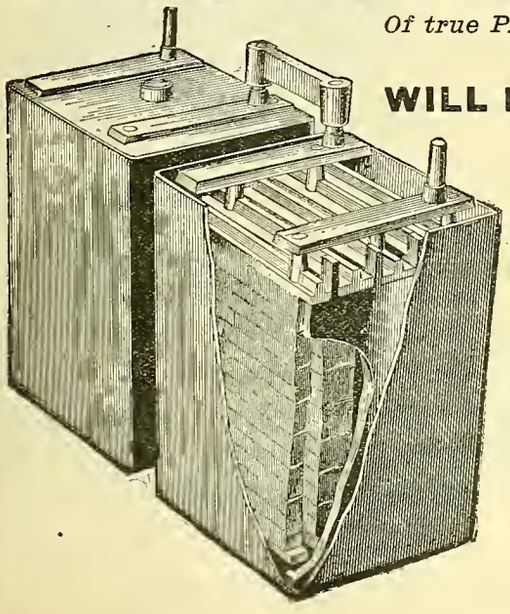
NEW YORK OFFICE, HAVEMEYER BLDG.

*REPRESENTED BY:*

Walter C. McIntire & Co., 506 Commerce St., Philadelphia, Pa.
Western Electrical Supply Company, St. Louis, Mo.
F. P. Little Electrical Construction & Supply Co., Buffalo, N. Y.
W. T. Osborn, Kansas City, Mo.
D. P. GOSLINE, 30 Oliver St., Boston, Mass.

All Our Apparatus Guaranteed as Represented.

# STANDARD PLANTE STORAGE BATTERIES



*Of true PLANTE Type and CRYSTALLINE FORMATION.*

Will give or receive without injury, currents that would destroy other batteries.

## WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.

Contain no asbestos or other separating material to increase their internal resistance.

## ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

## Highest efficiency, largest delivery, lowest internal resistance.

For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

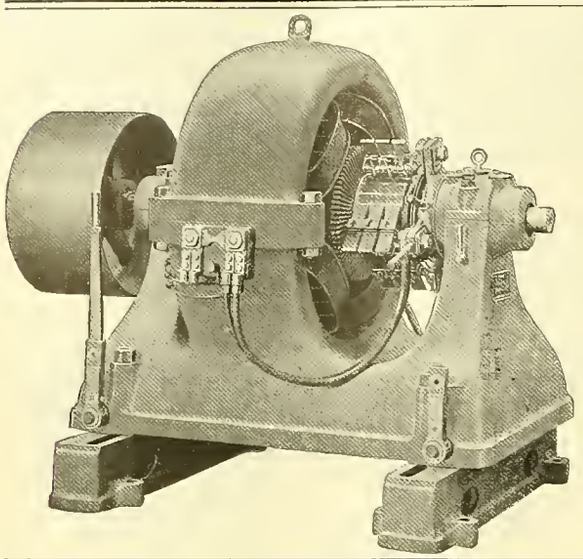
## Cannot be damaged by excessive charge or discharge currents.

A 400 ampere current has been taken from a 120 ampere hour cell.

☞ CHALLENGE: { We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

## ELECTRIC POWER STORAGE COMPANY,

Room 1210 Havemeyer Building, 26 Cortlandt Street, New York.



# The Walker Mfg. Company,

**CLEVELAND, OHIO,**

Manufacturers of all kinds of Electrical Apparatus, specially large size

## GENERATORS,
## Street Railway Motors,
## INCANDESCENT MACHINES, Etc., Etc.

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## QUALITY is our Standard of Value.

♦♦♦♦♦♦♦♦♦♦♦♦

# THE UNITED ELECTRIC IMPROVEMENT CO.,

OFFICE AND WORKS:
19th St. and Allegheny Ave., Philadelphia,

Manufacturing and Constructing Electrical Engineers.

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Complete Alternating Current Equipment for Central Stations.
Direct Current Multipolar and Bipolar Dynamos for Isolated Plants, Storage Battery Installations and Power Transmissions.
Improved Long Distance Series Incandescent Apparatus for Street and Commercial Illumination.
Series Incandescent Lamps for any Current and to fit any Standard Socket.
Transformers, Motors and Arc Lamps for Alternating Currents.
The Wirt Improved Volt and Ampere Meter for Direct and Alternating Currents—dead beat and can be left in circuit continuously.
Estimates Furnished for Complete Switch Boards.
Storage Battery Installations for any Capacity or Service.
Correspondence Solicited.

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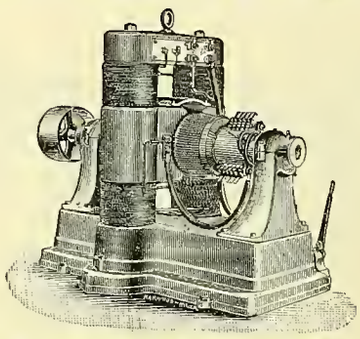
## ONONDAGA DYNAMO CO.,

MANUFACTURERS OF **DYNAMOS AND MOTORS.**

SPECIAL ATTENTION GIVEN TO EQUIPPING MILLS AND FACTORIES.



ELECTRICAL APPARATUS, WIRE, LAMPS, ETC.

**SYRACUSE, N. Y., U. S. A.**
**Western Office, 1105 Monadnock Building, - CHICAGO.**
LESLIE W. COLLINS Manager.

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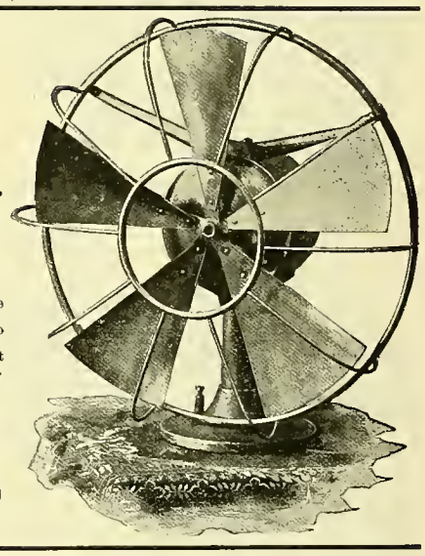
# THE BEST ELECTRIC FAN
## On the Market.

**For Alternating Current, Wound for 50 or 100 volts.**

The Fan is 14 inches in diameter.
Will always start when current is on
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

Agents Wanted in Different Localities.

For further information address
THE
**W. J. Davis Electric Co.,**
**PITTSFIELD, MASS.**



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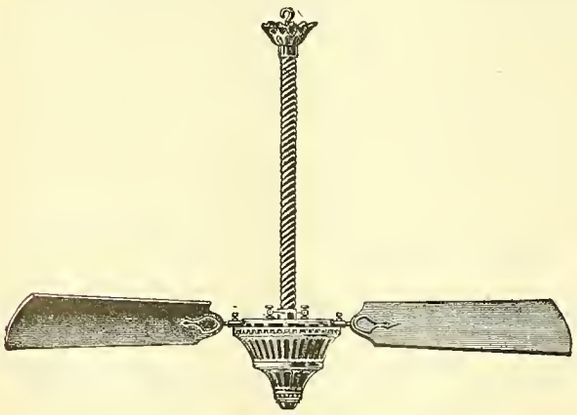
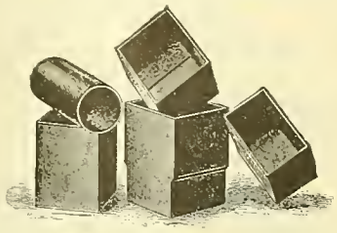


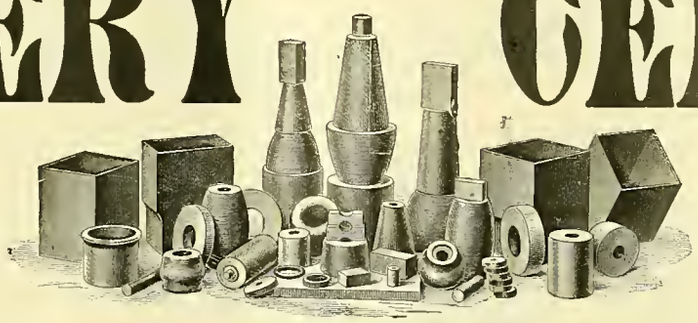
**AN EMPHATIC SUCCESS!**
**THE DIEHL ELECTRIC FANS WIRED IN A SERIES OF TWO OR MORE ON A STREET RAILWAY CURRENT.**

**DIEHL & COMPANY, 385 BROADWAY, NEW YORK.**

# THE FREEMAN



# BATTERY CELLS.



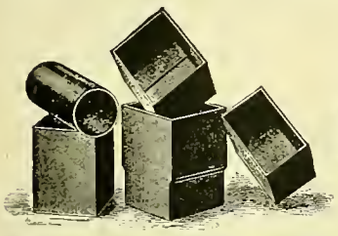
**Estimates Furnished on Application. Prompt Delivery.**

**Standard Sizes Always on Hand.**

The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplished, providing additional strength to such an extent that this cell can be used where no other would be practical.

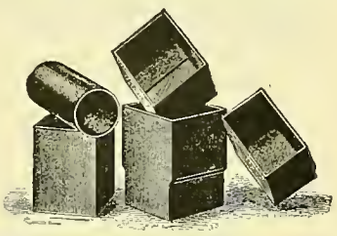
**Agents Wanted in all Cities.** **Write us for information and catalogue.**

THE



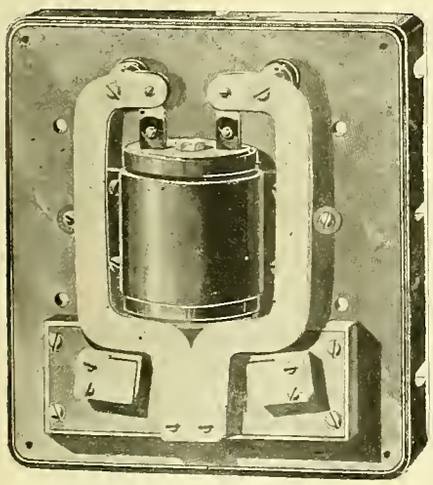
## Newton Rubber Works,

Newton Upper Falls, Mass.



## SINCE MARCH 1st

# Our New (Model 1895) Electric Light and Power Controllers



HAVE BEEN ADOPTED BY CENTRAL STATIONS OPERATING

**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{On}{Out}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

OUR GENERAL WESTERN AGENTS ARE

## WALLACE ELECTRIC CO., 307 DEARBORN ST., CHICAGO.

## ELECTRIC SELECTOR & SIGNAL CO., 45 Broadway, New York.

# ARE YOU BUYING

Your rubber covered wire from us? If not, you are

# MAKING A MISTAKE,

As we are furnishing our celebrated Paranite Wire, the grade of which has always been maintained at the highest point, at prices that

# GET THE BUSINESS.

Paranite Wire is known the world over as the highest possible grade of rubber insulation, and where the conditions are particularly severe, such, for instance, as brewery and stockyard work, Paranite is always chosen.
We are making

# LOW PRICES

On our other specialties and our line of general supplies.

**ELECTRIC APPLIANCE COMPANY,**
ELECTRICAL SUPPLIES. 242 Madison Street, CHICAGO.

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—OF—

All Colors and Descriptions.

**Automatic Mercurial Pumps**
OF LATEST DESIGN
For Incandescent Lamp Companies.

Scientific glass apparatus for Laboratories, Colleges, etc. Reliable workmanship and lowest prices. Agents wanted in Western Cities. **Send for new Catalogue.**

**The Jaeger Mfg. Co.,**
169 William St., NEW YORK.

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**OCTAGONAL PINE POLES,**
**NORWAY PINE CROSS-ARMS,**
**WHITE OAK PINS.**
It will pay you to get our prices.
BROWNLEE & CO., - Detroit, Mich.

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**BINDERS**
For the WESTERN ELECTRICIAN,
—$1.00.—

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**GOOD PATENTS**
Procured. **30 Years' Practice.** **GRANT INSURED.** Pamphlet, references and advice **free.**
CHAS. J. GOOCH. Washington, D. C.

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**Boswell Storage Battery.**
For Traction Work, Electric Lighting, Electric Launch, Telegraph, Phonograph, Surgical, and for all purposes where Light and Power are required.
Prices on Application.
D. E. BOSWELL & CO.,
154 Lake St., Chicago.

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**Miamisburg Electric Co., - Miamisburg, Ohio.**

**IMPERIAL DRY BATTERY.**
Guaranteed the best Dry Battery ever made. Internal short circuiting or local action is eliminated. Will not deteriorate when not doing work. Will hold its first value over long periods of time. Internal resistance small; high and constant E. M. F. Will not run down or die on the shelf. No bursting of seals or oozing of salts from the top.

**Burnley Cartridge Battery.**
Cartridge or Porone Cups made of especially prepared paper. One-half the size and one-third the weight of other porous cups. Guaranteed to be equal to any Salammoniac battery made. The cheapest battery now on the market.

**TEMPERED COPPER.**
All patterns of tempered copper segments guaranteed true to gauge, free from defects; no alloy; finish and temper equaled by none. Exclusively used by some of the largest companies in the country.

**All Batteries Guaranteed. Send for Catalogue.**

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SEND FOR SAMPLES AND PRICES OF

**SAMSON SPOT CORD**

For Arc Light and Trolley Cord.
SAMSON CORDAGE WORKS, - BOSTON, MASS.

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**GRAPHITE SPECIALTIES**
FOR ELECTRICAL USES:
Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.
JOS. DIXON CRUCIBLE CO., Jersey City, N. J.

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# Mason Electric Equip. Co.,

24 Plymouth Place, - CHICAGO, ILL.
SELLING AGENTS:
**Medbery Overhead Material,**
**Genuine Graphite Trolley Bushings,**
**Tracy Patent Oil Filter,**
AND OTHER SPECIALTIES.

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**SAL AMMONIAC**
(ELECTRIC BRAND)
**For Electrical Purposes**
Guaranteed 98/99% and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by
A. KLIPSTEIN & COMPANY, 122 Pearl St., New York.

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**"THE NORTON" Ammeters and Voltmeters.**

A standard instrument.
Perfect in construction.
The best instrument made for general work.
Satisfaction guaranteed.
New catalogue.
Agents wanted in leading cities.
Write us for prices and you will purchase.

**Charles E. Norton,**
INSTRUMENT MAKER,
Manchester, Conn.

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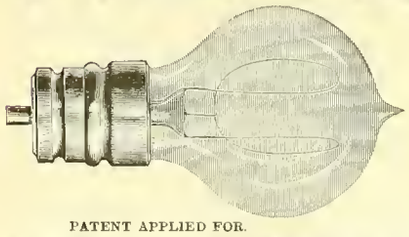
# THE NEW ÆTNA LAMP.



PATENT APPLIED FOR.

YOU DON'T SEE THE TWIST IN THE FILAMENT.

*THIS LAMP is specially adapted to street and general railway and steamboat use, because it is absolutely non-vibratable, and we guarantee for it 50 per cent. longer life and better service than any other lamp now on the market. The filament will not droop or get out of shape while in use, no matter at what angle it is burned.*
*A good lamp at a fair price. Ordinary lamps at ordinary prices.*

AGENTS WANTED IN LEADING CITIES.

WRITE US. **Ætna Electric Works,** Hartford, Conn.

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**INCANDESCENT STREET LIGHTING FROM ALTERNATING CURRENT DYNAMOS.**
Series Lamps. Series Sockets. Street Fixtures.

Incandescent Lamps for Arc and Multiple Circuits.

Trial orders mean permanent business. Correspondence solicited.

**BERNSTEIN ELECTRIC CO., - Boston, Mass.**

EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Secy.

# AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.

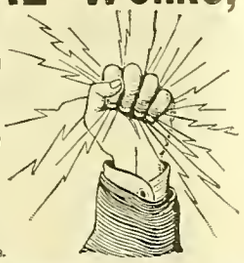
## BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,

## Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

CABLES FOR AERIAL AND UNDERGROUND USE.



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# IRON ARMORED INSULATING CONDUITS.

Two Wires in a Single Tube, the Standard Method of Electric Wiring.

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THE

# "CLARK" WIRE.

TRADE MARK.

For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

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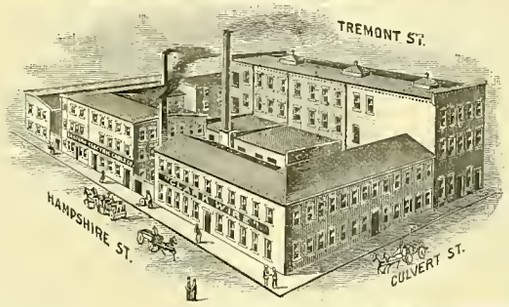


In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."

The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire.

We shall be pleased to mail Catalogues with Terms and Discounts for Quantities.

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## Clark Electric Specialty Mfg. Co.,

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MANUFACTURERS OF

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Water, Acid and Practically Fire Proof.

A strictly first-class insulating paint for armatures, fields, switchboards, conduits, iron and wood poles, connections, mouldings, wires, cut-out boxes, lamp hoods and all other kinds of electrical appliances where high insulation is desired. Write for further particulars.

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We congratulate you upon your success.

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HELIOS ELECTRIC CO.
Thos. Spencer
Supt.

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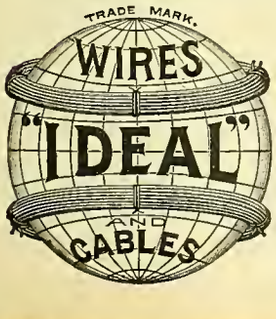
Approved by the New York Board of Fire Underwriters.

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**It will not Deteriorate by long use, nor Oxidize the Copper. Finished in the following Styles: Black Polished, White and Black Glazed Braid and White Fireproof.**

We can freely recommend this Wire for all inside wiring, from the fact that recent insulation tests made by reliable authorities show that it stands very high.

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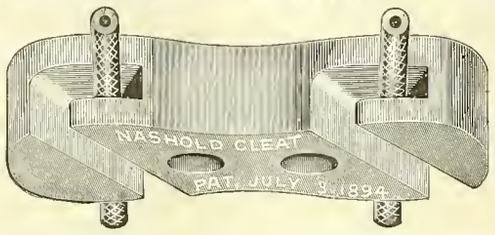
Patented in U. S., Canada, England, France, And Applied for In Germany.




FOR SALE BY ALL ELECTRICAL SUPPLY HOUSES.

**It is the most practical Cleat made.**
**It is made of finest glazed porcelain.**
**It is in one piece.**
**It has the strength.**

**It will lock the wire firmly.**
**It will NOT break in putting up.**
**It will NOT hold moisture.**
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The wire can easily be put in place or removed without loosening the Cleat. It is a great saver in Time and Labor over any other Cleat in use for putting up Electric Light or other Wires.

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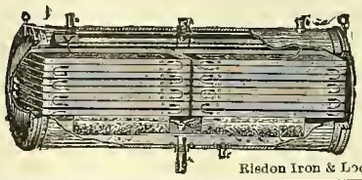
# Stilwell's Patent Live Steam-Feed Water Purifier.



**Removes all Impurities.**

Entirely prevents *scale* in Steam Boilers. Catalogue on application.

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NON CORROSIVE, CONVENIENT and EFFECTIVE.

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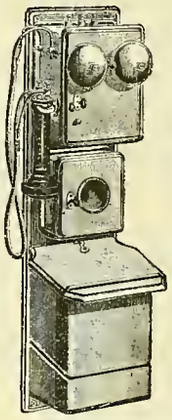

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By young married man, position as electrician or superintendent of street railway or electric light plant. Have had five years' experience in all branches of construction and operation. Can give best of references. Address "K,"
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First-cass man to attend engine and dynamos. None but practical men need apply.

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A thoroughly competent construction superintendent and general electrician of seven years' experience with T.-H. and Edison lighting and power apparatus, desires position as superintendent of lighting or railway station. Best of references furnished. Address "**superintendent,**"
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Electrical engineer (29), married, wants position with small manufacturing company or in central station; eight years' practical experience in the manufacture, installation and running of lighting, traction and electric welding machinery. First-class references. Address "**C. E.**"
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Competent, energetic young man, to invest from $500 to $1,000 and take charge of the wire work and trouble work of a good company in a growing city. One who can set up a dynamo and also understands telephone line work preferred. Reasonable salary paid and steady employment. No intemperate man wanted. Address "**G.**"
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# PROPOSALS.

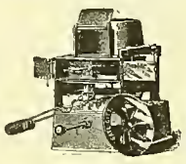
The city of Knoxville, Tennessee, is about to install its own light plant. Its light committee invites persons or firms dealing in electric lighting machinery and electrical supplies to correspond with them in reference to the immediate installation of an up-to-date electric light plant of not less capacity than 250 arc lamps of standard candle power.

J. R. WADE, Chairman.

# Proposals.

Notice is hereby given to all electric light companies supplying light to cities, that the contract by which the city of Johnstown, Pa., is now lighted will expire in September, 1895, and the councils of the city of Johnstown hereby invite proposals for the furnishing of light to the city for a term of three or five years. About two hundred (2,000 candle power) arc lamps will be required. The right of way over and through the streets and alleys will be granted for the erection of poles. A plant can be centrally located and supplied with coal at less than one dollar per ton.

**NICHOLAS & BARR,**
MANUFACTURERS OF
**GATE CITY SOLDERING FURNACE,**
28 W. Washington Street, Chicago, Ill.



The Gate city soldering furnace has the following points of excellence: 1. Economy of fuel.—2. Simplicity in construction and operation.—3. The only burner that cannot be clogged up.—4. Has a fixed pump.—5. Especially adapted to plumbers', tinners', cornice-makers' and roofers' use, and for conduit, electric light and telephone work.—6. Can be used with ease in strong wind on roofs.

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This company is manufacturing **A Compound Magneto Telephone** which it sells outright under a guarantee both as to efficiency and as against infringement of patents.

It talks as well over one hundred miles as any other Telephone talks over one mile.

This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists.

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# The NOWOTNY Telephone

Gives service equal to the best long-distance Bell telephone, and are noted for their wonderful volume of sound and clear articulation of speech.

We also **Manufacture Batteries** for every known purpose, which have a world-wide reputation.

**THE NOWOTNY ELECTRIC CO.,** CINCINNATI, OHIO.

# HIGH-GRADE TELEPHONES

We make a strictly first-class instrument for exchange service and private lines. It is a **BATTERY TELEPHONE** and is guaranteed not to infringe. Write for catalogue and prices.

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25 to 800 Lights.

½ H. P. and upward.

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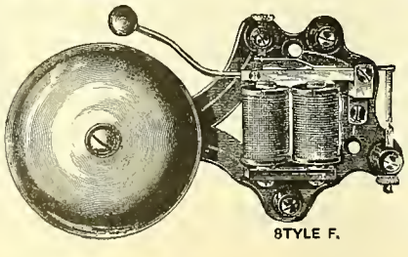

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Bronze Push Buttons, Window and Door Springs, Floor Pushes, Switches.

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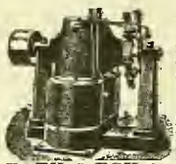

**$24.00 SPECIAL**

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# The Wirt Dynamo Brush.

Suitable for all Incandescent Dynamos, Plating Dynamos, Alternating Generators and Exciters, Electric Railway Generators, Stationary Motors.

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Bradbury-Stone Electric Storage Co.,
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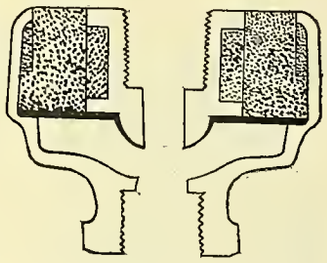

Sectional View—Patented July 10, 1894—Full Size.

**For Insulating Fixtures.**

This joint conforms to the requirements of Underwriters' rules. Write for prices and circulars.

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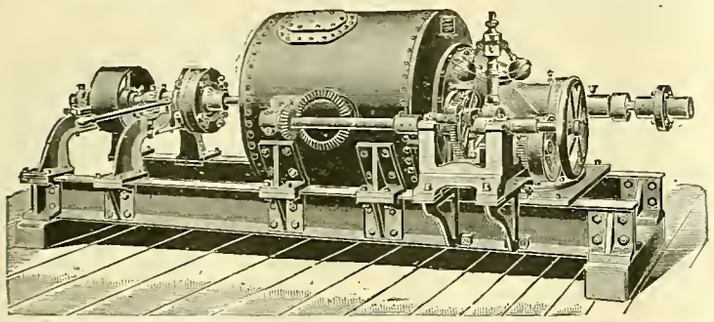

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The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double the power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

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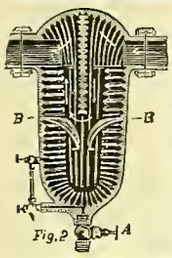


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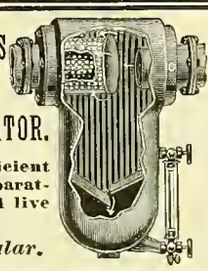

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***Get Circular.***

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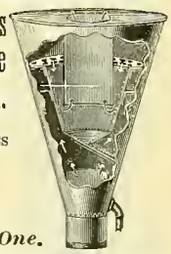

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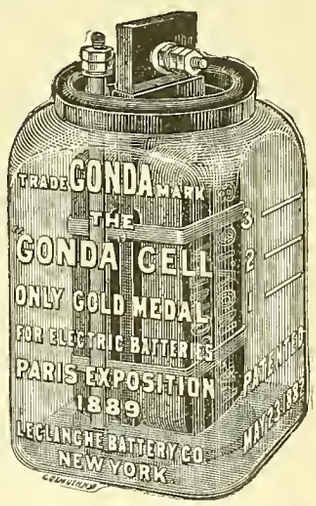


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SEND FOR CIRCULAR AND PRICES.

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***111 to 117 East 131st St., N. Y.***

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**Sole Manufacturers,**

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## MANUFACTURERS OF WROUGHT-IRON CEMENT-LINED TUBES FOR ELECTRIC SUBWAYS.

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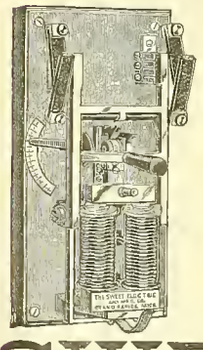

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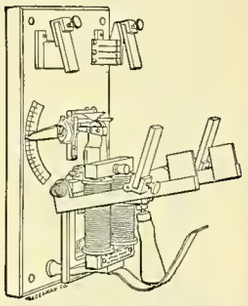

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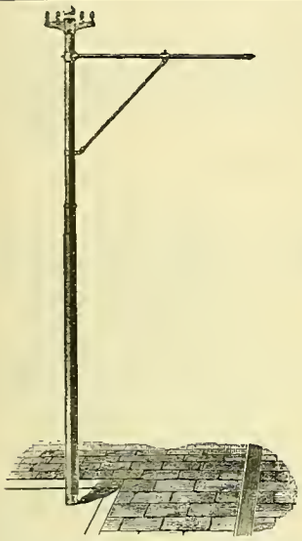

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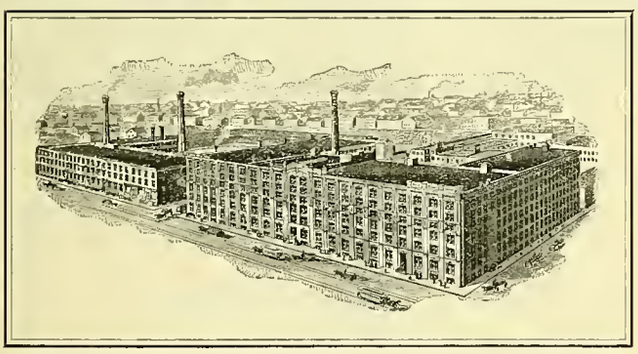

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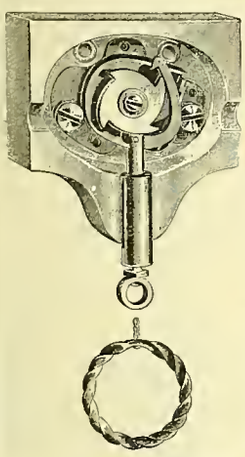
**Chandelier Switch.**



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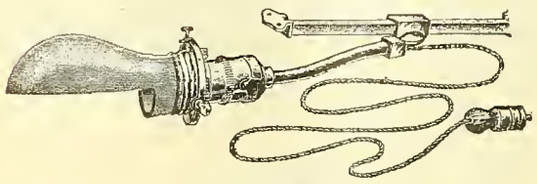

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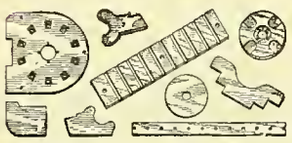

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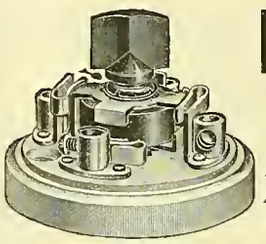

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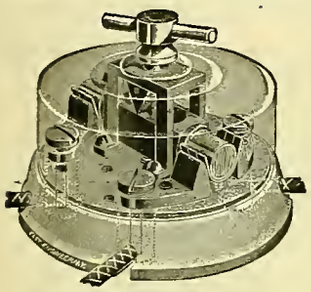
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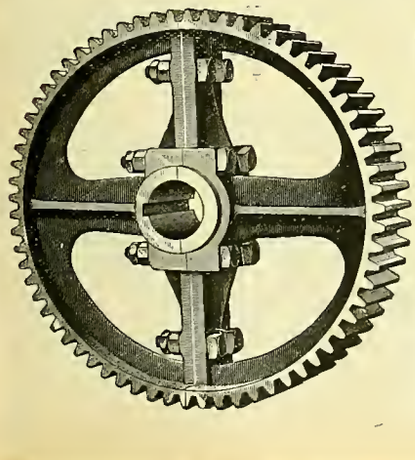
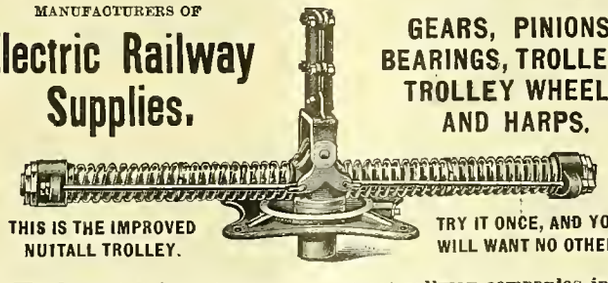
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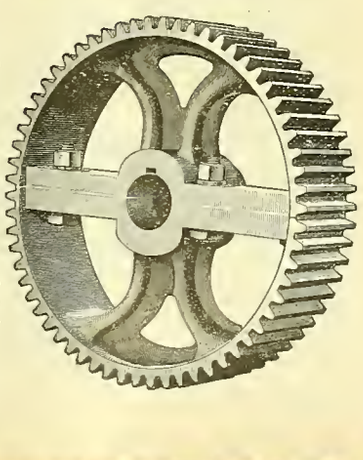
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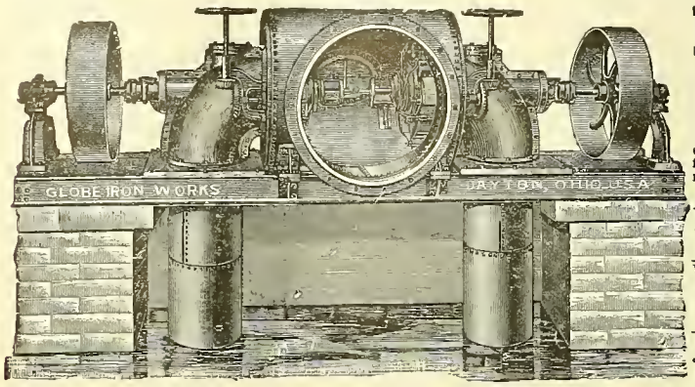


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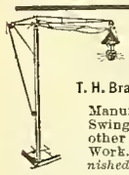

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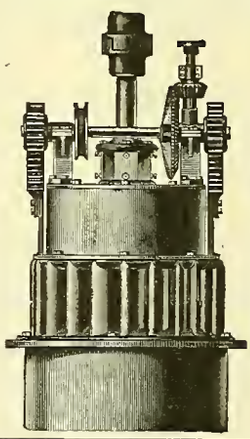

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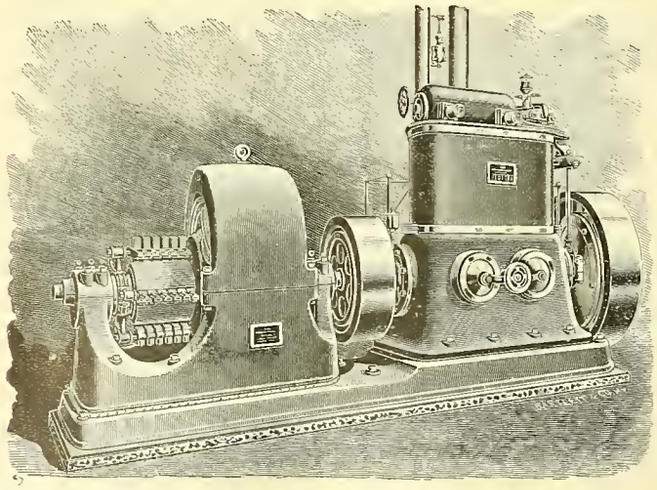

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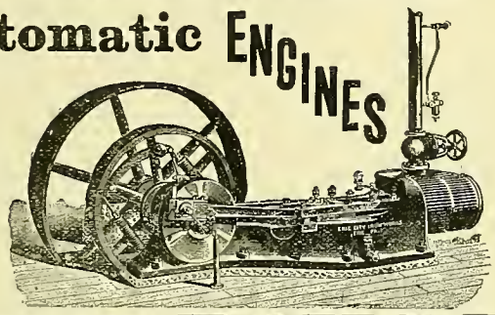

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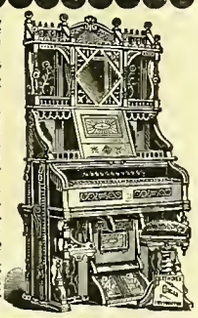

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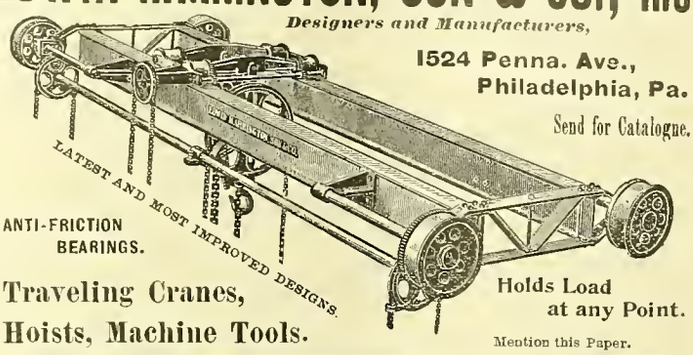


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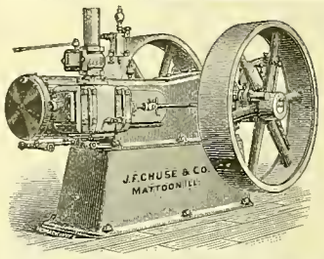


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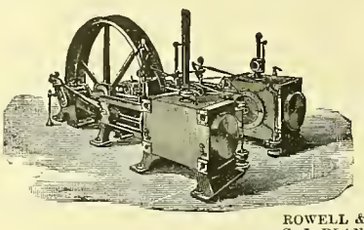

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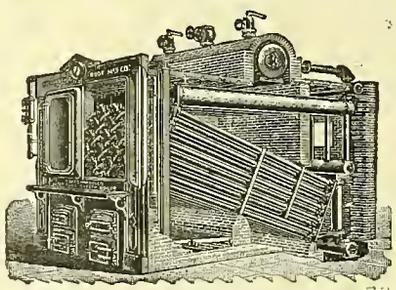

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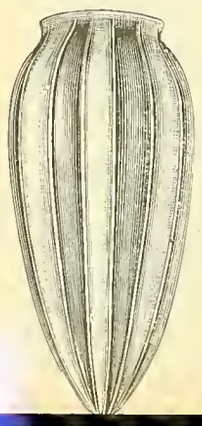

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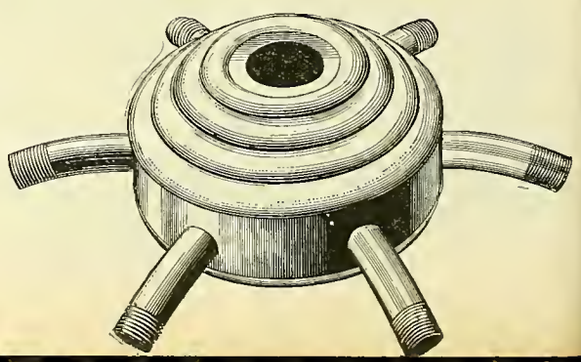

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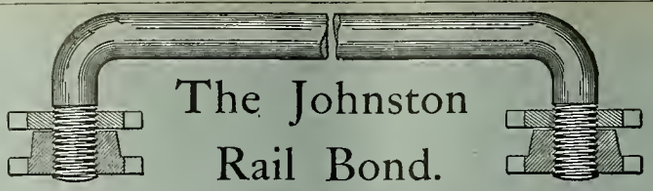

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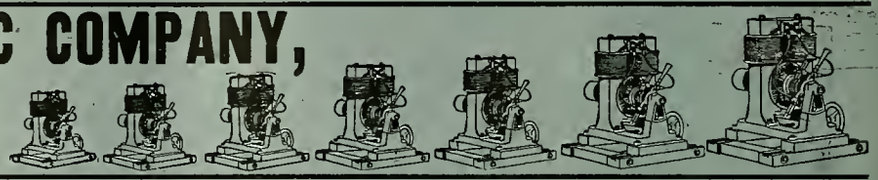

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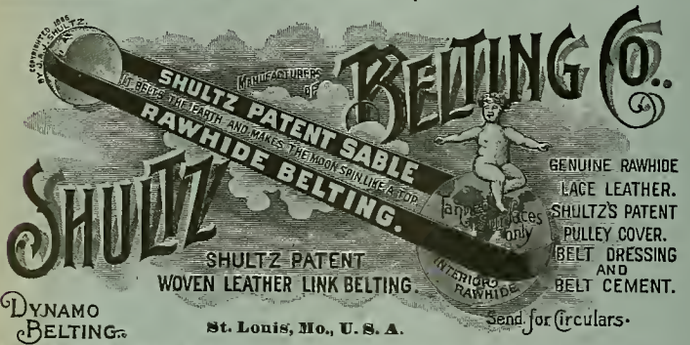


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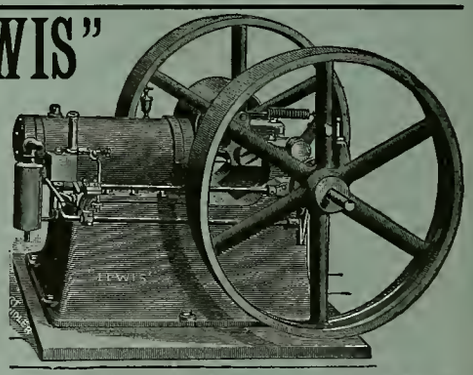


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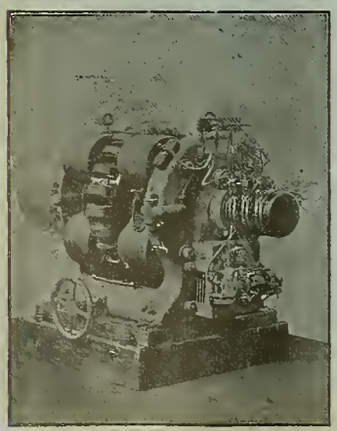

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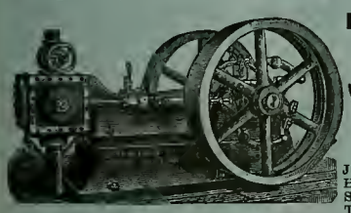

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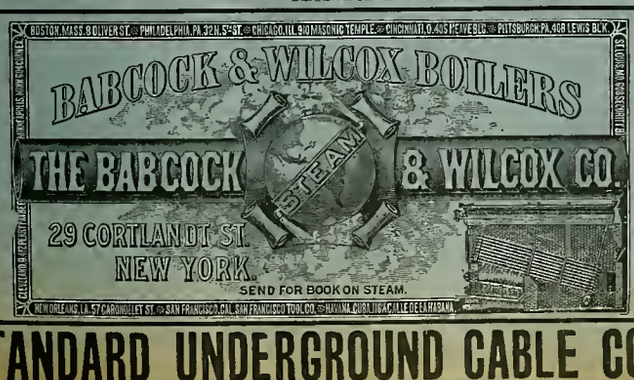


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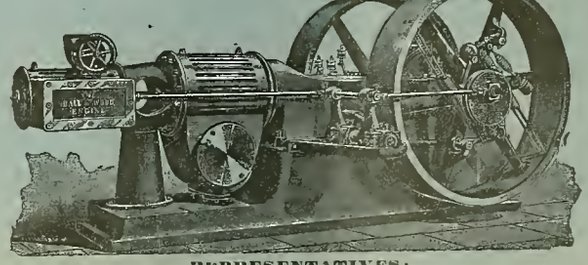

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## CLASSIFIED LIST.


**Accumulators.**
Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Cons. Electric St rage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co,
Nowotny Electric Co.
Ostrander &Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.

**Arc Lamps.**
C & C Electric Co.
Central Electric Co.
Clark Electric Co.
Corey, R. B.
Crocker-Wheeler Elec. Co,
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Mather Electric Co.
Perkins El. Switch Mfg. Co.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. B.
Central Electric Co.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Nowotny Electric Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Huebel & Manger
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Brownell & Co., The.
Clonbrock Steam Boiler Wks.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co., Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.
Phœnix Carbon Mfg. Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric.** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co
Wallace Electric Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Corey, R. B.
General Electric Co.
Partridge Carbon Co.
Reisinger, Hugo.
Wasnington Carbon Co.
Wertheim, Ed.
Western Electric Co.

**Compound.**
Eureka Compound Co.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins Co.
National Conduit Mfg. Co.

**Construction & Repairs.**
Allen-Hussey Co.
Amstutz, N. S.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El Const. Co.

**Contractors and Electric Light Plants.**
Allen-Hussey Co.
Amstutz, N. S.
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Clark Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Onondaga Dynamo Co.
Siemens & Balske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co , E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. B.
Brownlee & Co.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec, Mfg, Co.
Electric Appliance Co.
Elec. Selec. & Signal Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Desks.**
Montgomery Ward & Co.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Clark Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Onondaga Dynamo Co,
Roth & Eck.
Siemens & Halske Elec. Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

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Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Allen-Hussey Co.
Amstutz, N. S.
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co,
Ford, Owen.
Thayer Electric Co.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bunnell & Co., J. H.
Central Electric Co.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
M. & B. Te ephone Co.
Norton, Chas. E.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Queen & Co. Inc.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Electrical Specialties.**
Allen, L. B.
Clark El. Specialty Mfg. Co.
Interstate Com. El. Const Co.
Nashold Cleat Co.
Proctor-Raymond Elec. Co.

**Electrollers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
General Electric Co.

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Otto Gas Engine Wks.
Webster Mfg. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Brownell & Co., The.
Chuse & Co., J. F.
Erie City Iron Wks.
Racine Hardware Co.
Sioux City Eng. & Iron Wks.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Central Electric Co.
Davis Elec. Co., W. J.
Diehl & Co.

**Feed Water Heaters.**
Gonbert Mfg. Co.
Webster & Co.. Warren

**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Butler Hard Rubber Co.
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

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Partrick & Carter Co.

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Reliance Gauge Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

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Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Bryant Electric Co.
Bunnell & Co., J. B.
Butler Mfg. Co.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Elliott-Lincoln Elec. Co.
Forest City Elec. Wks.
General Electric Co
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Metropolitan Electric Co.
Morris & MacCurdy;
Nashold Cleat Co.
Now. tny Electric Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Proctor-Raymond Elec. Co.
Queen & Co Inc.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Thayer Electric Co.
Wallace Electric Co.

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Dixon Crucible Co., Jos.

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Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

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Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Fiberite Co., The.
Bart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Newton Rubber Wks.
Nowotny Electric Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Bunnell & Co., J. B.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
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Am. Electrical Mfg. Co.
Beacon Vac Pump & Elec.Co.
Bernstein Electric Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg. Co.

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Colgate Co., Geo. L.
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Electric Appliance Co.
General Electric Co.

**Magnet Wire.**

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Besly & Co., Chas. H.
Harrington, Son & Co., E.
Hine & Robertson Co.
Lukens Iron & Steel Co.
Nicholas & Barr.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene

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Independent Electric Co.
Westinghouse El. & Mfg. Co.

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Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co
Onondaga Dynamo Co.
Roth & Eck.
Sioux City Brass Works
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Packing.**
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Electric Appliance Co
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**Sal Ammoniac.**
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Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co

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Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones**
Andrae & Sons, J.
Central Electric Co.
Jameson & Co., W. D.
Nowotny Electric Co.
Partrick & Carter Co.
Western Electric Co.
Western Tel. Const. Co.
Williams & Abbott Elec. Co.

**Transformers.**
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Diamond Electric Co.
General Electric Co.
Hornberger Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co
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Samson Cordage Wks

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Westinghouse El. & Mfg. Co.

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Int. Corr. Schools.
Scientific Machinist Co.

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Smith, S. Morgan.

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Anderson, Albert & J. M.
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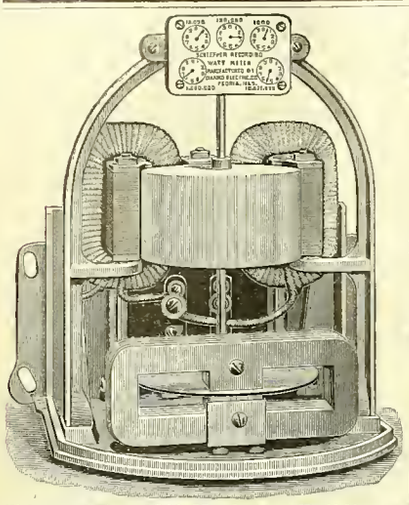
Bishop Gutta Percha Co.
Brixey, W. R
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.



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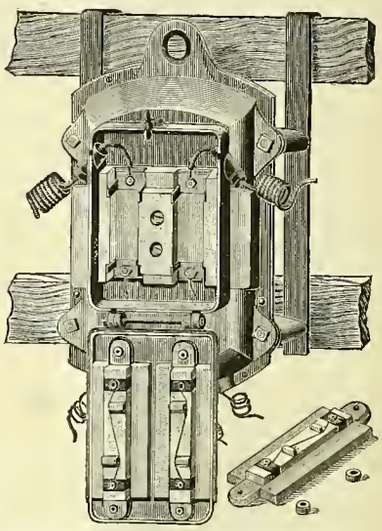

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It is the only perfected Arc Lamp for the alternator, either high or low frequency.

It comprises all that is desired in an Arc Lamp.

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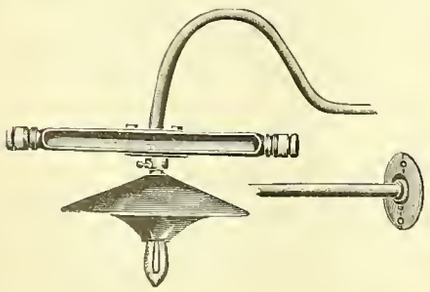
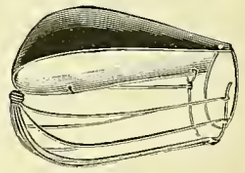
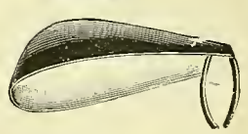
# WE MAKE MANY OTHER SPECIALTIES!



# WHAT ARE THEY?





*Send for Catalogue 894 and see.*

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## there are no skeletons

in the **Okonite** closet—in fact, there are no closets, as there is nothing to conceal—nothing to hide away; it needs no mantle of charity to cover chance defects.

**There are no defects.** Time, with his insidious finger, has poked and pried at **Okonite** for more than a decade and fails to find a single vulnerable point, a single weak spot. Use it anywhere, for any purpose, **it never disappoints.**

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It is said that the expression, "There is a skeleton in every closet," arose from the following incident: A young Italian student, finding he was dying, fearing to break the news to his mother, adopted the following device: He informed her that he was ill, and it had been foretold he would not recover until he had worn a shirt made by a woman who had no trouble. The widow soon discovered that it was no easy task to find such a person, but at length was referred to a lady who seemed surrounded with every comfort and happiness and possessing a husband who seemed devoted to her. The widow made known her request, and for an answer was shown a closet where a skeleton hung suspended from a beam. She was told it was the remains of the lady's former lover, who from motives of jealousy had been slain by her husband, and that he compelled her to visit it every day. The widow concluded that no one was without trouble, that "there was a skeleton in every closet," and became reconciled to the approaching loss of her son.—*London Answers.*

80° **what do you think** of that for a March day? and Chicago weather at that! Doesn't it seem very like **Fan Motor** weather? Our artist suggests that we picture March going out like a lamb, disappearing over the brow of a near-by hill with a **Lundell Fan Motor** in chase. It's a good suggestion, but we must leave it to your imagination this time.

We have good news for our friends of the alternating persuasion; this season we will offer a **Lundell** for alternating currents, and it is a beauty. Equal in every way to the direct current motor. The wearing parts of the two types are interchangeable.

**Now is the time to think and act.**

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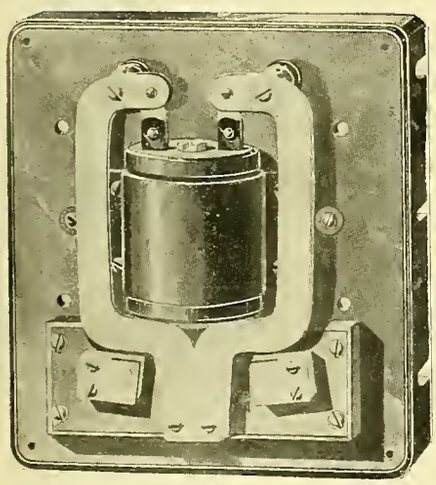
# SINCE MARCH 1st

# Our New (Model 1895) Electric Light and Power Controllers



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**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{On}{Out}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

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# ELECTRIC SELECTOR & SIGNAL CO., 45 Broadway, New York.

# INCANDESCENT LAMPS.

WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

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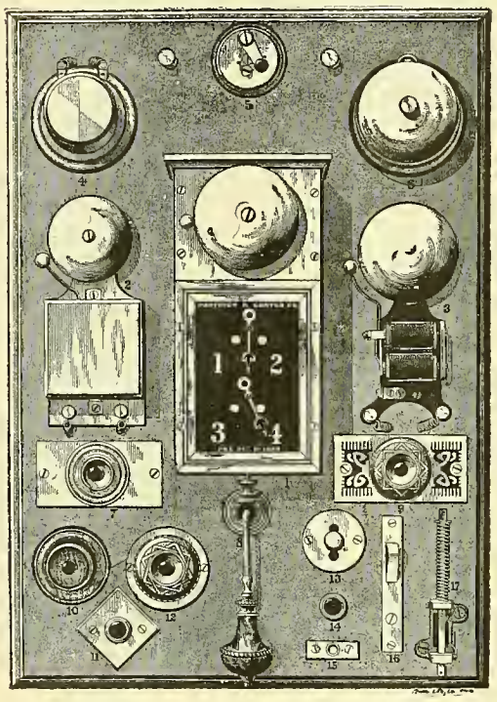

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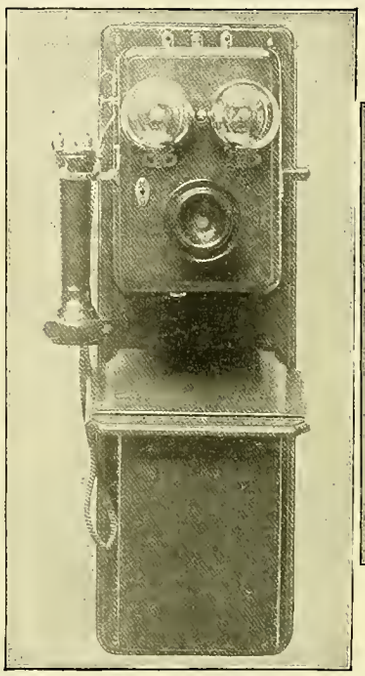

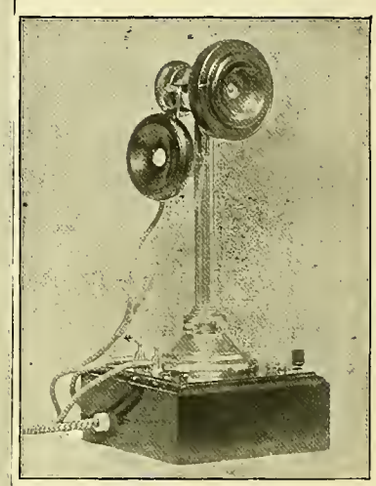

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**Metallic or Ground Circuit.**

SWITCHBOARDS ABSOLUTELY GUARANTEED.

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## BERGMANN LAMPS. KNIGHT ARC LAMP.

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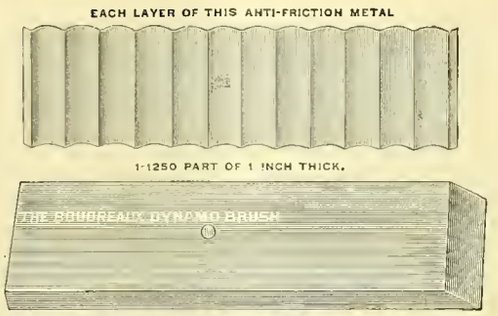
We find it satisfactory in all respects."

## The Boudreaux Dynamo Brush,

NO SPARKING
NO CUTTING
NO SPLUTTERING
NO HIGH RESISTANCE




NO GREASING
NO TRIMMING
NO SANDPAPERING
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**SUPERIOR** to Woven Wire, Copper or Carbon.

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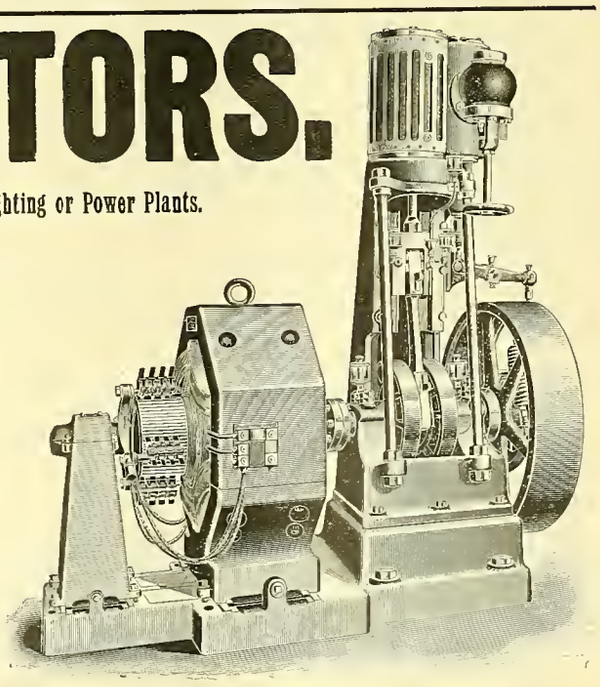

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Electric Motors, Automatic or Hand Controlled.
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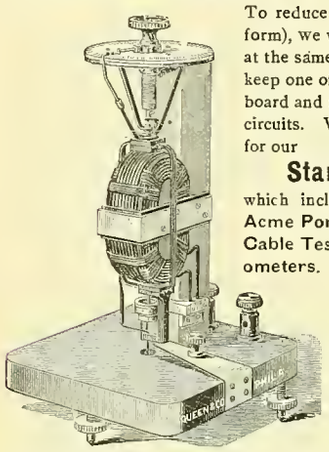

To reduce our stock of **Standard Dynamometers** (enclosed form), we will sell a limited number of these instruments at the same price as our open form. Every station should keep one of these current standards as a check for switchboard and recording meters on either direct or alternating circuits. We are in a position to fill promptly all orders for our

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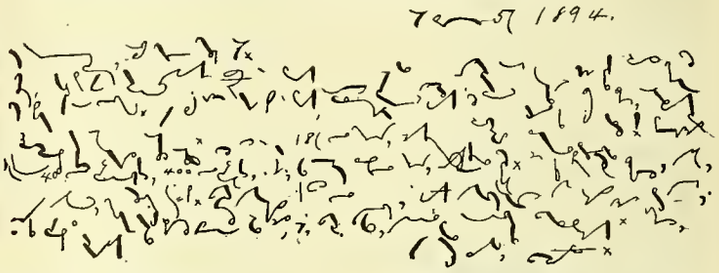
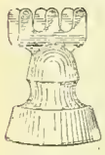


# MOULDED MICA TROLLEY LINE INSULATORS.



Hangers, Pull-Overs, Bracket Arm Insulators, Insulated Crossings, Frogs, Rail Bonds, etc.

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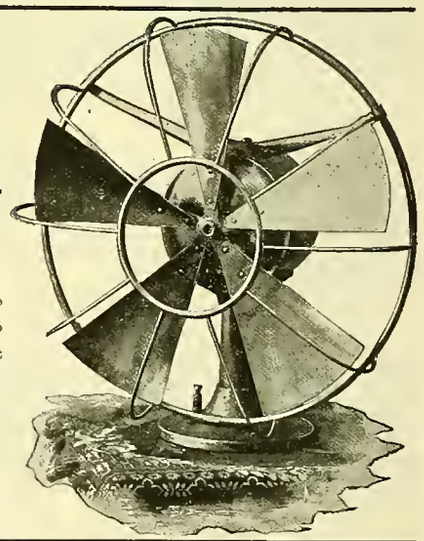

**For Alternating Current, Wound for 50 or 100 volts.**

The Fan is 14 inches in diameter.
Will always start when current is on
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

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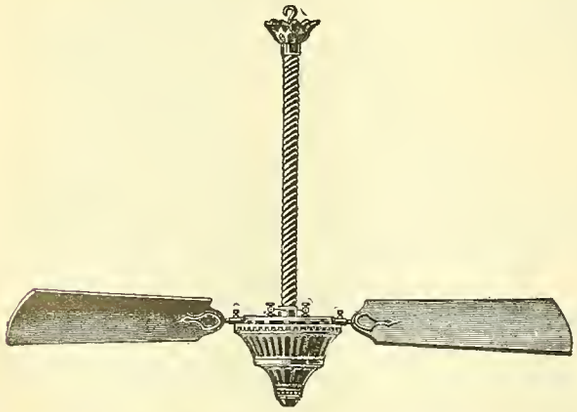

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**THE DIEHL ELECTRIC FANS WIRED IN A SERIES OF TWO OR MORE ON A STREET RAILWAY CURRENT.**

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WIRES AND CABLES

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The necessity of a high grade weatherproof insulation that can be relied upon at all times is appreciated by every careful station manager. "O.K." weatherproof wire has a perfectly uniform insulation and every foot of it is as good as a weatherproof wire can be made.

*We sell only "O. K."*

*We, only, sell "O. K."*

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It is not necessary for us to emphasize the fact that a low insulation resistance in your overhead line means loss of current, which is equivalent to an actual money loss.

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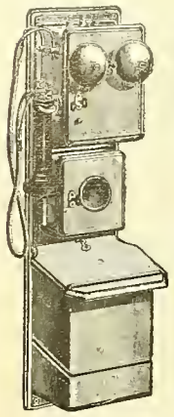

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Including Weatherproof and Underwriters' Wires, and particularly

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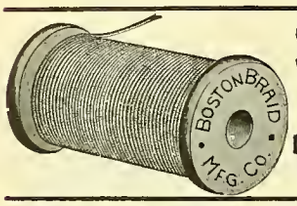


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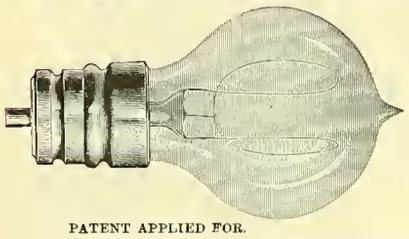

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These machines are constructed with **external armatures.** They have proved remarkably efficient and economical. Used largely in American and European Lighting and Railway Plants. Slow speed machines, made for direct-connection in sizes from 20 H. P. to 2000 H. P.

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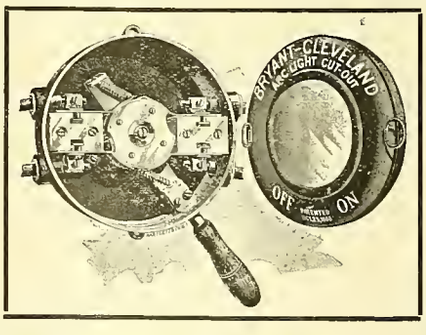


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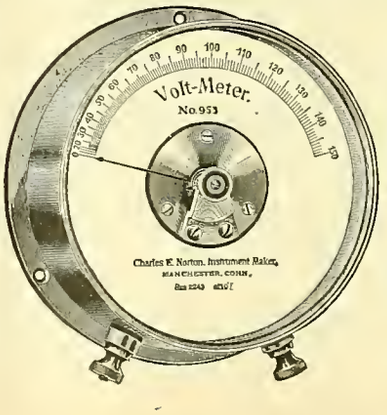


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Perfect in construction.
The best instrument made for general work.
Satisfaction guaranteed.
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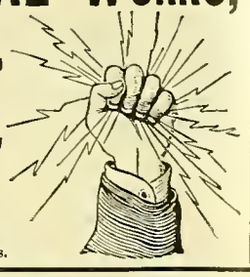

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The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

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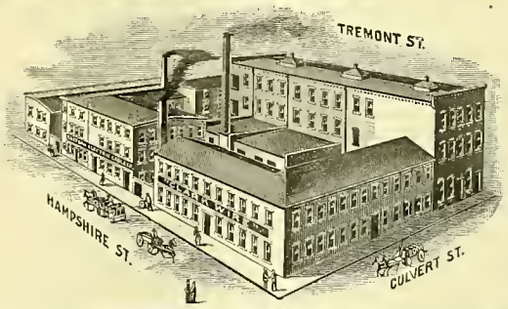


In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."

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A highly EFFICIENT and ECONOMICAL Arc Light Service depends on the quality of the Carbons.

THE BEST QUALITY IS THE CHEAPEST.

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For direct and alternating current Arc Lamps, are the most economical and efficient manufactured. They produce a very brilliant and absolutely steady light.

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NOTICE!—It has come to my knowledge that inferior carbons are offered to the trade under the name of "Electra," which name has been properly registered by me as my trade-mark, and therefore cannot be used by anybody else without infringing on my rights. Beware of imitations, and see that every packet of carbons bears the label with my trade-mark, "Electra."

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For Electric Railway and Electric Light Work.

Superior Quality. Perfect Insulation. Handsome Finish.

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Patented in U. S., Canada, England, France, And Applied for in Germany.

FOR SALE BY ALL ELECTRICAL SUPPLY HOUSES.

**It is the most practical Cleat made.**
**It is made of finest glazed porcelain.**
**It is in one piece.**
**It has the strength.**
**It will lock the wire firmly.**
**It will NOT break in putting up.**
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The wire can easily be put in place or removed without loosening the Cleat. It is a great saver in Time and Labor over any other Cleat in use for putting up Electric Light or other Wires.

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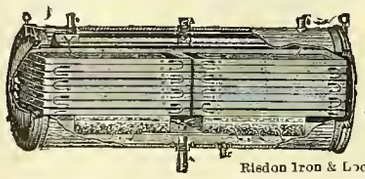
# Stilwell's Patent Live Steam-Feed Water Purifier.



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Entirely prevents *scale* in Steam Boilers. Catalogue on application.

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The city of Knoxville, Tennessee, is about to install its own light plant. Its light committee invites persons or firms dealing in electric lighting machinery and electrical supplies to correspond with them in reference to the immediate installation of an up-to-date electric light plant of not less capacity than 250 arc lamps of standard candle power.

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# Allen Soldering Stick.

NON CORROSIVE, CONVENIENT and EFFECTIVE.

*Price, 25 Cents.*

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# WANTED.

By young married man, position as electrician or superintendent of street railway or electric light plant. Have had five years' experience in all branches of construction and operation. Can give best of references. Address "K,"
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6 Lakeside Building, Chicago.

# WANTED.

Electrical engineer (29), married, wants position with small manufacturing company or in central station; eight years' practical experience in the manufacture, installation and running of lighting, traction and electric welding machinery. First-class references. Address "C. E.,"
Care WESTERN ELECTRICIAN,
6 Lakeside Building, Chicago.

# WANTED.

Competent, energetic young man, to invest from $500 to $1,000 and take charge of the wire work and trouble work of a good company in a growing city. One who can set up a dynamo and also understands telephone line work preferred. Reasonable salary paid and steady employment. No intemperate man wanted. Address "G."
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# POSITION WANTED.

Wish to make a change. Know street railway work from A to Z. Twelve years' experience as master mechanic, electrician and superintendent of street railway and lighting plants. Salary reasonable. Address "Hustler."
Care of Geo Cutter, Rookery, Chicago

# T.-H. Transformers Cheap.

Are changing our voltage and have for sale 20,000 lights' capacity, sizes from 10 to 150 lights, 1,000 volts primary, 52 or 104 volts secondary, all in excellent condition. Write for prices.

New Omaha T.-H. Electric Light Co.,
OMAHA, NEB.

# Proposals.

Notice is hereby given to all electric light companies supplying light to cities, that the contract by which the city of Johnstown, Pa., is now lighted will expire in September, 1895, and the councils of the city of Johnstown hereby invite proposals for the furnishing of light to the city for a term of three or five years. About two hundred (2,000 candle power) arc lamps will be required. The right of way over and through the streets and alleys will be granted for the erection of poles. A plant can be centrally located and supplied with coal at less than one dollar per ton. All communications to be addressed to JNO. J. BROWN,
City Controller. JOHNSTOWN, PA.

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**FOR ELECTRICAL USES:**

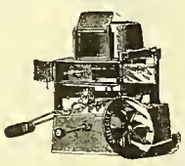
**Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the Inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.**

JOS. DIXON CRUCIBLE CO., Jersey City, N. J.

# STEAM ENGINEERING

(*Stationary, Locomotive or Marine*); *Mechanics; Mechanical Drawing; Electricity; Architecture; Architectural Drawing and Designing; Masonry; Carpentry and Joinery; Ornamental and Structural Iron Work; Railroad Engineering; Bridge Engineering; Municipal Engineering; Plumbing and Heating; Coal and Metal Mining; Prospecting, and the English Branches.* Students make rapid progress in learning to Draw and Letter. The Steam Engineering course is intended to qualify engineers to secure Licenses. Send for free Circular, stating the subject you wish to study, to

**The International Correspondence Schools, Scranton, Pa.**



**NICHOLAS & BARR,**
MANUFACTURERS OF
**GATE CITY SOLDERING FURNACE,**
28 W. Washington Street, Chicago, Ill.

The Gate city soldering furnace has the following points of excellence: 1. Economy of fuel.—2. Simplicity in construction and operation.—3. The only burner that cannot be clogged up.—4. Has a fixed pump.—5. Especially adapted to plumbers', tinners', cornice-makers' and roofers' use, and for conduit, electric light and telephone work.—6. Can be used with ease in strong wind on roofs.

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This company is manufacturing **A Compound Magneto Telephone** Which it sells outright under a guarantee both as to efficiency and as against infringement of patents.

It talks as well over one hundred miles as any other Telephone talks over one mile.

This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists.

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**539, 540 and 541 Monadnock Blk., Chicago, Ill.**

# The NOWOTNY Telephone

Gives service equal to the best long-distance Bell telephone, and are noted for their wonderful volume of sound and clear articulation of speech.

We also **Manufacture Batteries** for every known purpose, which have a world-wide reputation.

**THE NOWOTNY ELECTRIC CO.,** CINCINNATI, OHIO.

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We make a strictly first-class instrument for exchange service and private lines. It is a **BATTERY TELEPHONE** and is guaranteed not to infringe. Write for catalogue and prices.

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# Dynamos and MOTORS.

½ H. P. and upward.

25 to 800 Lights.

The Elliott-Lincoln Electric Co.,
1124 Payne Avenue,
CLEVELAND, OHIO.

THE
# ELKHART TRANSFORMERS,

HORNBERGER ELECTRIC MFG. CO.,
ELKHART, INDIANA.

The **Brady Mast Arms.**

T. H. Brady, New Britain, Conn., U. S. A.,

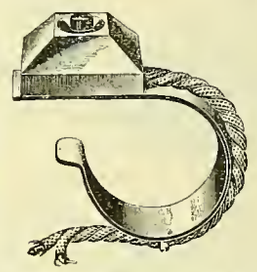
Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work. — *Catalogues and Prices furnished on application.*

# COMMUTATORS REFILLED.

Sioux City Brass Works.
SIOUX CITY, IOWA

# Table Push.

SOMETHING NEW.



SEND FOR NEW CATALOGUE.

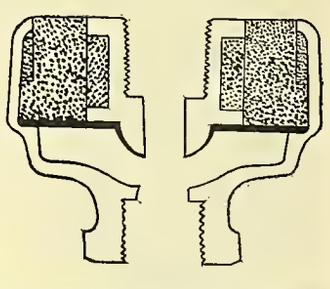
BELLS, PUSH BUTTONS, ETC.

**HUEBEL & MANGER,**
MANUFACTURERS
Electrical and Brass Goods,
286-290 Graham St., Brooklyn, N. Y.

# Storage Batteries

FOR ALL PURPOSES.
Bradbury-Stone Electric Storage Co.,
LOWELL, MASS.

# NEW INSULATING JOINT.



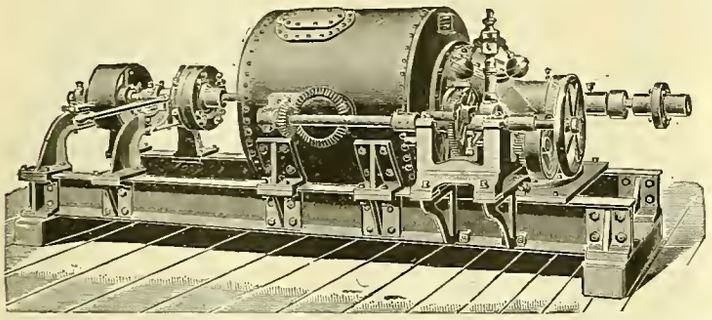
Sectional View—Patented July 10, 1894—Full Size.

**For Insulating Fixtures.**

This joint conforms to the requirements of Underwriters' rules. Write for prices and circulars.

Interstate Complete Electric Construction Co.,
809 to 817 So. 7th St., ST. LOUIS, MO.

# VICTOR TURBINE WATER WHEEL.



Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.

The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter**, being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

***SEND FOR CATALOGUE AND PARTICULARS.***

The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 36 H. P. under 38 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs, on horizontal shafts, and where the situation admits of their use we recommend them.

**The Stilwell-Bierce & Smith-Vaile Co., Dayton, Ohio.**

Risdon Iron & Locomotive Works, San Francisco, Cal., Pacific Coast Agents.

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***The Standard Open Circuit Batteries of the World.***

SEND FOR CIRCULAR AND PRICES.

**THE LECLANCHE BATTERY CO.,**

***111 to 117 East 131st St., N. Y.***

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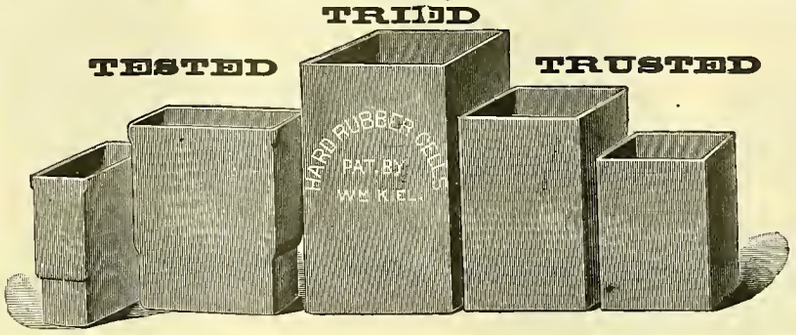
## Most Durable Battery Cells Produced.

**TRIED**

**TESTED** **TRUSTED**




**ROD SHEET, TUBING.**
Flexible Hard Rubber Tubing.
**INSULATOR HOOKS.**

Telephone Receivers, Battery Syringes, Bushings, Etc.

**Manufactured by The Butler Hard Rubber Co., 33 Mercer St., N. Y.**

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## ELECTRICAL BOOKS.

Orders Filled Promptly.

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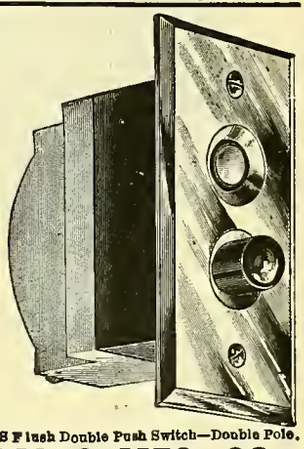
## C-S SPECIALTIES.



**C-S Flush Double Push Switch.**

Single Pole—Double Pole—Commutation; 3 Wire, 4 Wire.

**C-S Flush Key Switch.**

Single Pole—Double Pole—3 Wire.

**C-S Flush Automatic Switch.**

Single Pole.

ELECTRICALLY
MECHANICALLY
ARTISTICALLY

**PEERLESS.**

C-S Flush Double Push Switch—Double Pole.

**THE CUTTER ELECTRICAL & MFG. CO.,**

***27 So. 11th Street, Philadelphia, Pa., U. S. A.***

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## MICA

**Eugene Munsell & Co.**

218 WATER ST., N. Y.

W. H. SILLS, 153 E. Lake St., Chicago.

CUT AND UNCUT
India and Amber
Stamped Solid Sheet
SEGMENTS
AND RHEOSTAT

Send for Catalogue and Prices.

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CUYAHOGA SUPPLY CO., 10 S. Water St., Cleveland.
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TAPER RINGS, TUBES, SEGMENTS, TROUGHS, PLATES, CLOTH, &c.

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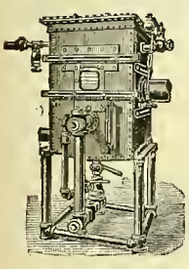

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*of our Vacuum Feed Water Heaters and Purifiers until we had first satisfied our customer that it was capable of saving money for him. Our Catalogue will make this saving clear to you. Shall we mail it? We also build the Webster Separator and Williames Vacuum System of Steam Heating.*

*WARREN WEBSTER & Co.,*

NEW YORK, 39 Cortlandt Street.
CHICAGO, Monadnock Building.

*CAMDEN, N. J.*

No. 8.

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For the WESTERN ELECTRICIAN

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**$1.00**

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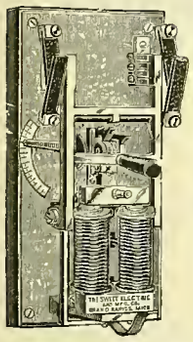
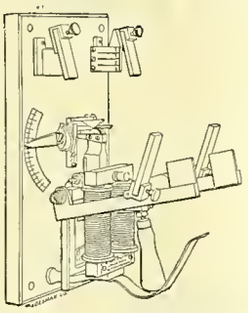


No! we make the final break off from carbons so that it is impossible to get heat enough to fuse points of your copper contact plates; no filing off of rough points, no hanging on after you have had a short circuit or over load, bound to work as easily after opening 1,000 times as it does when opened the first time.

**WE KNOW YOU NEED OUR CIRCUIT BREAKER,** and do not see why you should delay writing us any longer. One burn out will pay for a dozen of our instruments. **To be used on the Alternating or Direct Current Systems.**

**Write us at once.**



**SWEET ELECTRIC & MFG. CO.,**

***GRAND RAPIDS, MICH.***

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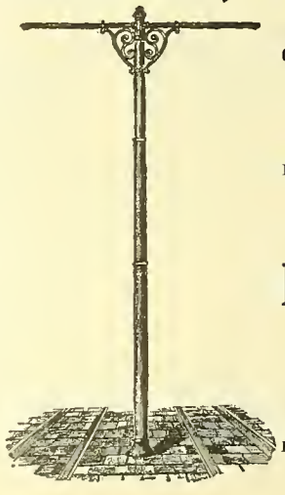
1821. 1888.

## Morris, Tasker & Co.,



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**PASCAL IRON WORKS,**
**Philadelphia.**

**DELAWARE IRON WORKS,**
**New Castle, Del.**

Manufacturers of

**Boiler Tubes, Wrought Iron Pipes and Fittings,**

**ELECTRIC LIGHT and RAILWAY PIPE POLES A SPECIALTY.**

ELECTRIC SUPPLIES.
LIGHTING PLANTS.
ENGINEERING.
CONTRACTING.
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RAILWAYS.
INCANDESCENT WIRING.
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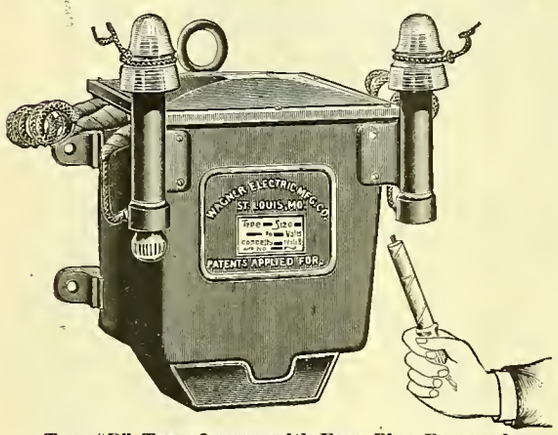
**Thayer Electric Co.,**
**1027 Garfield Building,**
**CLEVELAND, O.**
TELEPHONE 2910.

Don't let your contracts until you get our prices.
Prompt attention given to all orders.

# TRANSFORMERS.



Type "D" Transformer with Fuse Plug Removed.

***A New Type*** — *Transformer, Primary Cut-outs and Insulator Brackets all combined.*

No more brackets pulling off of walls.
With our wall or cross-arm hooks, transformer may be *Hung* and *Connected* in *Five minutes.*
Our new fuse plugs will not hold an arc with 5,000 volts.
*Our Transformers* are acknowledged by all experts to be the *Highest* in *Efficiency* ever made.
Adopted by the largest stations in the country.
*We Challenge Competition* in any form of test, in laboratory or practical use.
Made in all sizes, 5 lights to 3,000 lights.

JOHN MUSTARD, Betz Building, Philadelphia, Pa.
1564 Monadnock Block, Chicago, Ill.

**Wagner Electric Mfg. Co., ST. LOUIS, MO.**

**HAVE YOU READ**

Inventions, Researches and Writings of Nikola Tesla,
By THOMAS COMMERFORD MARTIN.
*500 Pages.* *330 Illustrations and New Portrait.*
PRICE, $4.00. Postage Prepaid.
SEE PAGE XVI FOR TABLE OF CONTENTS. ORDER AT ONCE.

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## Manchester, Conn.

**Power Generators for Lighting and Railway Purposes.**
**Complete Station Equipments.**

Mather Apparatus for sale exclusively in their respective territories by the following well-known and reliable Contractors:

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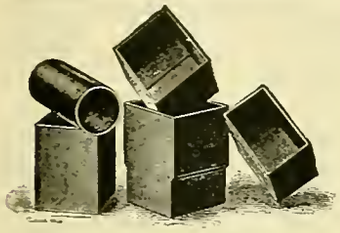
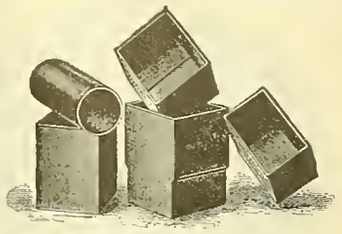
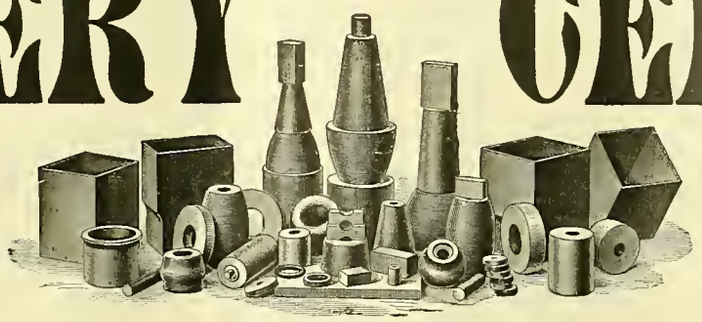
S. N. BLAKE, Elmira, New York: Northern and Western New York.
THE WILL & FINCK COMPANY, 818 Market St., San Francisco, Cal.: Agents for the Pacific Coast.



# THE FREEMAN



# BATTERY CELLS.



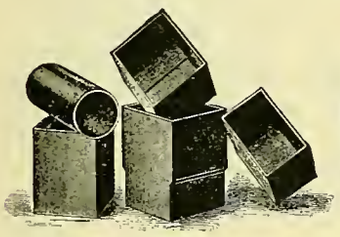
Estimates Furnished on Application. Prompt Delivery.

Standard Sizes Always on Hand.

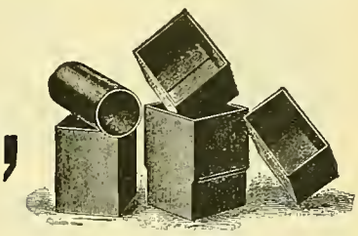
The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplished, providing additional strength to such an extent that this cell can be used where no other would be practical.

**Agents Wanted in all Cities.** **Write us for information and catalogue.**

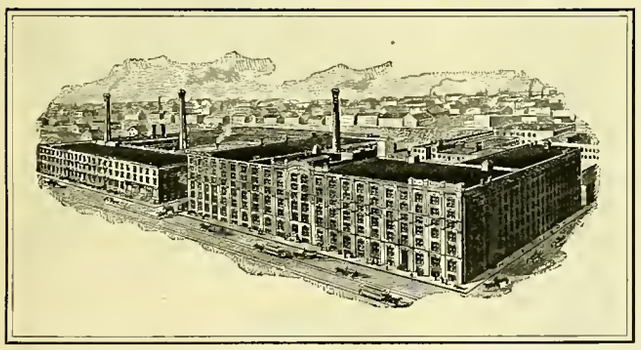
THE



## Newton Rubber Works,



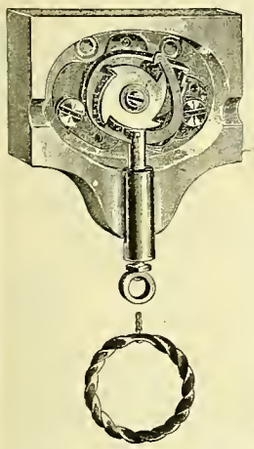
Newton Upper Falls, Mass.



List Number 947.

**BRYANT**

**Chandelier Switch.**



| | List Price. |
|---|---|
| 5 Amp., complete with 6 ft. Chain and Ring, - - - - - - each, | $1.50 |
| Extra Brass Chain, - - - per foot, | .05 |
| Extra Brass Rings, - - - each, | .05 |

This Chandelier Switch is intended to be placed in the canopy of the chandelier, and is fitted with a clamping attachment on the back which clamps around the pipe, and is held in place by a set-screw. Is rated at ten amperes. The chain can be dropped down between the pipe and the shell of the chandelier, or through a small hole in the canopy outside of the chandelier. It is fitted with brass ring hanging below the chandelier, the first pull of which lights the entire chandelier, the next pull cutting it off.

Chain and ring can be furnished in special finish where desired to match any finish or fixture.

# The Bryant

## CHANDELIER SWITCH.

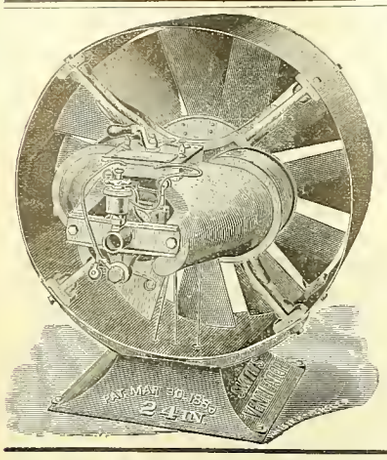
**ONE Pull Lights the Entire Chandelier.**
**The NEXT Pull Puts it Out.**

*Buy a* **SAMPLE** *and you will buy* **MORE.**

IN STOCK AT NEW YORK AND CHICAGO.

# WESTERN ELECTRIC COMPANY,

NEW YORK, Greenwich and Thames Streets.
CHICAGO, 227 to 275 South Clinton Street.



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Now is the time to place your orders for **Ventilating Apparatus.**
Sizes: 18 inches to 96 inches in diameter. Wound for 110, 220 and 500 volts.

## FULLER'S PATENT COMBINATION FAN MOTOR

For public buildings, theaters, hotels, restaurants, factories, churches, and all places where fresh air is necessary.
What you want is **FRESH AIR,** not the same air churned over and over again, as is the case with toy Fan Motors of 10 and 12 inch variety.

Also Manufacturers of **Fuller Double-Voltage Dynamo,** **Standard Dynamos and Motors.**

**Prices Quoted on Application.**

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# WATERHOUSE-GAMBLE ARC LAMPS.

*Plain or Ornamental*

For Direct Incandescent Circuits.

Write for CATALOGUE and PRICES.

## The Most Economical Lamp Made.

WE MANUFACTURE

*Switches, Sockets, Rosettes, and Receptacles.*

## The Perkins Electric Switch Mfg. Co.,

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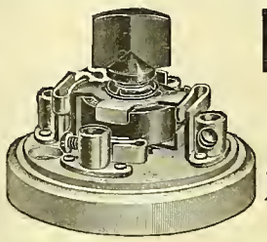
# HART SNAP SWITCHES!

STANDARD SWITCHES, 5 and 10 ampere S. P.
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



## FLUSH SWITCHES

Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

**SEND FOR CATALOGUE.**

## THE HART & HEGEMAN MFG. COMPANY,

**Hartford, Conn.**

# W. S. EDWARDS MFG. CO.,

MANUFACTURERS OF

## ELECTROLIERS,

Combination Fixtures,

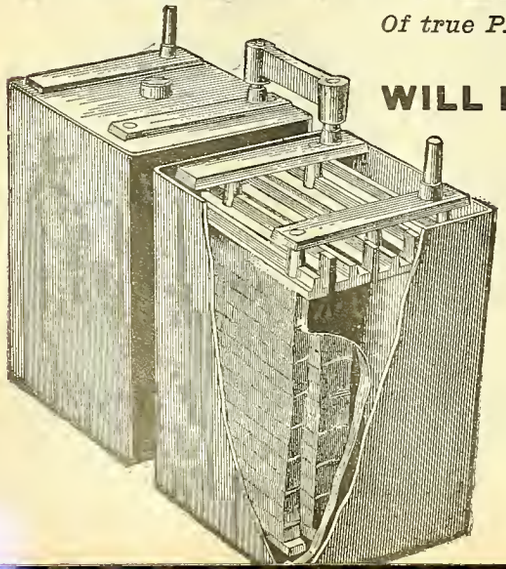
Electric and Combination Brackets.

EXCLUSIVE DESIGNS. LOW PRICES.

Our new catalogue of Electric fixtures is now ready.
If you buy fixtures send for same.

**21 and 23 East Lake St.,**
**CHICAGO.**

# STANDARD PLANTE STORAGE BATTERIES



*Of true PLANTE Type and CRYSTALLINE FORMATION.*

Will give or receive without injury, currents that would destroy other batteries.

**WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.**

Contain no asbestos or other separating material to increase their internal resistance.

**ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.**

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

**Highest efficiency, largest delivery, lowest internal resistance.**

For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

**Cannot be damaged by excessive charge or discharge currents.**

A 400 ampere current has been taken from a 120 ampere hour cell.

☞ **CHALLENGE:** We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

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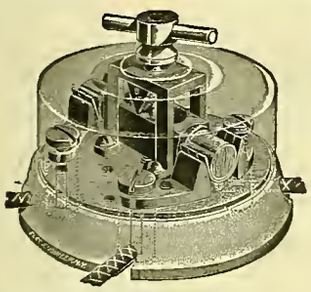
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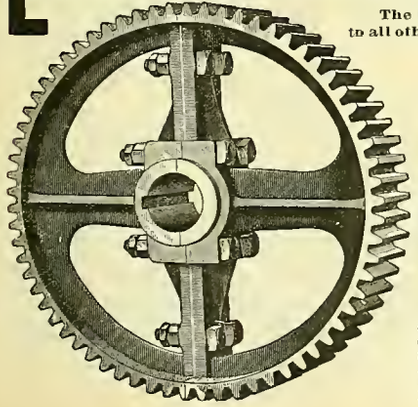

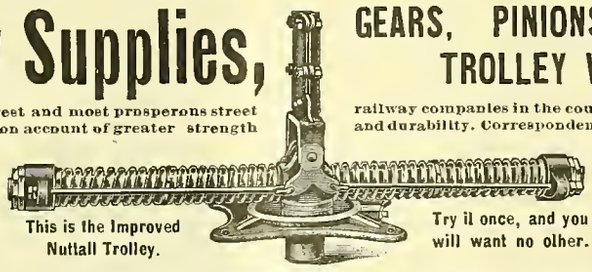
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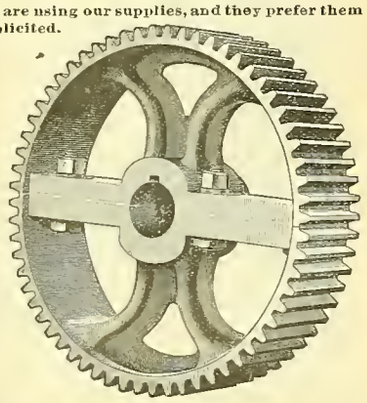

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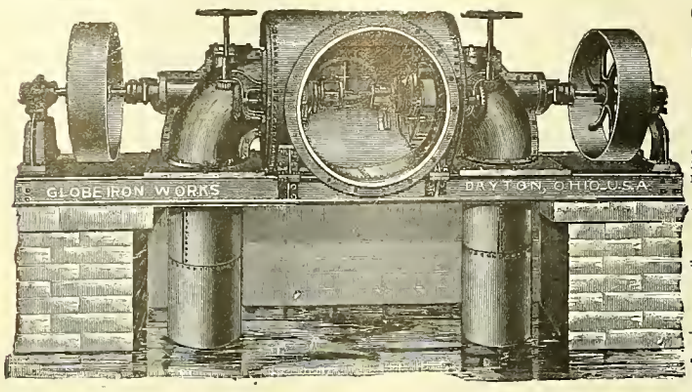


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| ⅞ " | 16.42 | 122.00 | 127.18 | 196.19 | 82.58 |
| ¾ " | 16.78 | 117.33 | 112.60 | 175.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118.40 | 75.52 |

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| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | Pr Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.33 | 128.00 | 134.18 | 199.66 | 80.60 |
| ⅞ " | 16.66 | 134.80 | 120.85 | 188.14 | 83.09 |
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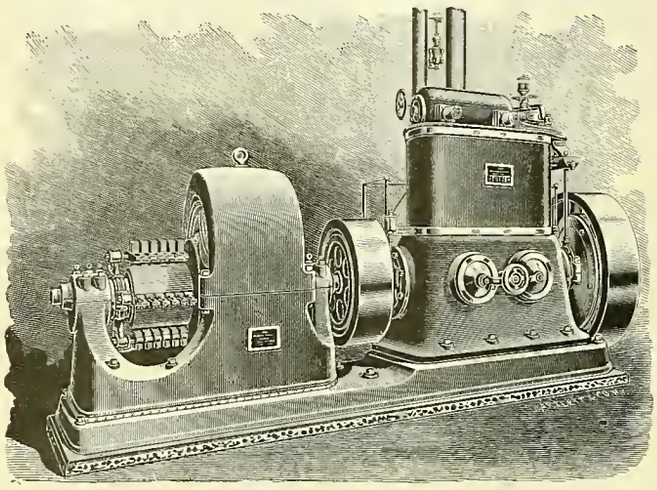

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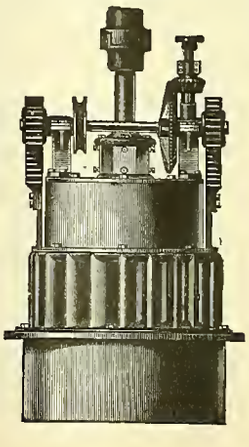

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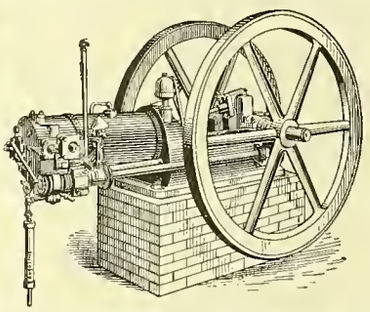

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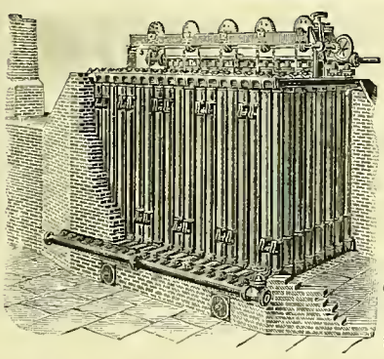

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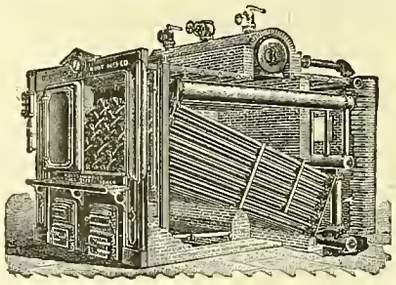

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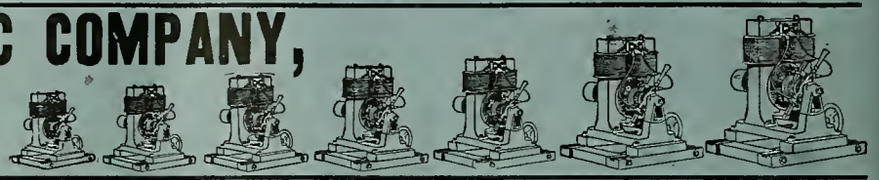

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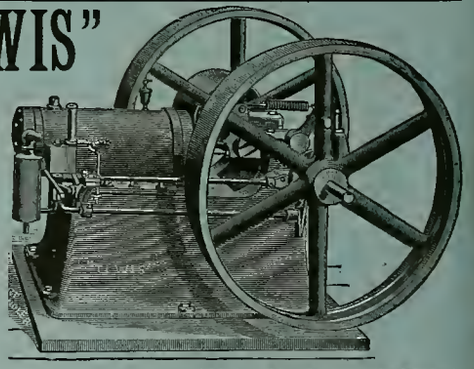

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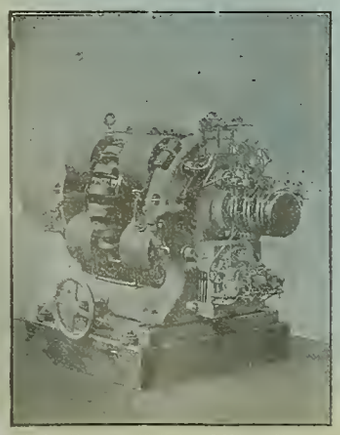

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# Western Electrician

$3 per Annum. EVERY SATURDAY. 10 cents per Copy.

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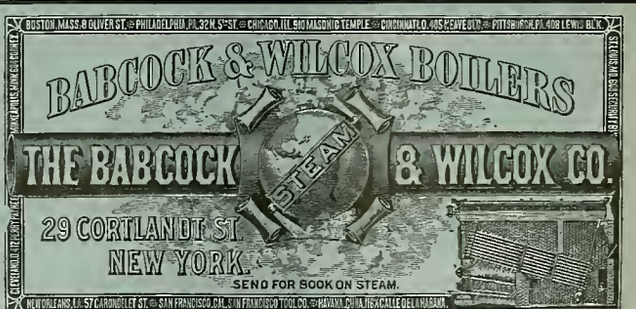


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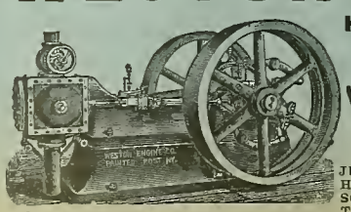

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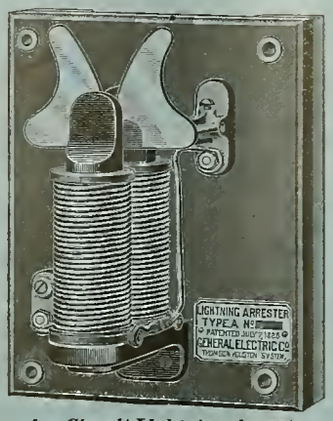

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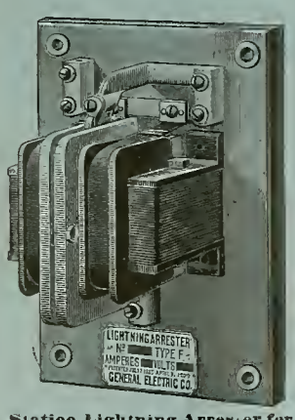

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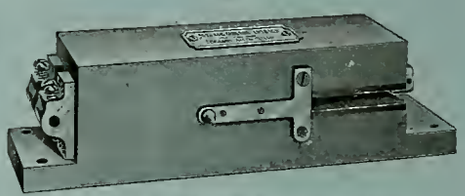
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Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

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Clark Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft Wayne Elec. Corporation.
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Bunnell & Co., J. H.
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Dearborn Electric Co.
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Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
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Brixey, W. R.
bunnell & Co., J. H.
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Chicago Ins. Wire Co.
Dearborn Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
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Andrae & Sons, J.
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Forest City Elec. Wks.
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Brownell & Co., The.
Chase & Co., J. F.
Erie City Iron Wks.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Central Electric Co.
Davis Elec. Co., W. J.
Diehl & Co.
Interior Conduit & Ins. Co.

**Feed Water Heaters.**
Besly & Co., Chas. H.
Hine & Robertson Co.

**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Butler Mfg. Co.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Forest City Elec. Wks.
General Electric Co
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Metropolitan Electric Co.
Morris & MacCurdy;
Nashold Cleat Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Proctor-Raymond Elec. Co.
Queen & Co Inc.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Thayer Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Edwards, W. S. Mfg. Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Cbicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Aetna Electric Works.
Am. Electrical Mfg. Co.
Automatic Elec. Spec. Co.
Beacon Vac Pump & Elec. Co.
Bernstein Electric Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Onio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Waldo-Hyde, Wm.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co, Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Hine & Robertson Co.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
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Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec, Mfg, Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Roth & Eck.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Packing.**
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Garlock Packing Co.

**Paints.**
Morris & MacCurdy.

**Patents.**
Gooch, Chas. J.

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Baker & Co.

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**Rheostats.**
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**Sal Ammoniac.**
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Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
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Gustafson, W. A.
Jameson & Co., W. D.
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"C" STYLE.
Made in Sizes from 4 to 20 Drops.

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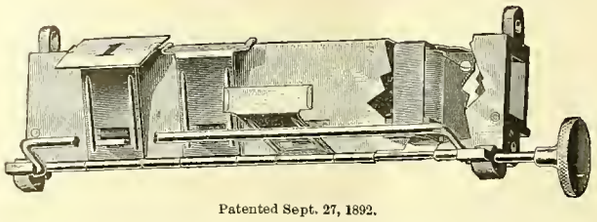
That never fail to Annunciate.



Patented Sept. 27, 1892.

This illustrates the inside construction of our Gravity-Drop Annunciator as applied to the 4 Drop "Eclipse" Case.

No Springs. No Screws. Nothing to get out of adjustment. Simplicity itself.

*Our other Specialties:*

**REX** Wood-box Bells,
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Floor Pushes,
Door Connections, etc., etc.

## PROCTOR-RAYMOND ELECTRIC CO.,

Rochester, N. Y.

# AUTO-TELEPHONE SYSTEM.

# Public Notice!

***Notice is hereby given*** that we are the ***exclusive licensee*** of the U. S. Letters Patent No. 533,729, granted to ***Thomas McCoubray***, and other patents connected with the Auto-Telephone System.

On the 28th day of February, 1895, we ***commenced suit*** against the Interior Telephone Company, of 203 Broadway, New York, and against Frank R. Colvin, its president, for the infringement of Patent No. 533,729, covering the recarbonized petroleum residuum carbon powder used in our transmitters, and to restrain the further use of the invention described and claimed in this patent, and have no fear of the result of this suit.

The Interior Telephone Company have made the following admission in speaking of the McCoubray patent: "Their patent * * * covers identically the same powder which we have used since we went into business." The Colvin transmitters now in use infringe our patent.

***We caution*** all dealers in and users of telephones against purchasing any telephonic transmitters or apparatus infringing this or other ***McCoubray*** patents, as suit will be brought against them to restrain them from selling or using such apparatus or transmitters, and for damages.

***Dealers in and users of Telephones,*** in order to avoid litigation and the consequent payment of damages, should purchase their telephonic apparatus or transmitters from us.

We are prepared to give ***any reasonable security*** to ***indemnify our customers*** in case ***suits*** should be brought against them, or we will ***even agree to take back*** the transmitters or apparatus which we sell, if they are claimed to be an infringement of any patent owned or controlled by other manufacturers than ourselves, at a fair valuation, at any time our customers shall have suit brought against them.

## THE TUCKER ELECTRICAL CONSTRUCTION COMP'Y,

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DO YOU WANT

The best made?
To be up to time?
Quick results from a 'phone?
To save time?
The most efficient?
The most durable? Then

Buy the "Gerson"

These 'phones are used on private lines between Boston and Chicago.

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**Long Distance and Interior.**

**SATISFACTION GUARANTEED.**

U. S. Government gives the "Gerson" 99 per cent. for efficiency—highest given.

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## W. D. JAMESON & CO.,

**150 Broadway, New York,**

SOLE AGENTS FOR

## THE GERSON Electrical Mfg. Co.,

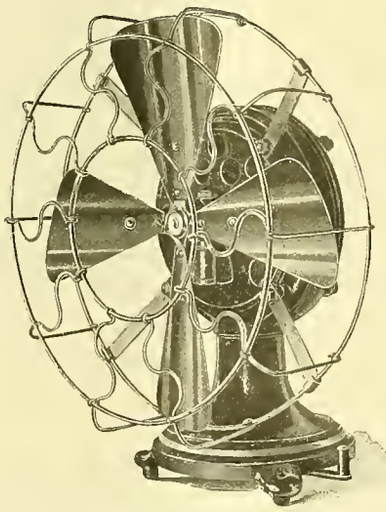
INCORPORATED,

of Philadelphia, Pa.

## The Napoleon of all Fan Motors is the

# LUNDELL

For Direct or Alternating Currents.



Lundell Alternating Current Motor.

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ST. LOUIS, MO.;
Southern Electrical Supply Co.

KANSAS CITY:
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WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

## GLOBE ELECTRIC LIGHT CO., General Offices: Carter Building. BOSTON, MASS.

AGENTS WANTED. WRITE US.

# RECEIVER'S SALE.

## WARING ELECTRIC COMPANY.

The entire stock of

## NOVAK LAMPS,

of ALL candle powers and voltages, together with a large amount of

## MACHINERY,

consisting of dynamos, pumps, etc., must be SOLD AT ONCE to close up the affairs of the company. For prices and terms address

**WM. WALDO-HYDE,** Receiver,

*Hartford, Conn.* *Manchester, Conn.*

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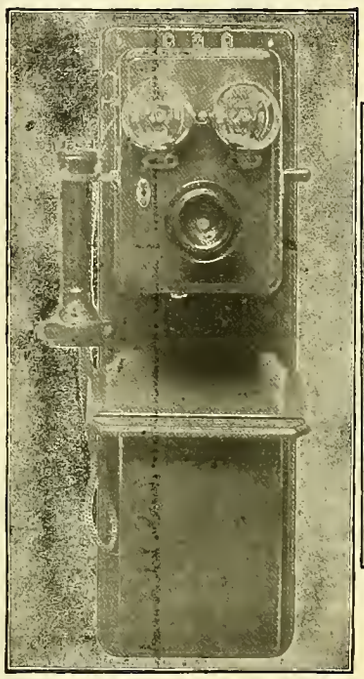

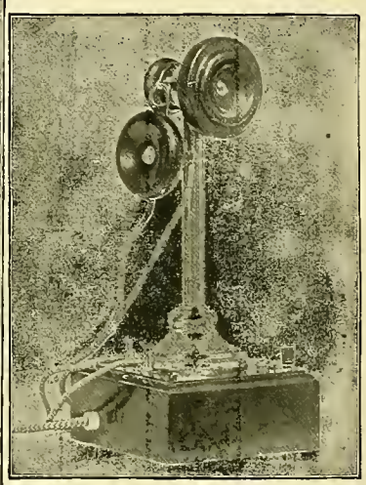

Desk Set.

**Complete Exchange Plants.**
**Metallic or Ground Circuit.**

**SWITCHBOARDS ABSOLUTELY GUARANTEED.**

**STATE AGENTS WANTED.**

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**Bullitt Building, - Philadelphia.**

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GENERAL INCANDESCENT ARC LAMP CO.'S

## BERGMANN LAMPS. KNIGHT ARC LAMP.

**The Above Lines Include ARC LAMPS for Every Service.**

Address Inquiries to **R. B. COREY,** General Sales Agent,

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The Boudreaux Dynamo Brush Co. NO GAUZE.

# WE ARE NO UNDERTAKERS.

The Boudreaux Dynamo Brush Co. NO CARBON.

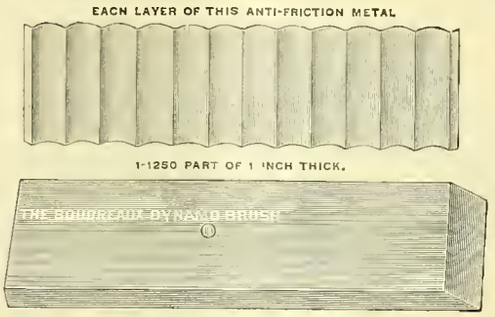
## Don't wait until the life of the commutator is exhausted

*—BEFORE SENDING FOR—*

## THE BOUDREAUX DYNAMO BRUSH.

NO SPARKING.

NO CUTTING.




NO TRIMMING.

NO GREASING.

**TESTIMONIAL.**

INTERNATIONAL & WELLS PACKING CO., Stock Yards, R. A. Shields, Electrician.—"We take pleasure in stating that we have been using your brushes on our commutators since Nov. 16th last, and so far are quite satisfied with results. They run free of sparking and scratching, and are likely **TO LENGTHEN THE LIFE OF THE COMMUTATOR.** We consider them a great improvement on the old copper brush."

The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

## THE BOUDREAUX DYNAMO BRUSH CO.,

The Boudreaux Dynamo Brush Co. NO COPPER.

**Mallers Building, CHICAGO.** **Postal Telegraph Building, NEW YORK.**

# BUCKEYE

QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

## INCANDESCENT LAMPS

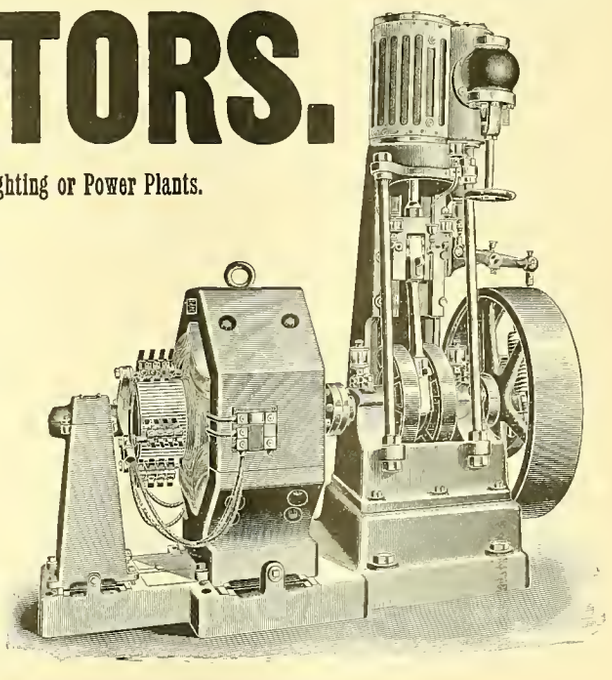
Monadnock Building, Chicago. **THE BUCKEYE ELECTRIC CO., Cleveland, O.**

# EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*



## THE EDDY ELECTRIC MFG. CO.,

*WINDSOR, CONN.*

**NEW YORK OFFICE, HAVEMEYER BLDG.**

*REPRESENTED BY:*

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**D. P. GOSLINE, 30 Oliver St., Boston, Mass.**

**All Our Apparatus Guaranteed as Represented.**

# THE C & C ELECTRIC COMPANY

MANUFACTURERS OF

## MULTIPOLAR DYNAMOS, BIPOLAR DYNAMOS,

Direct Driven or Belted, in sizes up to 250 H. P. Up to 100 H. P.

Electric Motors, Automatic or Hand Controlled.
Complete Plants for Power Transmission.
Isolated lighting plants, Central Station Apparatus.

**General Office:**
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**Works: GARWOOD, N. J.**
**on CENTRAL R. R. of N. J.**

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# HELIOS ELECTRIC COMPANY,

Factory and Offices,

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*We have no Stock nor Old Style Lamps that we must get rid of at any price—no junk.*

## THE HELIOS LAMPS

Are the latest patterns and newest type. Our Lamps are much in advance of any lamp now on the market, because they are New and of Latest Designs.

Our ALTERNATING LAMPS have Reflector Plates. Our DIRECT CURRENT Lamps do not see-saw. Our Focusing Lamps, both Direct and Alternating, are especially adapted for photo-engraving and stereopticon work.

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Mountain Electric Co., Agents for Colorado, Utah, Wyoming and New Mexico, Denver, Col.
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## CHICAGO SHORTHAND INSTITUTE, 35th St. and Wabash Ave.

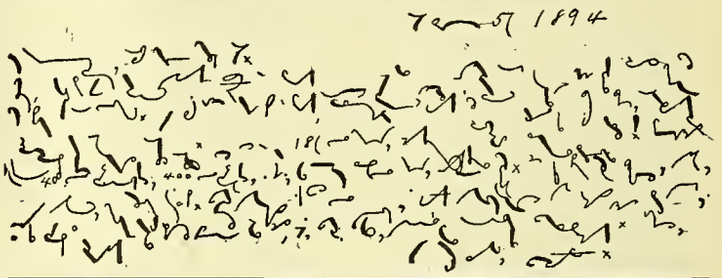
**A Central School of Shorthand and Typewriting of the most Modern and Complete Type.**

**A COMPLETE COURSE OF SHORTHAND.** We offer you shorthand instructions in abundance, and most excellent in quality. Our course is graded and arranged in logical order. We claim not a new system, but a new method of imparting the art of shorthand by which we can equip any ordinary intelligent person for the execution of any stenographic work devolving upon the expert stenographer or court reporter.

The method of instruction employed is practical and progressive. The principles are taken up and explained in an orderly manner, and the student directed how to apply them correctly in the work of forming the characters rapidly and artistically. You may have access to the quintessence of the standard systems—Pitman, Munson, Graham. We guarantee to turn you out a full-fledged stenographer capable of any kind of stenographic work. The art is made a specialty.

Tuition, $10.00 per month. Secure class seats immediately.

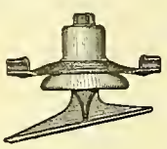
Evening classes, $5.00 per month. 98 per cent. of our students hold positions.



# "Monarch" Insulating Material.

A hard, black composition, which is not liable to crack or break during service, or alter its form under ordinary changes of temperature. It is moulded to exact shape, and is suitable for switch-blocks, sockets, bushings, telephone bases, and other parts requiring accuracy of dimension and finish.

## TROLLEY LINE INSULATORS.



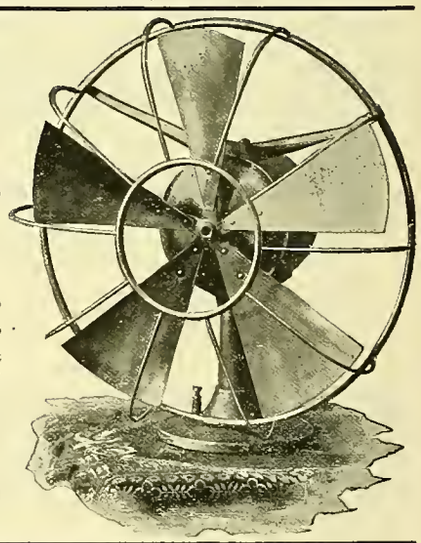
Insulated with Moulded Mica, and designed with special reference to their strength, durability and high insulating qualities.

**VULCABESTON** Heat Proof Insulation.

**H. W. JOHNS MFG. CO.,**

New York, Philadelphia, Boston. *240 and 242 Randolph Street, CHICAGO, ILL.*

# THE BEST ELECTRIC FAN On the Market.



**For Alternating Current, Wound for 50 or 100 volts.**

The Fan is 14 inches in diameter.
Will always start when current is on.
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

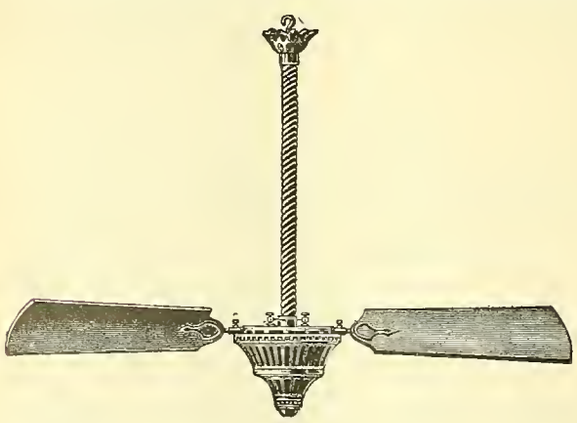
Agents Wanted in Different Localities.

For further information address

THE

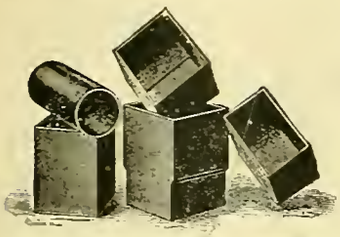
**W. J. Davis Electric Co.,**

**PITTSFIELD, MASS.**



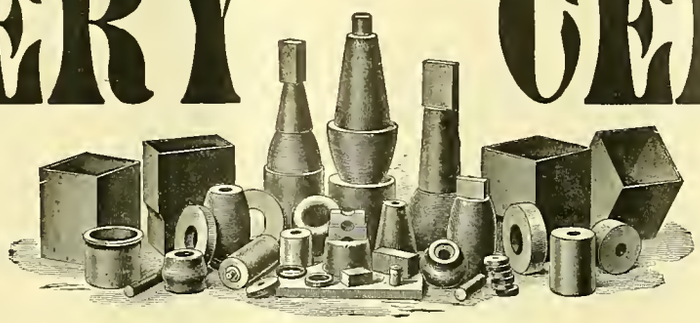
**AN EMPHATIC SUCCESS!**
**THE DIEHL ELECTRIC FANS WIRED IN A SERIES OF TWO OR MORE ON A STREET RAILWAY CURRENT.**

**DIEHL & COMPANY, 385 BROADWAY, NEW YORK.**



# THE FREEMAN

# BATTERY CELLS.



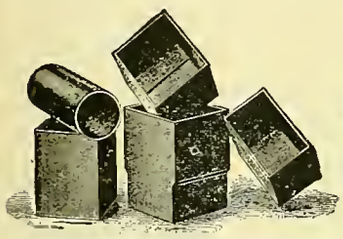
Estimates Furnished on Application. Prompt Delivery.

Standard Sizes Always on Hand.

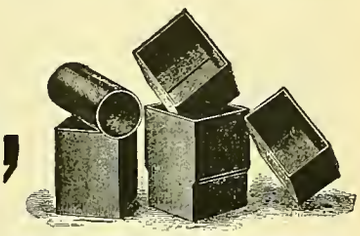
The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplished, providing additional strength to such an extent that this cell can be used where no other would be practical.

**Agents Wanted in all Cities.** **Write us for information and catalogue.**

THE



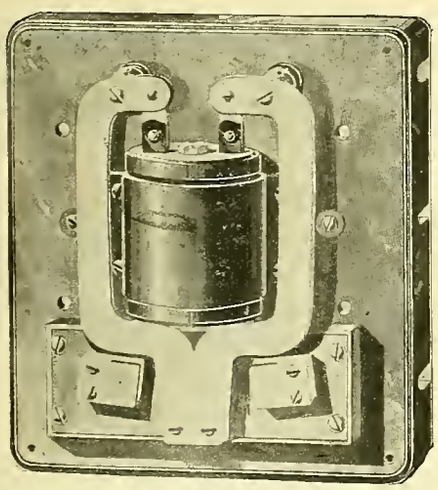
## Newton Rubber Works,



Newton Upper Falls, Mass.

## SINCE MARCH 1st

# Our New (Model 1895) Electric Light and Power Controllers



HAVE BEEN ADOPTED BY CENTRAL STATIONS OPERATING

**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{On}{Out}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

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We are in a position to offer something exceedingly attractive in the line of a

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Which we claim to be the best battery telephone that can be bought on the open market to-day. We are also headquarters for

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And are quoting prices that get the business on

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And everything that goes to make up a complete equipment. We also have the best non-infringing

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**It will pay you to get our prices.**

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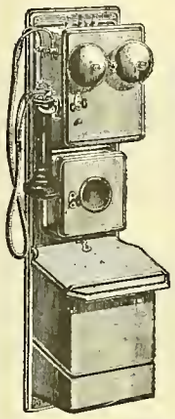

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½ TO 10 CANDLE POWER.

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Series Lamps a Specialty.

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General Sales Agents,

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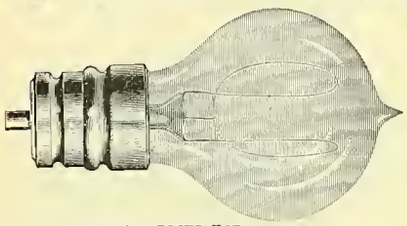

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**YOU DON'T SEE THE TWIST IN THE FILAMENT.**

*THIS LAMP is specially adapted to street and general railway and steamboat use, because it is absolutely non-vibratable, and we guarantee for it 50 per cent. longer life and better service than any other lamp now on the market. The filament will not droop or get out of shape while in use, no matter at what angle it is burned.*

*A good lamp at a fair price. Ordinary lamps at ordinary prices.*

**AGENTS WANTED IN LEADING CITIES.**

**WRITE US.** **Ætna Electric Works, Hartford, Conn.**

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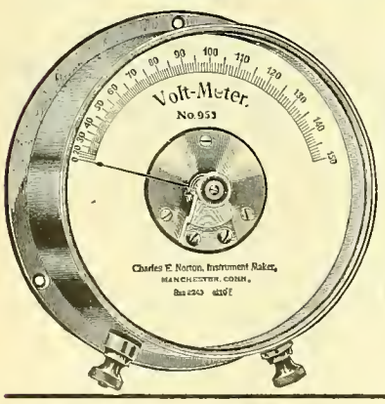


A standard instrument.
Perfect in construction.
The best instrument made for general work.
Satisfaction guaranteed.
New catalogue.
Agents wanted in leading cities.
Write us for prices and you will purchase.

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**SAMSON SPOT CORD**

For Arc Light and Trolley Cord.

SAMSON CORDAGE WORKS, - BOSTON, MASS.

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## For Electrical Purposes

Guaranteed 98/99% and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by

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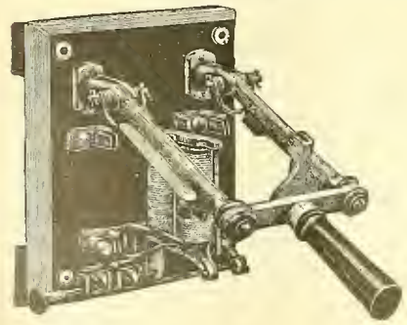
# MOTOR ARMATURES COST MONEY.



You can prevent them from burning out by using

## THE BRODIE AUTOMATIC MOTOR-SWITCH.

It combines in one piece of apparatus a double-pole switch, adjustable limit-switch and automatic cut-out, and instantly disconnects the motor whenever it is overloaded and whenever the circuit fails from any cause.

Agents wanted in all sections of the country.

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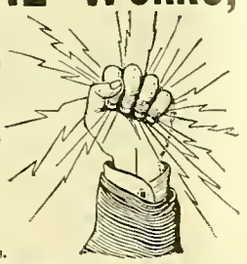
INCANDESCENT AND FLEXIBLE CORDS,

Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

CABLES FOR AERIAL AND UNDERGROUND USE.



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Two Wires in a Single Tube, the Standard Method of Electric Wiring.

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# "CLARK" WIRE.

TRADE MARK.

For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

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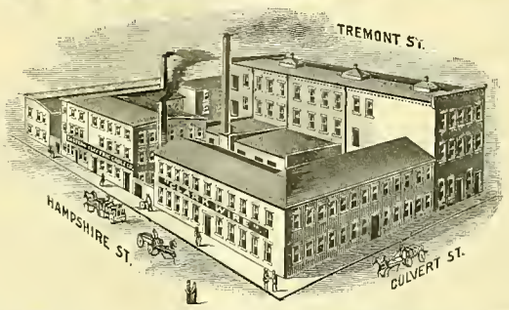


In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."

The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first class Insulated Wire.

We shall be pleased to mail Catalogues with Terms and Discounts for Quantities.

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A strictly first-class insulating paint for armatures, fields, switchboards, conduits, iron and wood poles, connections, mouldings, wires, cut-out boxes, lamp hoods and all other kinds of electrical appliances where high insulation is desired. Write for further particulars.

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We own Patent No. 395,584, covering Wrought-Iron Cement-Lined Pipe for Subways and the method of Laying. Also, Patents Nos. 416,234 and 416,235 for Distributing Boxes. Over 9,000,000 feet of this Subway Constructed by us *now in use in the United States and Canad*

# "IDEAL" INSULATED COPPER WIRE.

Approved by the New York Board of Fire Underwriters.

The Only Authorized FIBRE COVERED WIRE for INSIDE, TUBE and CONCEALED WORK GENERALLY.

It will not Deteriorate by long use, nor Oxidize the Copper. Finished in the following Styles: Black Polished, White and Black Glazed Braid and White Fireproof.

We can freely recommend this Wire for all inside wiring, from the fact that recent insulation tests made by reliable authorities show that it stands very high.

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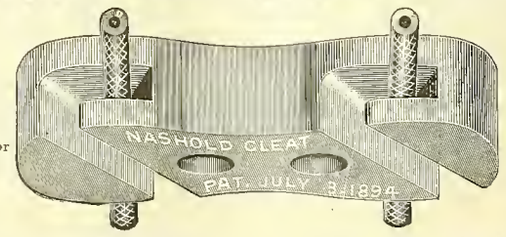
Patented in U. S., Canada, England, France, And Applied for In Germany.




FOR SALE BY ALL ELECTRICAL SUPPLY HOUSES.

**It is the most practical Cleat made.**
**It is made of finest glazed porcelain.**
**It is in one piece.**
**It has the strength.**

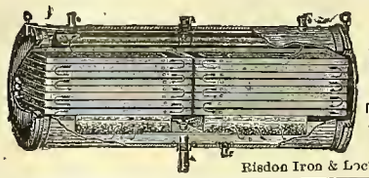
**It will lock the wire firmly.**
**It will NOT break in putting up.**
**It will NOT hold moisture.**
**It will NOT hurt the insulation.**

The wire can easily be put in place or removed without loosening the Cleat. It is a great saver in Time and Labor over any other Cleat in use for putting up Electric Light or other Wires.

## The Nashold Cleat Company,

Telephone, Harrison 636. 934-935 Monadnock Bldg., CHICAGO, ILL.

# Stilwell's Patent Live Steam-Feed Water Purifier.



**Removes all Impurities.**

Entirely prevents *scale* in Steam Boilers. Catalogue on application.

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NON CORROSIVE, CONVENIENT and EFFECTIVE.

*Price, 25 Cents.*

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# NOTICE.

*To Steam Users, and others interested in the manufacture, purchase, or use of, and sale, of Steam Boilers.*

Having been granted Letters Patent on a "Safety Water Tube Boiler," of the "type" and "class" in which the Steam and Water drums are arranged and located transversely to the flow of products of combustion in their travel from the furnace to out-take to stack, of which the "Stirling" and "Pierpoint" are examples. My patents covering, in a fundamental degree, devices and arrangements, for the maintenance of continuous circulation throughout the entire boiler system, and, it having become known to me that certain parties are offering for sale boilers of this class, for which boilers they claim such continuous circulation, it is, therefore, necessary for me to notify manufacturers, users, buyers and sellers, and those who may be acting as agents for the sale of such boilers, that the same are a direct infringement of my patents, which it is my purpose to protect to the utmost extent. at the same time to guarantee to all purchasers of my Boilers the fullest protection against claims or litigation on the part of any and all patentees of Water Tube Boilers.

L. M. MOYES,
[Late Manager Babcock & Wilcox Co.]
PATENTEE AND MANUFACTURER
**Combine Safety Water Tube Boiler,**
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Electrical engineer (29), married, wants position with small manufacturing company or in central station; eight years' practical experience in the manufacture, installation and running of lighting, traction and electric welding machinery. First-class references. Address "C. E.,"
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Are changing our voltage and have for sale 20,000 lights' capacity, sizes from 10 to 150 lights, 1,000 volts primary, 52 or 104 volts secondary, all in excellent condition. Write for prices.

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# For Sale, Very Cheap.

One 10x12 Ball High Speed Engine.
One 50 H. P. Tubular Boiler.
One 60 H. P. Tubular Boiler.
Worthington Pump, Heater, Surgetank, for above.
Sixteen 6⅞ ampere Sperry Arc Dynamos.

Hyde Park Electric Light & Power Company,
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# PROPOSALS.

The city of Knoxville, Tennessee, is about to install its own light plant. Its light committee invites persons or firms dealing in electric lighting machinery and electrical supplies to correspond with them in reference to the immediate installation of an up-to-date electric light plant of not less capacity than 250 arc lamps of standard candle power.

J. R. WADE, Chairman.

# Proposals.

Notice is hereby given to all electric light companies supplying light to cities, that the contract by which the city of Johnstown, Pa., is now lighted will expire in September, 1895, and the councils of the city of Johnstown hereby invite proposals for the furnishing of light to the city for a term of three or five years. About two hundred (2,000 candle power) arc lamps will be required. The right of way over and through the streets and alleys will be granted for the erection of poles A plant can be centrally located and supplied with coal at less than one dollar per ton. All communications to be addressed to JNO. J. BROWN,

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**FOR ELECTRICAL USES:**

**Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the Inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.**

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This company is manufacturing **A Compound Magneto Telephone**

Which it sells outright under a guarantee both as to efficiency and as against infringement of patents.

It talks as well over one hundred miles as any other Telephone talks over one mile.

This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists.

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# HIGH-GRADE TELEPHONES

We make a strictly first-class instrument for exchange service and private lines. It is a **BATTERY TELEPHONE** and is guaranteed not to infringe. Write for catalogue and prices.

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# Dynamos and MOTORS.

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Guaranteed the best Dry Battery ever made. Internal short circuiting or local action is eliminated. Will not deteriorate when not doing work. Will hold its first value over long periods of time. Internal resistance small; high and constant E. M. F. Will not run down or die on the shelf. No bursting of seals or oozing of salts from the top.

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Cartridge or Porous Cups made of especially prepared paper. One-half the size and one-third the weight of other porous cups. Guaranteed to be equal to any Salammoniac battery made. The cheapest battery now on the market.

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All patterns of tempered copper segments guaranteed true to gauge, free from defects; no alloy; finish and temper equaled by none. Exclusively used by some of the largest companies in the country.

**All Batteries Guaranteed. Send for Catalogue.**

THOROUGHLY RELIABLE

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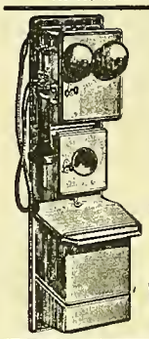
(LONG and SHORT DISTANCE)



I make prices to suit the construction man, for I want his trade.

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# '95 Catalog Now Ready!

House Goods Supplies,

ELECTRIC LIGHT SUPPLIES,

TELEPHONE SUPPLIES.

ESTABLISHED 1867

## PARTRICK & CARTER CO.

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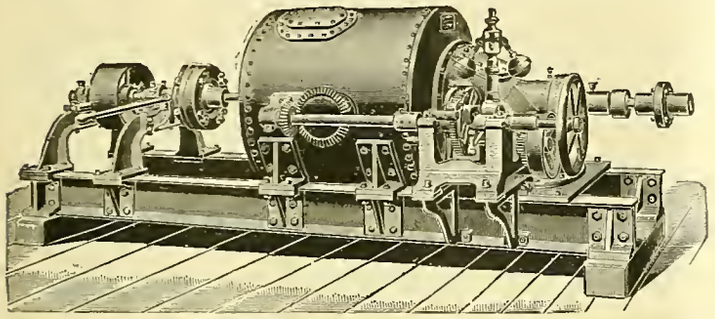
CATALOGUES ON APPLICATION
Send Business Card and mention WESTERN ELECTRICIAN.

# VICTOR TURBINE WATER WHEEL.



Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.

The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

***SEND FOR CATALOGUE AND PARTICULARS.***

The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 36 H. P. under 38 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs, on horizontal shafts, and where the situation admits of their use we recommend them.

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Risdon Iron & Locomotive Works, San Francisco, Cal., Pacific Coast Agents.

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**USE THE BEST!**

## Eureka Commutator Compound.

A perfect Compound for Dynamos and Motors. Works on any Commutator with Copper or Carbon Brushes. Send for sample; price 75c per stick.

**Eureka Compound Co,**
**SIOUX FALLS, S. D.**

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**Storage Batteries**
FOR ALL PURPOSES.
Bradbury-Stone Electric Storage Co.,
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ELECTRIC CO., 192 Broadway, New York,

Is the only concern in the world that makes

## Arc Lighting

Apparatus for every purpose, and for use on every current.

Our Arc Lamps can be used on any current whatever

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**$1.00**

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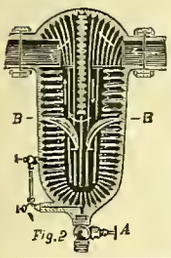


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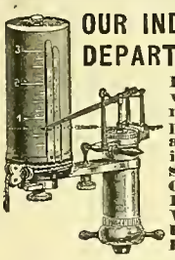
**For Extracting Oil From Exhaust. Knocked Out All Competitors In Three Important Tests. Send for Circular.**



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**Is complete with the most modern perfect articles in the line. Send for Catalogue. Reducing Wheels, Planimeters, Etc**

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Nothing is so profitable in a small way as **EUREKA PACKING.**

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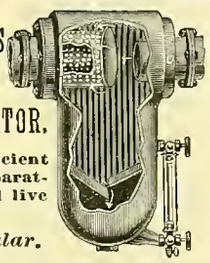

**The most efficient device for separating water and live steam.**

***Get Circular.***

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## Robertson's Exhaust Pipe Head.

A First-class Article At Very low Price.

***You Need One.***

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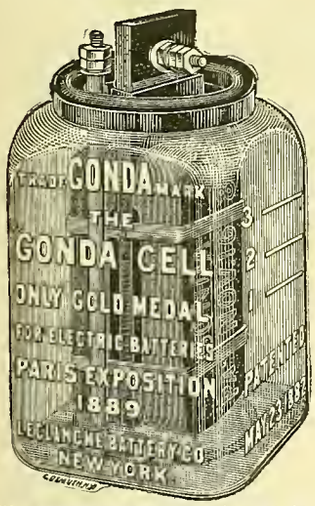


***The Standard Open Circuit Batteries of the World.***

SEND FOR CIRCULAR AND PRICES.

**THE LECLANCHE BATTERY CO.,**
***111 to 117 East 131st St., N. Y.***

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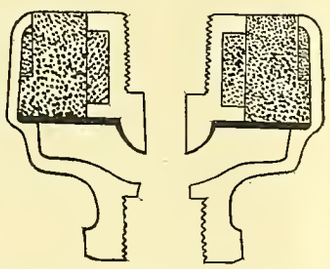
## NEW INSULATING JOINT.



Sectional View—Patented July 10, 1894—Full Size.

**For Insulating Fixtures.**

This joint conforms to the requirements of Underwriters' rules. Write for prices and circulars.

**Interstate Complete Electric Construction Co.,**
809 to 817 So. 7th St., ST. LOUIS, MO.

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## The Brady Mast Arms.

T. H. Brady, New Britain, Conn., U. S. A.,

Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work.—*Catalogues and Prices furnished on application.*

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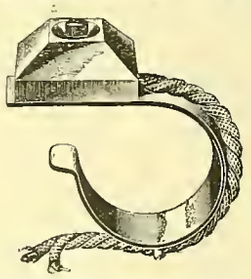
## Table Push.

SOMETHING



NEW.

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**HUEBEL & MANGER,**
MANUFACTURERS
Electrical and Brass Goods,
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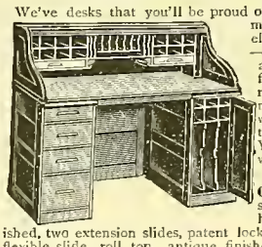
**—isn't it almost time?**



We've desks that you'll be proud of—that ornament the most elaborate office—best material and splendid finish. We'll return the money if you want to send the desk back. You won't want to.

**Roll Top Office Desk,** solid oak, highly polished, two extension slides, patent lock and perfect flexible slide, roll top, antique finished, castered, high curtain, 4 ft., **$17.50;** 4 ft. 6 in., **$18.50;** 5 ft., **$20.50.** Low curtain, 4 ft., **$14.75;** 4 ft. 6 in., **$17.00;** 5 ft., **$18.75.**

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**Montgomery Ward & Co.,**
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TERMS. Cash with order, or will ship to our own address and draw through your bank with draft attached to Bill of Lading.

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**Sole Manufacturers,**

Grimshaw White Core and Raven Core Wires, Grimshaw Underground Lead Covered Cables,
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Vulca Bushings, all sizes, Vulca Electrical Wire Ducts for Interior Construction.

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## WATERHOUSE-GAMBLE ARC LAMPS.

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Correspondence Solicited.

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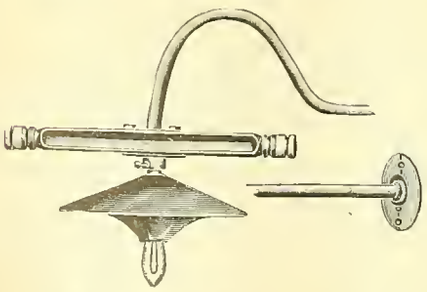
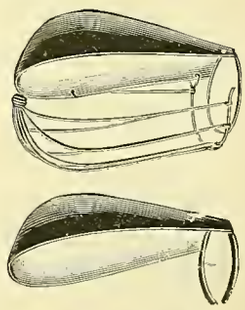


## WHAT ARE THEY?



*Send for Catalogue 894 and see.*

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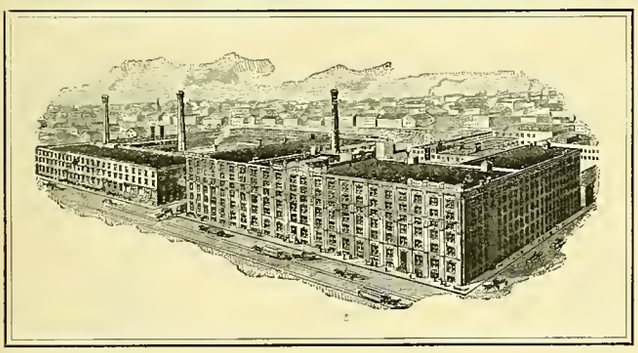


# The Bryant

## CHANDELIER SWITCH.

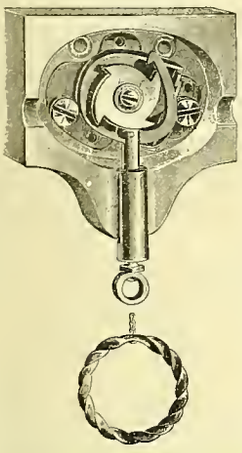
**ONE Pull Lights the Entire Chandelier.**
**The NEXT Pull Puts it Out.**

*Buy a* **SAMPLE** *and you will buy* **MORE.**

IN STOCK AT NEW YORK AND CHICAGO.

List Number 947.

**BRYANT**
**Chandelier Switch.**



| | List Price. |
|---|---|
| 5 Amp., complete with 6 ft. Chain and Ring, - - - - - - each, | **$1.50** |
| Extra Brass Chain, - - - per foot, | **.05** |
| Extra Brass Rings, - - - each, | **.05** |

This Chandelier Switch is intended to be placed in the canopy of the chandelier, and is fitted with a clamping attachment on the back which clamps around the pipe, and is held in place by a set-screw. Is rated at ten amperes. The chain can be dropped down between the pipe and the shell of the chandelier, or through a small hole in the canopy outside of the chandelier. It is fitted with brass ring hanging below the chandelier, the first pull of which lights the entire chandelier, the next pull cutting it off.

Chain and ring can be furnished to special finish where desired to match any finish or fixture.

# WESTERN ELECTRIC COMPANY,

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CABLE ADDRESS, HELIOS PHILADELPHIA
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We congratulate you upon your success.

Yours truly,
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For Direct and Alternating Currents.

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***NOTE THIS OFFER:*** Let us know the price you are now paying, stating yearly consumption, and we will guarantee to beat it from 50 cents to $2.00 per thousand.

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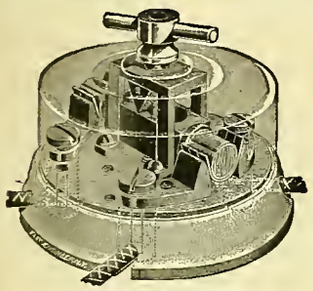

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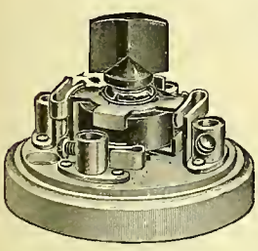
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



## FLUSH SWITCHES

Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

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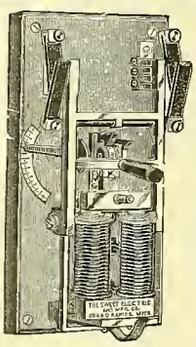
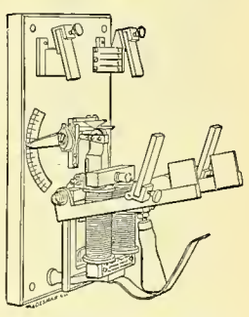


No! we make the final break off from carbons so that it is impossible to get heat enough to fuse points of your copper contact plates; no filing off of rough points, no hanging on after you have had a short circuit or over load, bound to work as easily after opening 1,000 times as it does when opened the first time.

**WE KNOW YOU NEED OUR CIRCUIT BREAKER,** and do not see why you should delay writing us any longer. One burn out will pay for a dozen of our instruments. **To be used on the Alternating or Direct Current Systems.**

Write us at once.



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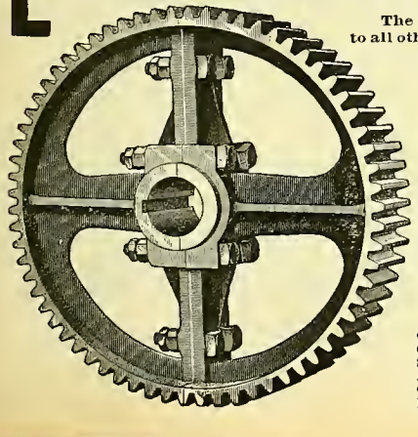
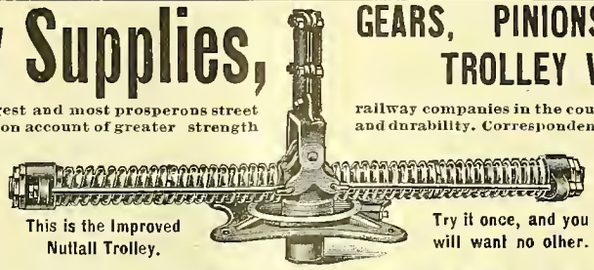
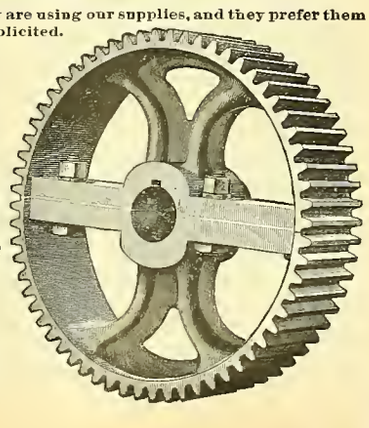




This is the Improved Nuttall Trolley.

Try it once, and you will want no other.



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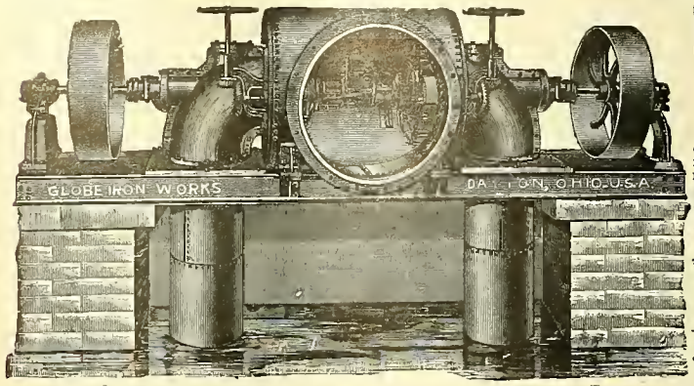


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The originals of these certificates and tests of other sized wheels can be seen at our office.

**Test of a 45-inch Wheel—July 9, 1894.**

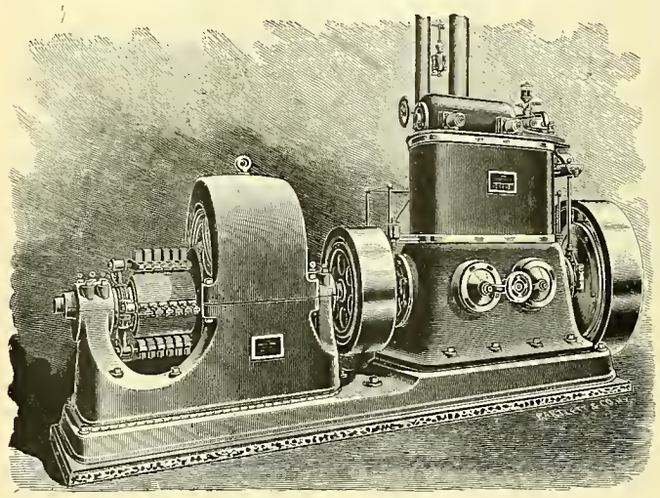
| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 18.06 | 119.17 | 141.68 | 205.27 | 79 76 |
| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.55 |
| ¾ " | 16.78 | 117.33 | 112.60 | 175.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.17 | 1.8 40 | 76.62 |

**Test of a 42-inch Wheel—July 14, 1894.**

| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.33 | 128.00 | 134.18 | 199.56 | 80.50 |
| ⅞ " | 16.66 | 134.80 | 120.85 | 188.14 | 83.09 |
| ¾ " | 16.59 | 129.33 | 104.85 | 162.89 | 82.77 |
| ⅝ " | 17.13 | 125.25 | 92 76 | 142.40 | 79 21 |
| ½ " | 17.48 | 121.00 | 70.80 | 98.85 | 70.60 |

For information and catalogue write

**THE DAYTON GLOBE IRON WORKS CO., Dayton, O., U. S. A.**



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### THREE TYPES:

**COMPOUND, 5 to 1,000 H. P.,** For Electric Lighting, Street Railway and high-grade service generally.

**STANDARD, 5 to 250 H. P.,** Ranks with the best non-compounded automatic engines.

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21-23 Fremont St., San Francisco, Cal. — 259 Main St., Salt Lake City, Utah. — Wonderly Bldg, Grand Rapids, Mich.
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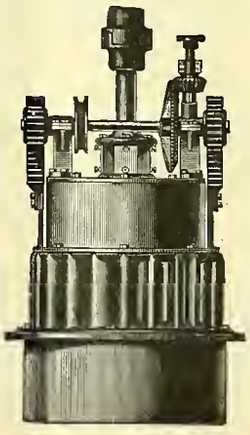

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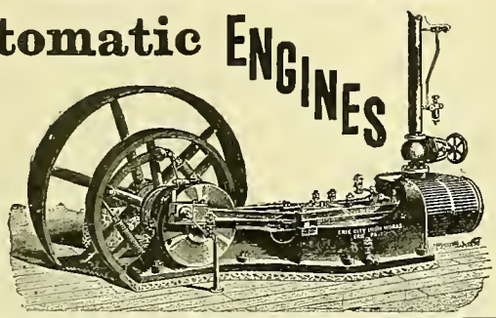

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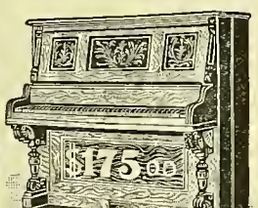

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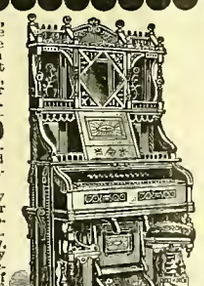

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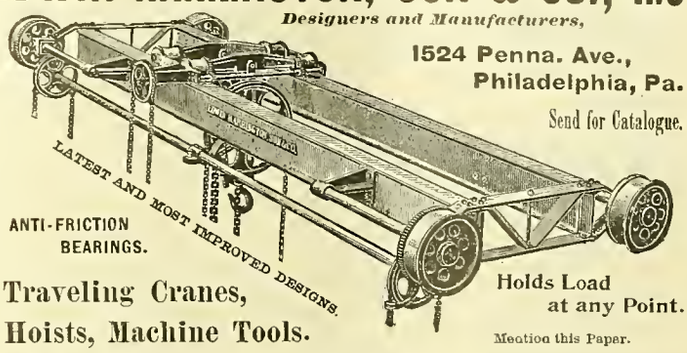


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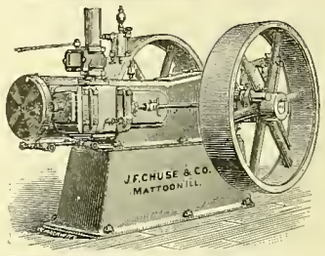


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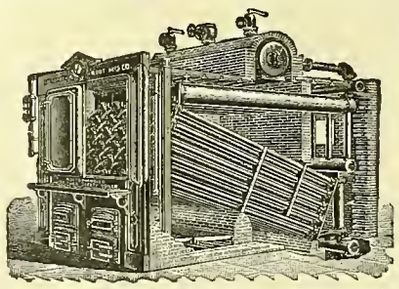

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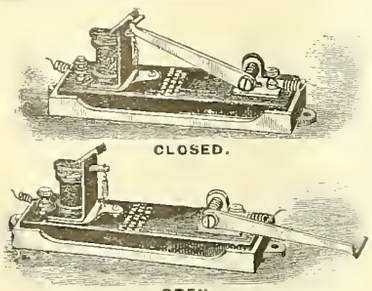

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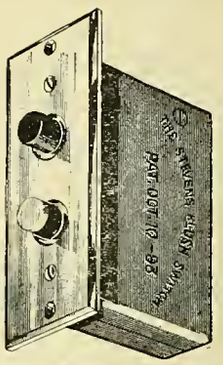


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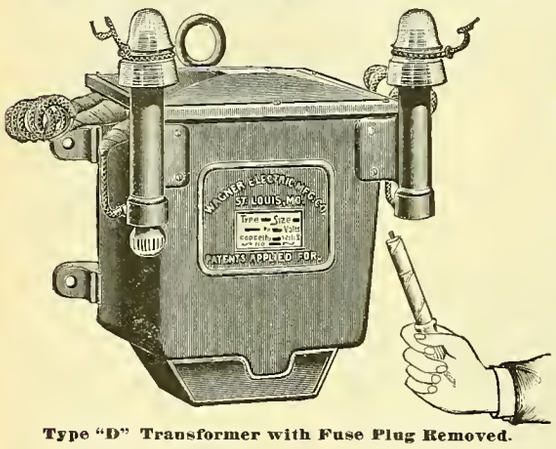


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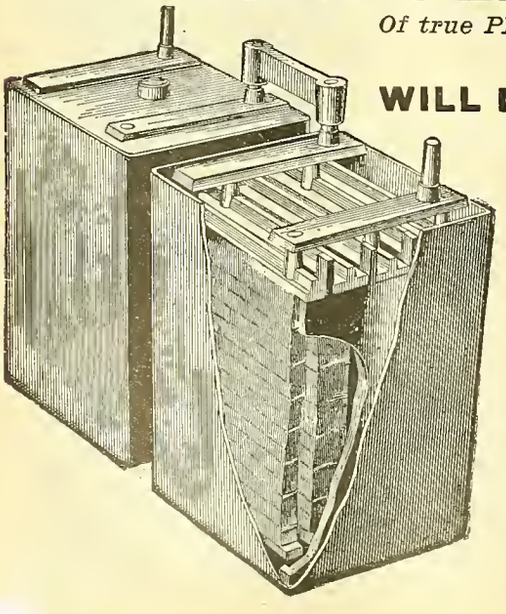

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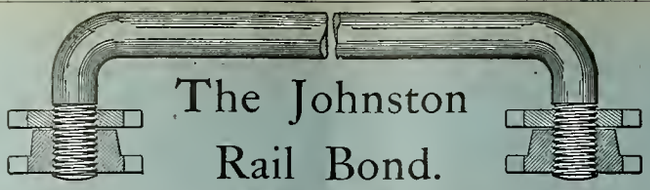

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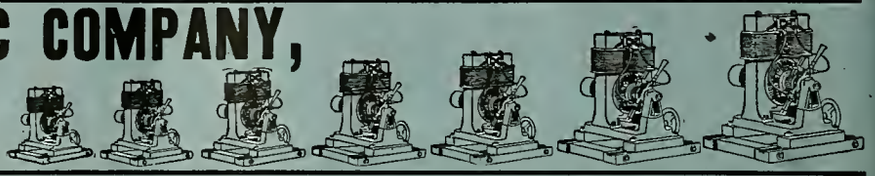

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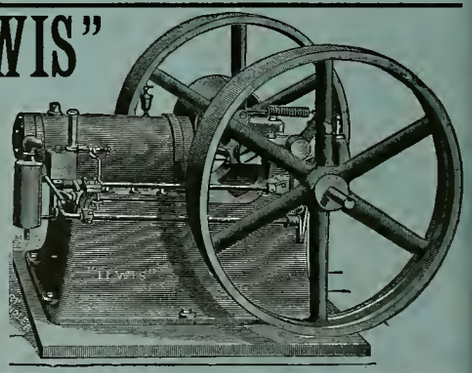

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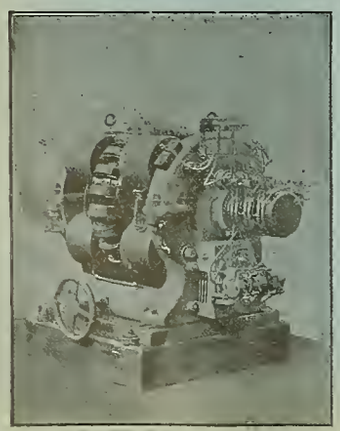

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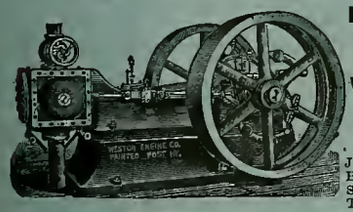

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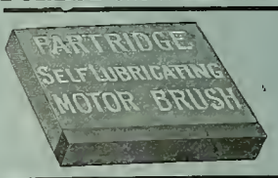


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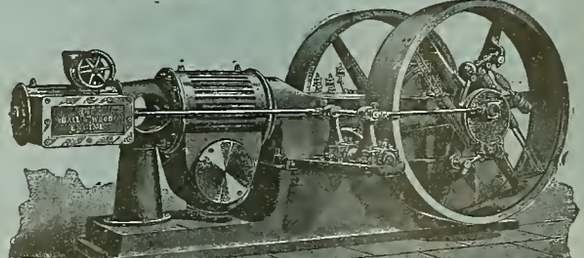

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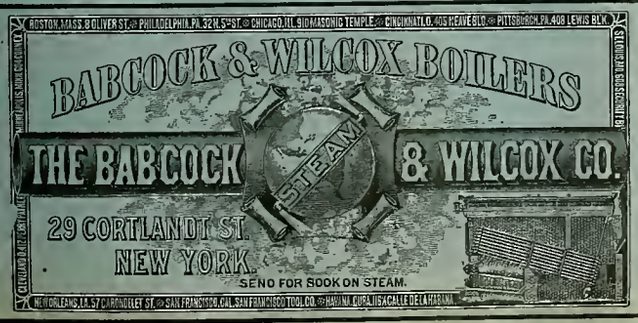
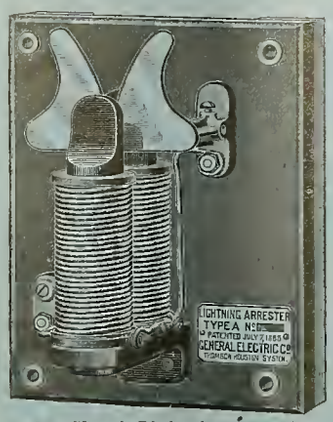
James & Company, Chattanooga, Tenn.




**STANDARD UNDERGROUND CABLE CO.,**

THE ROOKERY, WESTINGHOUSE BUILDING, TIMES BUILDING, NEW YORK

**WIRES and CABLES.**



Arc Circuit Lightning Arrester.

# INSURANCE NOW

*AT SMALL COST MEANS*

# PROTECTION

*FOR THE FUTURE OF*

# Large Investment.

OUR LINE AND STATION LIGHTNING

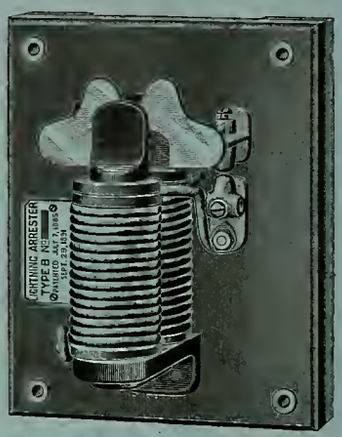
# ARRESTERS

*FOR*

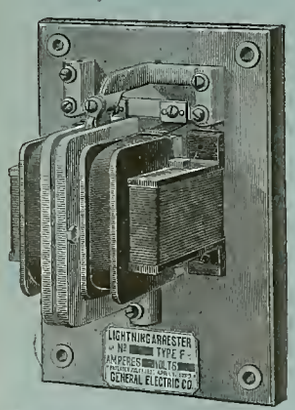
ALL LIGHT AND POWER CIRCUITS

*STILL REMAIN*

The Only Reliable Arresters Before the Public.



Lightning Arrester for Light or Power Circuits.



Station Lightning Arrester for Alternating Circuits.

The Only Lightning Arresters Embodying the

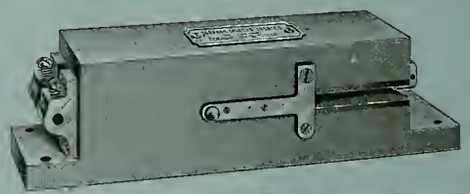
## MAGNETIC BLOWOUT PRINCIPLE,

WHICH IS ALWAYS READY FOR BUSINESS,

*AND NEEDS NO ATTENTION OR ADJUSTMENT.*

Those without this protection should make provision now.

**WRITE FOR OUR PRICES.**


Lightning Arrester for Railway Circuits.

# GENERAL ELECTRIC COMPANY.

**SALES OFFICES:**

Boston, Mass., 180 Summer St.
New York, N. Y., 44 Broad St.
Syracuse, N. Y., 244 West Fayette St.
Buffalo, N. Y., Erie Co. Savings Bk. Bldg.
Philadelphia, Pa., 509 Arch St.
Baltimore, Md., 227 East German St.
Pitsburgh, Pa., 425 Wood St.

Atlanta, Ga., Equitable Bldg.
Cincinnati, Ohio, 264 West Fourth St.
Columbus, Ohio, 14 North High St.
Nashville, Tenn., 308 North Summer St.
Chicago, Ill., Monadnock Bldg.
Detroit, Mich., 13 Rowland St.
Omaha, Neb., 309 South 13th St.

Kansas City, Mo., N. Y. Life Bldg.
St. Louis, Mo., Walnwright Bldg.
Dallas, Tex., cor. Elm and Griffin Sts.
Helena, Mont., Electric Bldg.
Denver, Colo., 505 16th Street, Kittredge Bldg.
San Francisco, Cal., 15 First Street.
Portland, Ore., Front and Ankeny Sts.
Seattle, Wash., Bailey Bldg.

FOREIGN DEPARTMENT: { Schenectady, N. Y. / New York Office, 44 Broad St. }

Canada, Canadian General Electric Co., Ltd., Toronto, Ont.

**CARPENTER ENAMEL RHEOSTATS.**

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## CLASSIFIED LIST.


**Accumulators.**
Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.

**Arc Lamps.**
Am Gas Engine Elec. Co.
C & C Electric Co.
Central Electric Co.
Clark Electric Co.
Corey, R. B.
Crocker-Wheeler Elec. Co,
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Mather Electric Co.
Perkins El. Switch Mfg. Co.
Standard Thermometer Co.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Hemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Gillette, E. & F.
Huebel & Manger
Ostrander & Co., W. R.
Partrick & Carier Co.
Proctor-Raymond Elec. Co.
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Bicycles.**
Monarch Cycle Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Brownell & Co., The.
Clonbrock Steam Boiler Wks.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co., Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Central Electric Co.
Pariridge Carbon Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Corey, R. B.
General Electric Co.
Pariridge Carbon Co.
Wertheim, Ed.
Western Electric Co.

**Compound.**
Eureka Compound Co.
Standard Paint Co.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins Co.
National Conduit Mfg. Co.

**Construction & Repairs.**
Allen-Hussey Co.
Amstutz, N. S.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El Const. Co.

**Contractors and Electric Light Plants.**
Allen-Hussey Co.
Amstutz, N. S.
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Clark Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Siemens & Halske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Brodie Electric Co.
Brownlee & Co.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec, Mfg, Co.
Electric Appliance Co.
Electric Protection Co.
Elec. Selec. & Signal Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Desks.**
Montgomery Ward & Co.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Clark Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Mather Electric Co.
Roth & Eck.
Siemens & Halske Elec. Co.
Waldo-Hyde, Wm.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Allen-Hussey Co.
Amstutz, N. S.
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg, Co,
Ford, Owen.
Thayer Electric Co.

**Electrical Instruments.**
Anderson, Albert & J. M.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Norton, Chas. E.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Queen & Co. Inc.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Electrical Specialties.**
Allen, L. B.
Clark El. Specialty Mfg, Co.
Electric Protection Co.
Interstate Com. El. Const Co.
Nashold Cleat Co.
Proctor-Raymond Elec. Co.
Rockford Torch Co.

**Electrollers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
General Electric Co.

**Engines, Gas.**
Am. Gas Engine Elec. Co.
Otto Gas Engine Wks.
Webster Mfg. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Brownell & Co., The.
Chuse & Co., J. F.
Erie City Iron Wks.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Central Electric Co.
Davis Elec. Co., W. J.
Diehl & Co.
Interior Conduit & Ins. Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Bard Rubber Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Butler Mfg. Co.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Forest City Elec. Wks.
General Electric Co
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Morris & MacCurdy;
Nashold Cleat Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Proctor-Raymond Elec. Co.
Queen & Co Inc.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Thayer Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Edwards, W. S. Mfg. Co.
Hemingray Glass Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Fiberite Co., The.
Bart & Begeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Independent Electric Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Aetna Electric Works.
Am. Electrical Mfg. Co.
Automatic Elec. Spec. Co.
Beacon Vac Pump & Elec.Co.
Bernstein Electric Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Waldo-Hyde, Wm.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co, Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Harrington, Son & Co., E.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Andrae & Sons, J.
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec, Mfg, Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Works.
Mather Electric Co.
Roth & Eck.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.
Staudard Paint Co.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm.Co. Ltd

**Pianos and Organs.**
Beethoven Piano & Organ Co.

**Platinum.**
Baker & Co.

**Poles.**
Brownlee & Co.
Morris, Tasker & Co.
Nuttall Co., R. D.
Valentine-Clark Co.

**Porcelain.**
Empire China Works.
General Electric Co.
Hemingray Glass Co.

**Publishers, Electrical.**
Electrician Publishing Co

**Push Buttons.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Separators.**
Goubert Mfg. Co.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

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American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones.**
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Central Electric Co.
Gillette, E. & F.
Gustafson, W. A.
Jameson & Co., W. D.
M. & B. Telephone Co.
Partrick & Carter Co.
Western Electric Co.
Western Tel. Const. Co.
Williams & Abbott Elec. Co.

**Transformers.**
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Diamond Electric Co.
General Electric Co.
Hornberger Elec. Mfg. Co.
Louisville Elec. Works.
Ft. Wayne Elec. Corporation.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

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Samson Cordage Wks.

**Trucks, Electric Car.**
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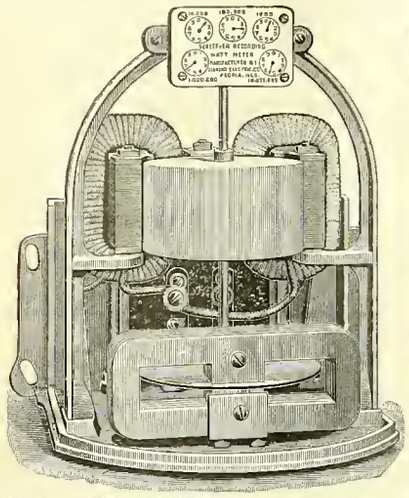
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.



Chicago Office, 1307 Manhattan Building, Central Electric Co., Selling Agents.

# SCHEEFFER'S RECORDING WATT-METER.

For Alternating Circuits. No Commutator. No Brushes.

Registers Direct Actual Power Consumed.

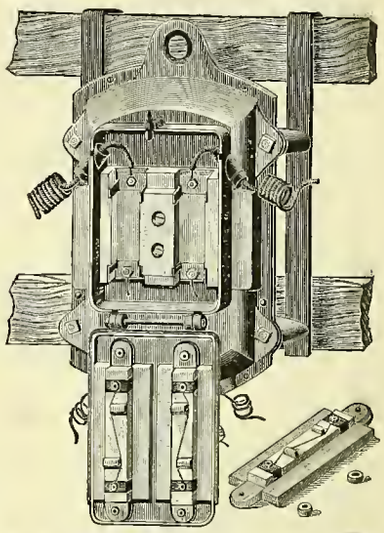
EASILY ADJUSTED. ABSOLUTELY RELIABLE.

# DIAMOND TRANSFORMER.

Simplest, Safest and Best.

FOR ANY VOLTAGE. FOR ALL SYSTEMS.

## DIAMOND ELECTRIC CO., Peoria, Ill.



# SAWYER-MAN INCANDESCENT LAMPS,

## With Bases to Fit Any Socket.

We have now resumed the manufacture of the well-known Sawyer-Man Lamps, on a scale to meet any possible demand.

We have adopted new methods of manufacture which add to the appearance and quality of our lamps, and make them by reason of their efficiency and long life, the cheapest and best lamps ever offered.

PRICES:

**PLAIN LAMPS.**

| | |
|---|---|
| 8, 10 and 16 candle power lamps | 25 cents each. |
| 20 and 25 candle power lamps | 30 " |
| 32 candle power lamps | 38 " |
| 16 candle power street car lamps | 25 " |
| 16 candle power street car lamps, anchored | 32 " |

**ORNAMENTAL LAMPS.**

| | |
|---|---|
| 8, 10 and 16 candle power lamps | 30 cents each. |
| 20 and 25 candle power lamps | 35 " |

Discounts according to quantity.

For etching the plain or ornamental lamps, 3½ cents each, net.

**COLORED LAMPS.**

"Dipped" lamps in red, blue or green, 5 cents each, net, additional.

Lamps with bases to fit Thomson-Houston sockets, 3 cents extra.

Boxing and packing at cost.

Prices are subject to change without notice.

# Westinghouse Electric & Manufacturing Company,

PITTSBURG, PA.

**Branch Offices in all Leading Cities.**

# WESTINGHOUSE ELECTRIC & MANUFACTURING CO.,

**PITTSBURGH, PA.**

We manufacture Complete Installations of

# ELECTRICAL APPARATUS

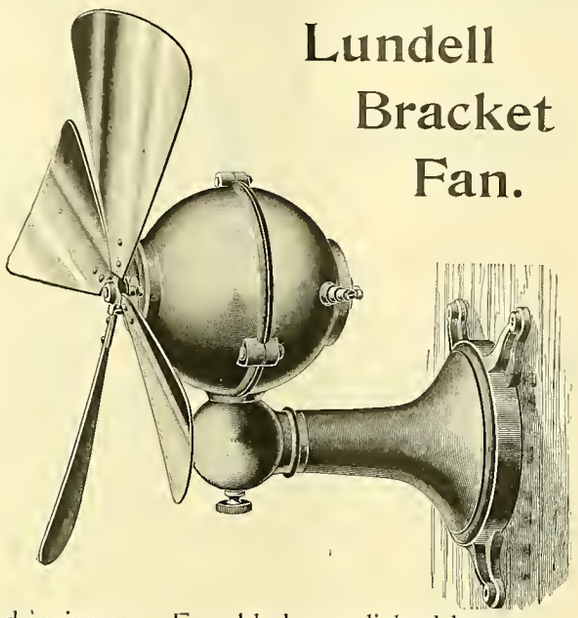
For **CENTRAL STATION ELECTRIC LIGHTING, LONG DISTANCE TRANSMISSION OF POWER, ELECTRIC RAILWAY AND ISOLATED PLANTS.**

**BRANCH OFFICES IN ALL LARGE CITIES.**

## Suit the action to the thought

and turn your thoughts in the direction of **Lundell Motors.** No other make of Fans will bring greater reward in

**customers—satisfaction—cash.**



**Lundell Bracket Fan.**

The type of Bracket Fan Motor illustrated is one that will find ready sale with a large class of trade—restaurants, hotels, clubs, billiard parlors, etc. No necessity for a jack-carpenter, fastens directly against the wall. Has a ball-joint, allowing adjustment of fan in any direction. Regulating switch giving 3 speeds. Body finished in japan. Fan blades polished brass. Furnished with guards when desired.

For constant potential incandescent circuits up to 115 volts.

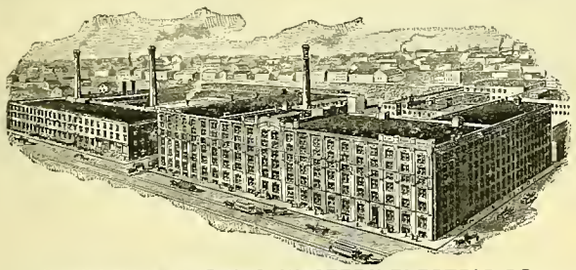
**Don't let the season get ahead of you. We are ready.**

## Central Electric Company,

Branches: { Kansas City, Mo.: Gate City Electric Co. / St. Louis: Southern Electric Supply Co.

173-175 Adams St., Chicago.

Okonite Wires.
Interior Conduit.
Helios Arc Lamps.



CHICAGO FACTORIES, WESTERN ELECTRIC CO.

# CIRCULAR LOOM CONDUIT.

## FLEXIBLE . . . CONDUIT . . . .

The present stiff tubes furnished for this purpose have long been found imperfect and unsatisfactory to the electrical engineer and constructor. The ***rigidity*** of the tube makes it an impossibility to install in buildings already constructed, without cutting the surface of the wall or ceiling; and the ***numerous*** joints and elbows make the drawing in of wires very difficult.

In any system of interior tubing, the first cost of the tube is in a measure immaterial; but the cost of the connections and elbows and the cost of labor in applying same, is the most important factor. There is also an equity to be figured in the ***waste*** of ***short*** and ***damaged*** lengths, which are practically worthless.

The ***Flexible Conduit*** recommends itself, because:—

1. It is thoroughly flexible.
2. It is thoroughly waterproof.
3. It requires no joints or elbows.
4. It will not readily ignite.
5. Wires will not stick in it.
6. It can be furnished in any length.

While the first cost of our tubing may seem high, we would suggest that consumers figure the cost of a ***short, stiff tube,*** the cost of ***joint sleeves,*** the cost of the ***elbows,*** the cost of the ***labor*** in applying same, and the probable ***waste*** in odd and damaged lengths; and net cost will show the economy of Flexible Conduit.

## IRON ARMORED CONDUIT . . . . . .

*Iron Armored* Circular Loom Conduit will be ready for delivery *May first,* and orders are now being entered for shipment on that date.

As is the case with the *flexible* conduit, experiment shows that the *Armored* Conduit will be the *most economical* and *satisfactory* conduit on the market.

ORDERS FILLED FROM NEW YORK OR CHICAGO AT MANUFACTURERS' PRICES.

# WESTERN ELECTRIC COMPANY,

**NEW YORK,** Greenwich and Thames Streets.
**CHICAGO,** 227 to 275 South Clinton Street.

CINCINNATI, O., Standard Electrical Works. DENVER, COLO., Mountain Electric Co. SAN FRANCISCO, CAL., California Electrical Works.

# INCANDESCENT LAMPS.

WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

## GLOBE ELECTRIC LIGHT CO., General Offices: Carter Building, BOSTON, MASS.

AGENTS WANTED. WRITE US.

# RECEIVER'S SALE.

## WARING ELECTRIC COMPANY.

The entire stock of

## NOVAK LAMPS,

of ALL candle powers and voltages, together with a large amount of

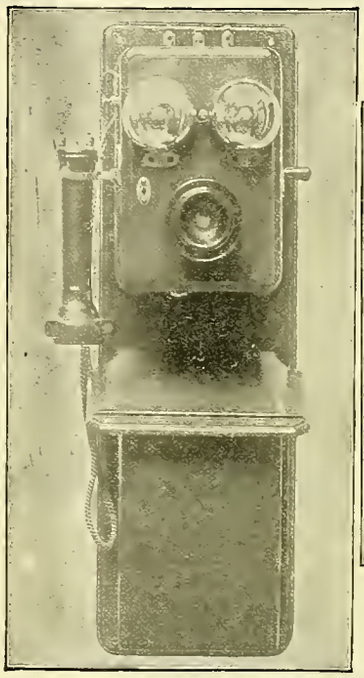
## MACHINERY,

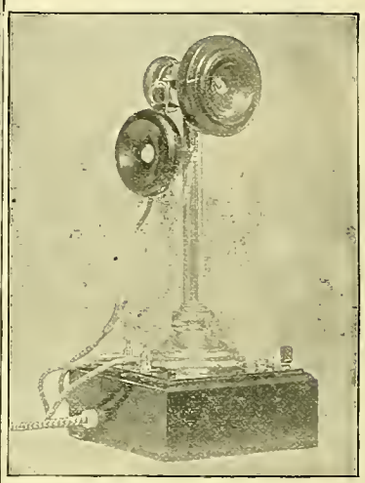
consisting of dynamos, pumps, etc., must be SOLD AT ONCE to close up the affairs of the company. For prices and terms address

**WM. WALDO-HYDE,** Receiver,

*Hartford, Conn.* *Manchester, Conn.*

## M. & B.





Desk Set.

**Complete Exchange Plants.**
**Metallic or Ground Circuit.**

SWITCHBOARDS ABSOLUTELY GUARANTEED.

STATE AGENTS WANTED.

ADDRESS

## M. & B. TELEPHONE CO.,

Bullitt Building, - Philadelphia.

# IMPORTED CARBONS!

GENERAL INCANDESCENT ARC LAMP CO.'S

## BERGMANN LAMPS. KNIGHT ARC LAMP.

**The Above Lines Include ARC LAMPS for Every Service.**

Address Inquiries to **R. B. COREY,** General Sales Agent,

Room 714 Havemeyer Building, NEW YORK CITY.

# FROM OCEAN TO OCEAN.

***San Francisco, Cal.***—Wm. G. Lawrence, engineer in charge of the exhibit of *Fort Wayne Electric Corporation:* At the California Midwinter International Exposition, 1894, I made a trial of your brushes on the Wood alternating current dynamo and exciter. The brushes and commutators ran cool, free from sparks, and with a good polish.

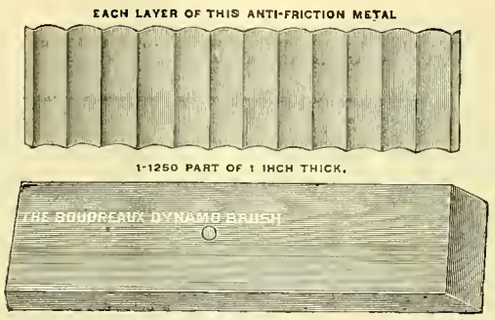
**THEY KNOW**

***New York.***—Interior Conduit & Insulation Co., Chas. S. Pease, Supt.: We take pleasure in recommending your Dynamo Brush after an extended test. We find it satisfactory in all respects.

**THE UNSURPASSED MERITS OF**

## The Boudreaux Dynamo Brush,

NO SPARKING
NO CUTTING
NO SPLUTTERING
NO HIGH RESISTANCE




NO GREASING
NO TRIMMING
NO SANDPAPERING
NO TURNING DOWN

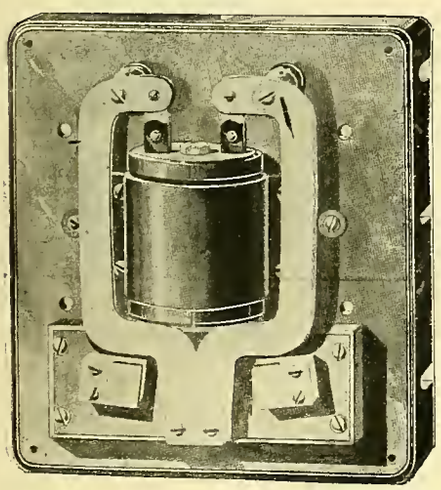
**SUPERIOR** to Woven Wire, Gauze, Copper or Carbon.

## The Boudreaux Dynamo Brush Co.,

**Mallers Building, Chicago.** **Postal Telegraph Bldg., New York.**

# SINCE MARCH 1st

# Our New (Model 1895) Electric Light and Power Controllers



HAVE BEEN ADOPTED BY CENTRAL STATIONS OPERATING

**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{On}{Out}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

**OUR GENERAL WESTERN AGENTS ARE**

## WALLACE ELECTRIC CO., 307 DEARBORN ST., CHICAGO.

## ELECTRIC SELECTOR & SIGNAL CO., 45 Broadway, New York.

# THE C & C ELECTRIC COMPANY

MANUFACTURERS OF

## MULTIPOLAR DYNAMOS, BIPOLAR DYNAMOS,

Direct Driven or Belted, in sizes up to 250 H. P. Up to 100 H. P.

Electric Motors, Automatic or Hand Controlled.
Complete Plants for Power Transmission.
Isolated lighting plants, Central Station Apparatus.

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on CENTRAL R. R. of N. J.

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# HELIOS ELECTRIC COMPANY,

Factory and Offices,

1310 Filbert Street, Philadelphia, Pa.

*We have no Stock nor Old Style Lamps that we must get rid of at any price—no junk.*

## THE HELIOS LAMPS

Are the latest patteros and newest type. Our Lamps are much in advance of any lamp now on the market, because they are New and of Latest Designs.

Our ALTERNATING LAMPS have Reflector Plates. Our DIRECT CURRENT Lamps do not see-saw. Our Focusing Lamps, both Direct and Alternating, are especially adapted for photo-engraving and stereopticon work.

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Mountain Electric Co., Agents for Colorado, Utah, Wyoming and New Mexico, Denver, Col.
Machinery Supply Co., Agents for Southern California and Arizona, Los Angeles, Cal.
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**A Central School of Shorthand and Typewriting of the most Modern and Complete Type.**

**A COMPLETE COURSE OF SHORTHAND.** We offer you shorthand instructione in abundance, and most excellent in quality. Our course is graded and arranged in logical order. We claim not a new system, but a new method of imparting the art of shorthand by which we can equip any ordinary intelligent person for the execution of any stenographic work devolving upon the expert stenographer or court reporter.

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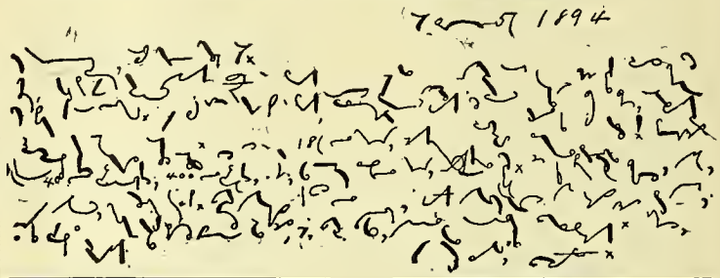
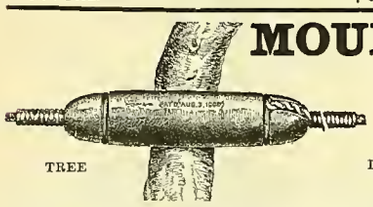
Tuition, $10.00 per month. Secure class seats immediately.

Evening classes, $5.00 per month. 98 per cent. of our students hold positions.




## MOULDED MICA.



TREE INSULATORS.

Wall Socket for Sign Work, etc.

## Weatherproof Sockets.

For use outdoors and in damp situations.

Regular Edison, Thomson-Houston & Westinghouse Base.

TROLLEY LINE INSULATORS,
VULCABESTON.

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240 & 242 Randolph Street,
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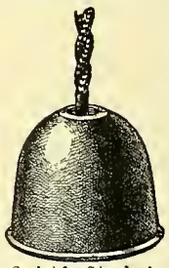
NEW YORK, PHILADELPHIA, BOSTON.



Socket for Standard ⅛-inch Pipe Bracket Fixtures.

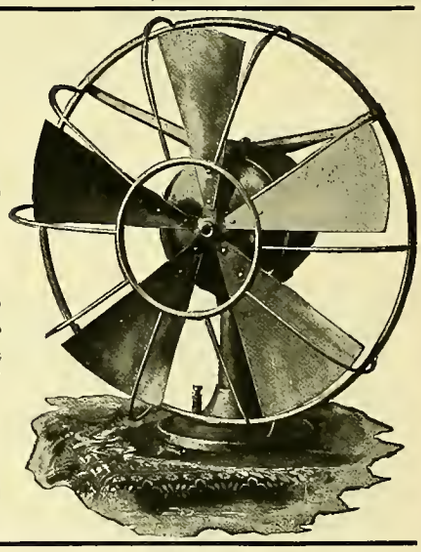
## THE BEST ELECTRIC FAN On the Market.

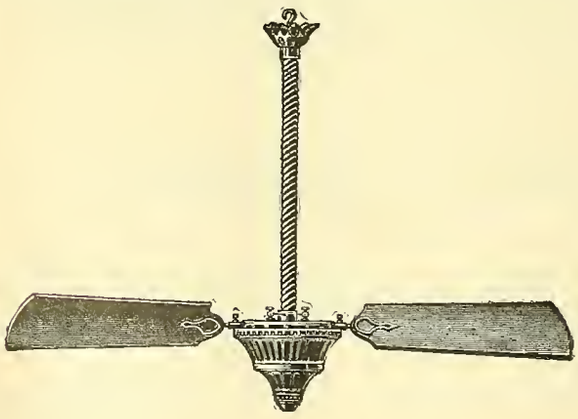
**For Alternating Current, Wound for 50 or 100 volts.**

The Fan is 14 inches in diameter.
Will always start when current is on
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

Agents Wanted in Different Localities.

For further information address
THE
W. J. Davis Electric Co.,
PITTSFIELD, MASS.

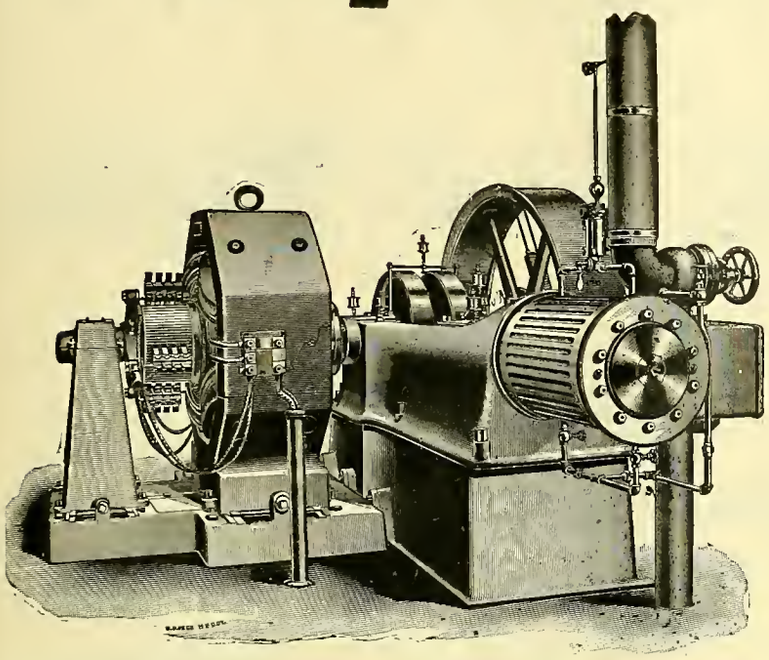




AN EMPHATIC SUCCESS!
THE DIEHL ELECTRIC FANS
WIRED IN A SERIES OF
TWO OR MORE ON A
STREET RAILWAY CURRENT.

DIEHL & COMPANY, 385 BROADWAY, NEW YORK.

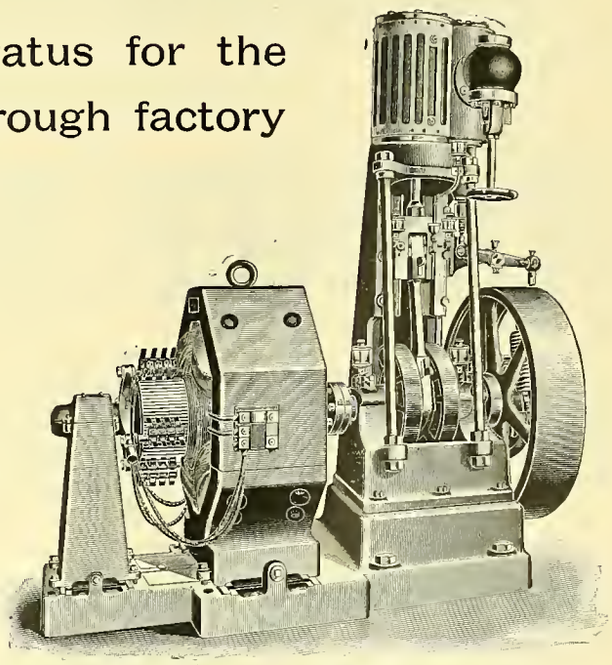
# Eddy Generators



DIRECT CONNECTED OR BELTED
FOR
ELECTRIC RAILWAYS,
CENTRAL STATIONS,
ISOLATED LIGHTING
OR
POWER PLANTS.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.



## All Our Apparatus Guaranteed As Represented.

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NEW YORK OFFICE,
HAVEMEYER BUILDING.

WINDSOR, CONN.

REPRESENTED BY:

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# THE UPTON ARC LAMP

## FOR ALL CIRCUITS.

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## The Cheapest to Buy, Use and Maintain.

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Direct current lamps, constant potential, with globe and resistance, to burn 8, 11, 14 hours, - - - - $12.00

Alternating current lamps and globe, - $14.00

Series current lamps and globe, - - $14.00

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# STANDARD THERMOMETER CO.,

## PEABODY, MASS.,

*The Original Manufacturers of the*

## SIMPLEX, WARD and KNIGHT LAMPS.

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**CHARLES A. BRAMHALL, Selling Agent,**

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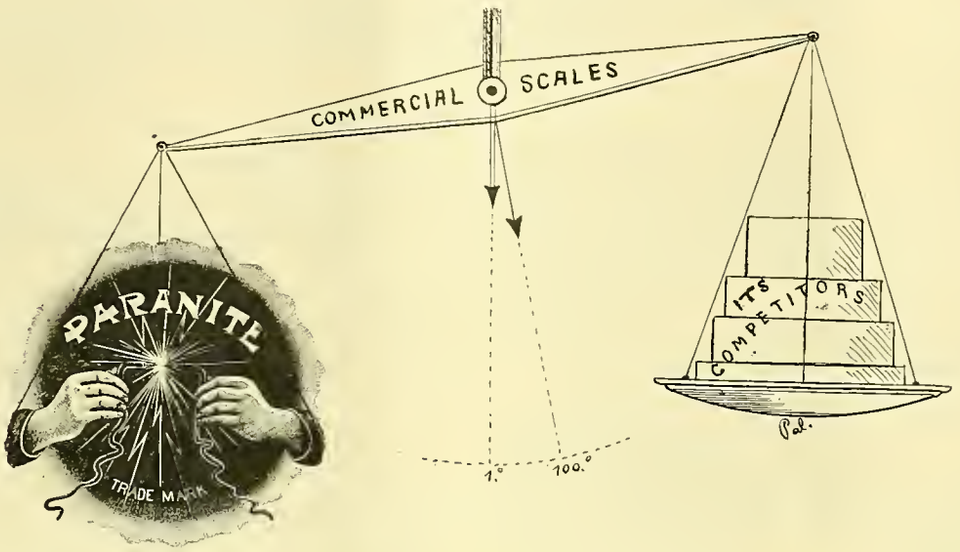
# An Easy Winner.

**WHEN WEIGHED IN THE BALANCE OF TRUE MERIT PARANITE WIRE WILL ALWAYS BE FOUND A HEAVY COMPETITOR.**




We are willing and anxious that large users of high grade rubber covered wires determine for themselves the truth of the claims we make for our Paranite insulation. We claim that to-day our wire has

## THE BEST COMPOUND

that is being placed on any rubber covered wire, and want all users to substantiate our claims. Although it may seem almost a paradox we wish to add also that

## OUR PRICES GET THE BUSINESS.

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Electrical Supplies,

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**MINIATURE INCANDESCENT LAMPS.**

For Series and Battery Current.

½ TO 10 CANDLE POWER.

*High Efficiency. Long Life.*

Series Lamps a Specialty.

**AUTOMATIC ELECTRICAL SPECIALTY CO.,**

General Sales Agents,

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**OCTAGONAL PINE POLES, NORWAY PINE CROSS-ARMS, WHITE OAK PINS.**

**It will pay you to get our prices.**

**BROWNLEE & CO., - Detroit, Mich.**

**GOOD PATENTS**

Procured. **30 Years' Practice. GRANT INSURED.** Pamphlet, references and advice **free.**

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For the "WESTERN ELECTRICIAN,"

**—$1.00.—**

**Boswell Storage Battery.**

For Traction Work, Electric Lighting, Electric Launch, Telegraph, Phonograph, Surgical, and for all purposes where Light and Power are required.

**Prices on Application.**

**D. E. BOSWELL & CO.,**
154 Lake St., Chicago.

**PINS AND BRACKETS**

Should always be made of good material. We make a specialty of first-class Pins and Brackets, both Oak and Locust, and we would ask you to bear this in mind when ordering for your Spring construction. We also carry a full line of

**CONSTRUCTION MATERIAL,**

Including Weatherproof and Underwriters' Wires, and particularly

**BISHOP WHITE CORE RUBBER COVERED WIRES AND CABLES.**

**Dearborn Electric Company,**

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**SAMSON SPOT CORD**

For Arc Light and Trolley Cord.

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**CHICAGO INSULATED WIRE CO.,**

**414-416 Northern Building, CHICAGO.**

**BEWARE** of the so-called insulating compounds claiming to be as good as **P. & B.**

**THERE ARE NONE JUST AS GOOD.**

**The Standard Paint Company,** Sole Manufacturers,
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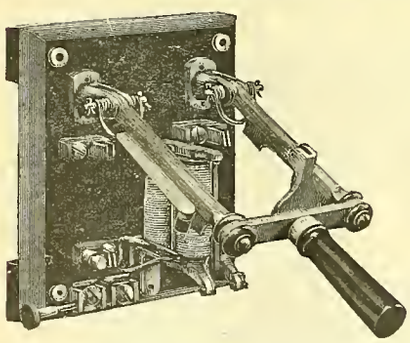
**CHICAGO: Metropolitan Electric Company, 186-188 Fifth Avenue.**

**MOTOR ARMATURES COST MONEY**



You can prevent them from burning out by using

**THE BRODIE AUTOMATIC MOTOR-SWITCH.**

It combines in one piece of apparatus a double-pole switch, adjustable limit-switch and automatic cut-out, and instantly disconnects the motor whenever it is overloaded and whenever the circuit fails from any cause.

Agents wanted in all sections of the country.

For circulars and prices, address

**THE BRODIE ELECTRIC CO., - Manchester, N. H.**

THIS IS ONE OF THE

**Bryant Weatherproof Sockets.**

Ask your dealer for them.

Dealers, send us your Business Card.

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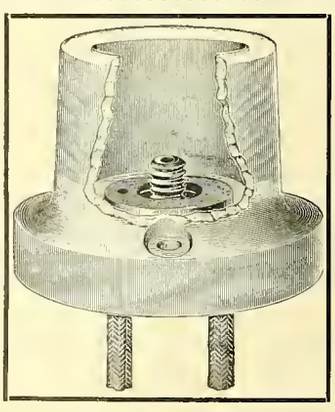

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**Can be Used for Transposing.**

The points or teats on the lower rim of the petticoat attracts the water on the outer surface of the insulator into drops. The water drops from these points on to the cross-arm, thereby preventing the moisture from creeping up on the inner petticoat, and thence to the pin. Owing to the great success of our Patent Teat Insulator in Telegraph Work, where the efficiency of the Insulator has proven to be more than twice that of the ordinary Insulator, we have concluded to apply the device to all Insulators for Telegraph, Telephone and Street Railway Work.

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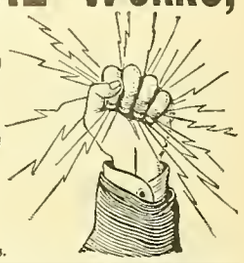
**CABLES FOR AERIAL AND UNDERGROUND USE.**



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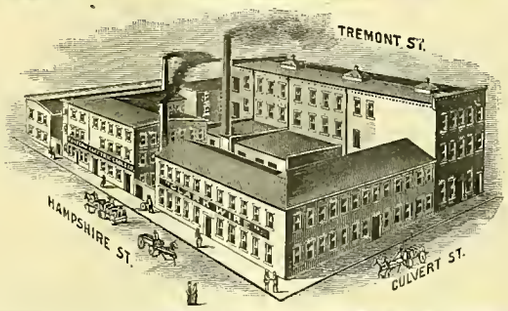


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We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire.

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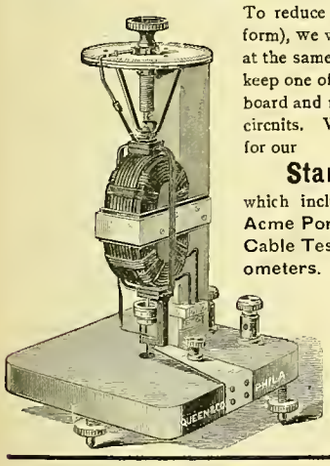


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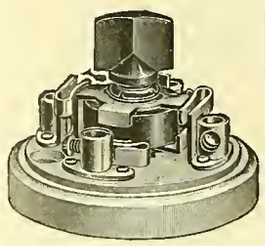
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



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Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

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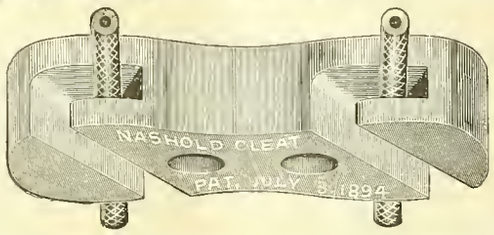


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**It is the most practical Cleat made.**
**It is made of finest glazed porcelain.**
**It is in one piece.**
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**It will lock the wire firmly.**
**It will NOT break in putting up.**
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The wire can easily be put in place or removed without loosening the Cleat. It is a great saver in Time and Labor over any other Cleat in use for putting up Electric Light or other Wires.

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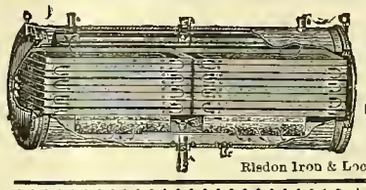

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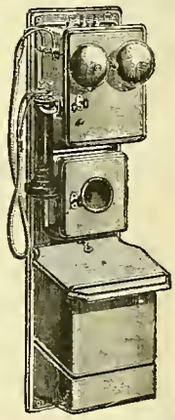

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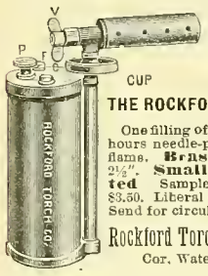


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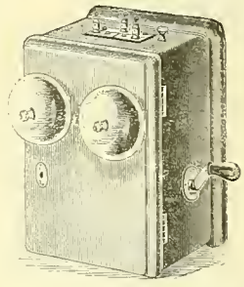

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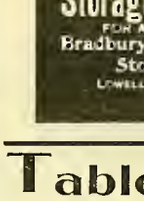
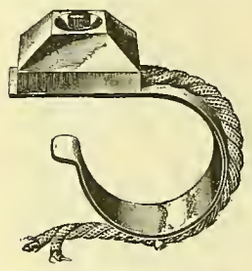



# Table Push.

SOMETHING NEW.



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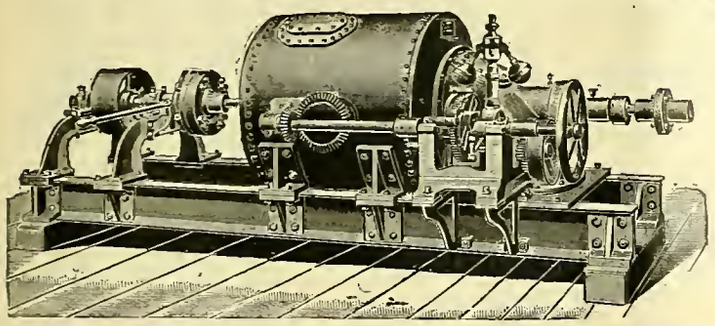

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The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter**, being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

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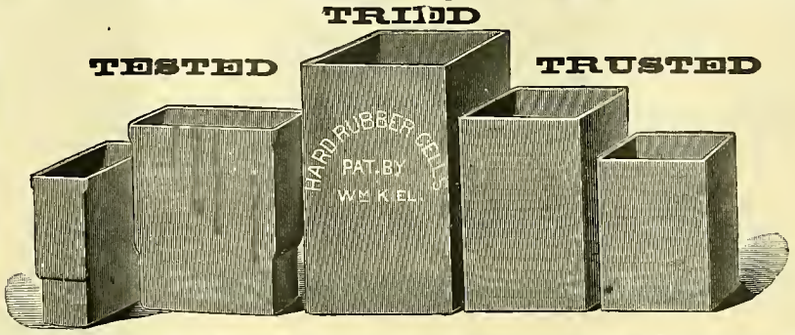


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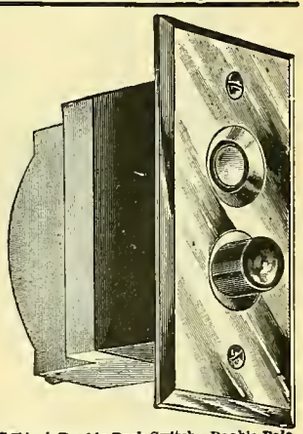

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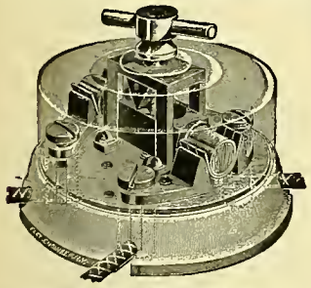

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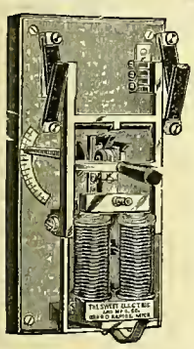

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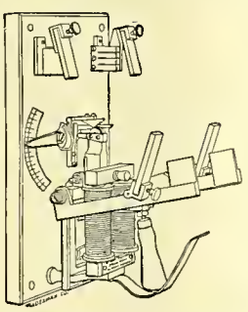

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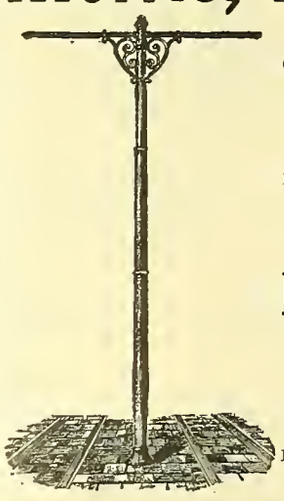

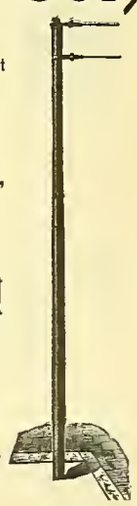

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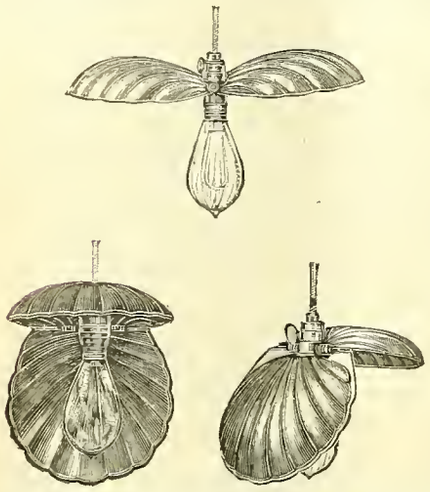

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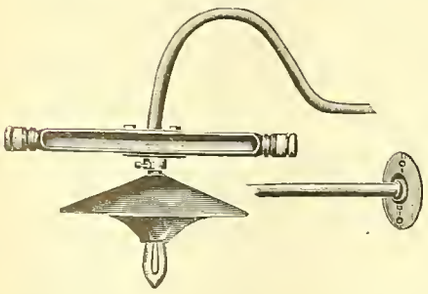

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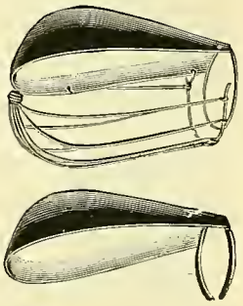

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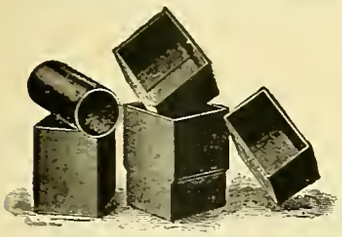

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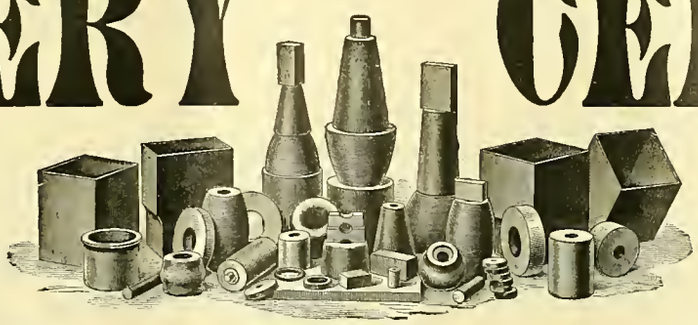

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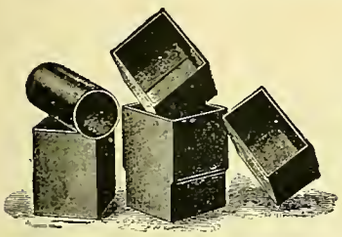

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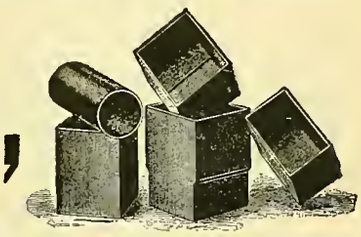

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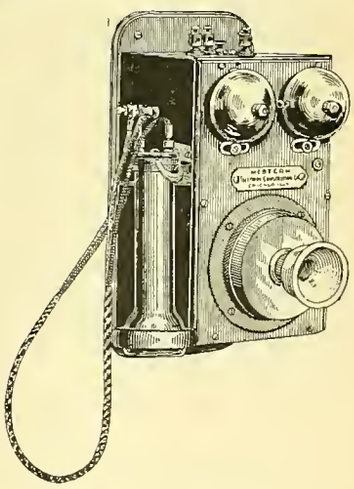

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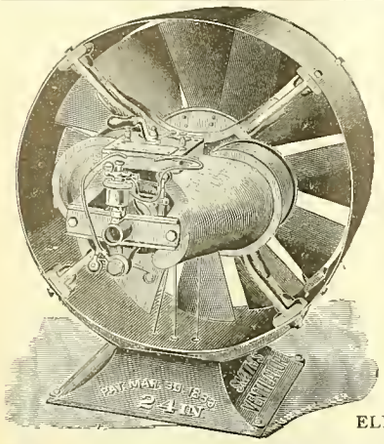

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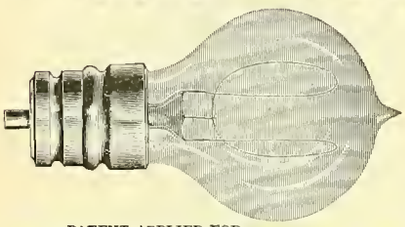

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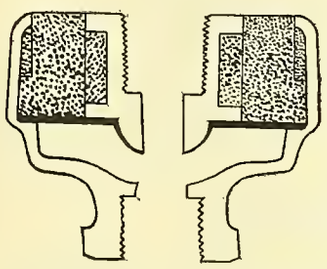

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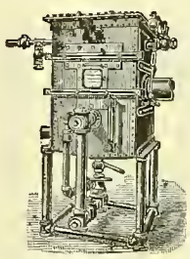

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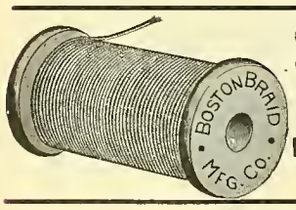


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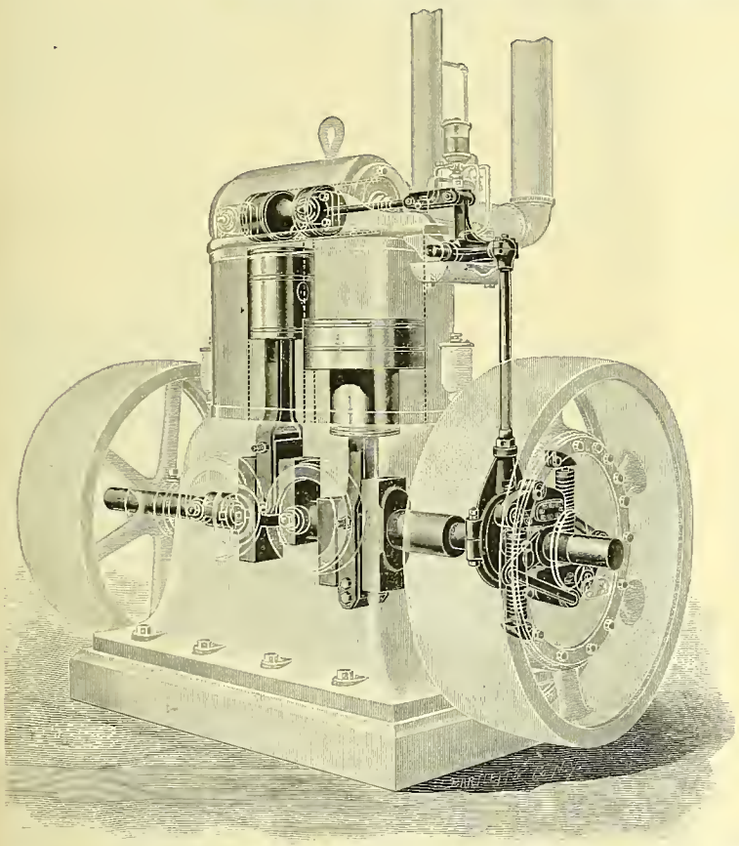

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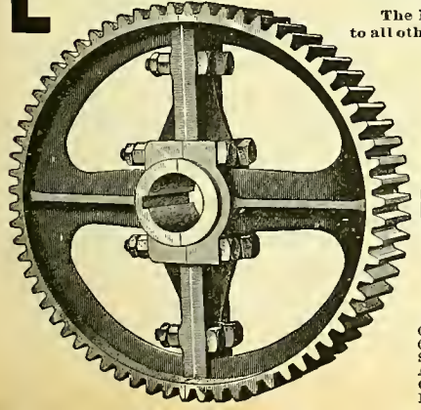

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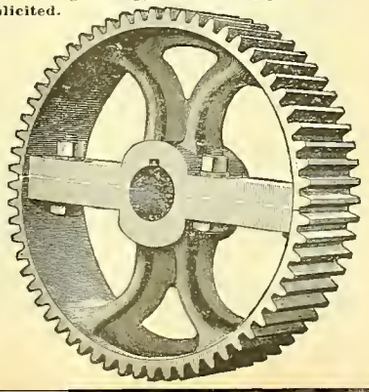

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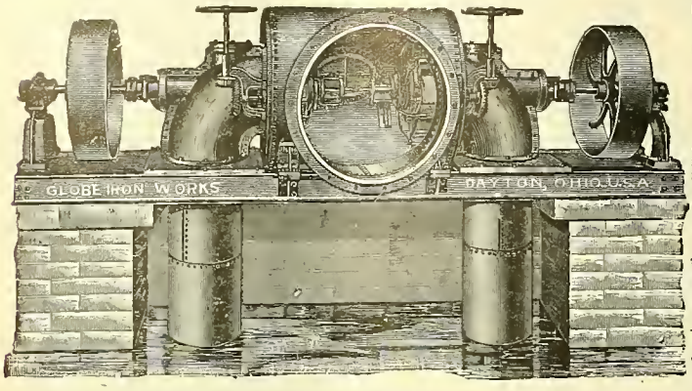


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| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.06 | 119.17 | 141.68 | 205.27 | 79.76 |
| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.68 |
| ¾ " | 16.78 | 117.33 | 112.60 | 175.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
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| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
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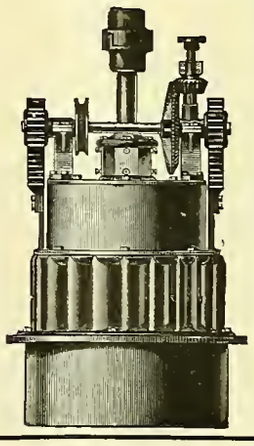

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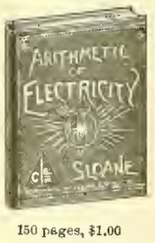


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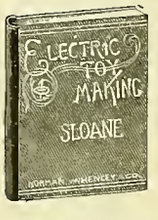


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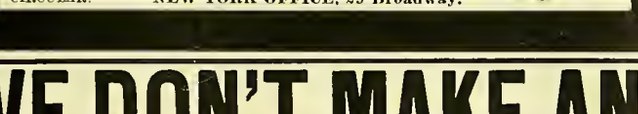

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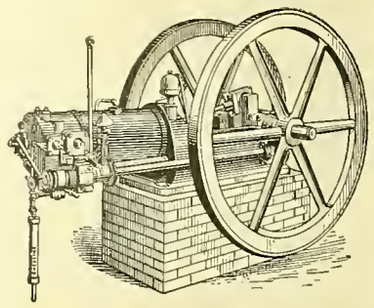

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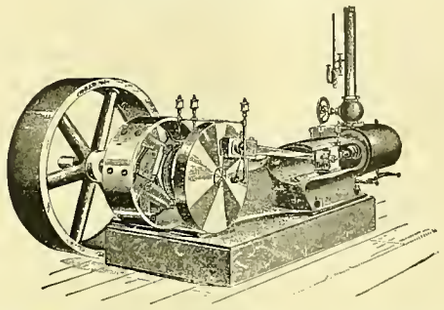

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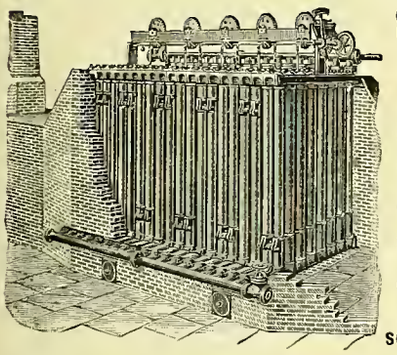

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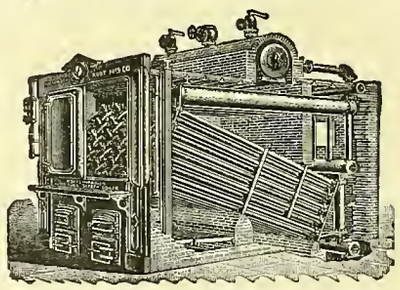

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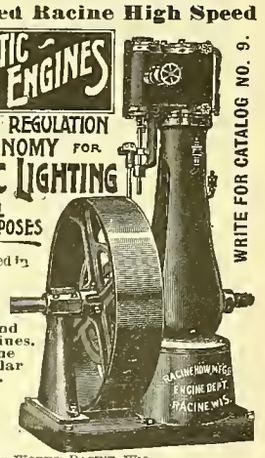


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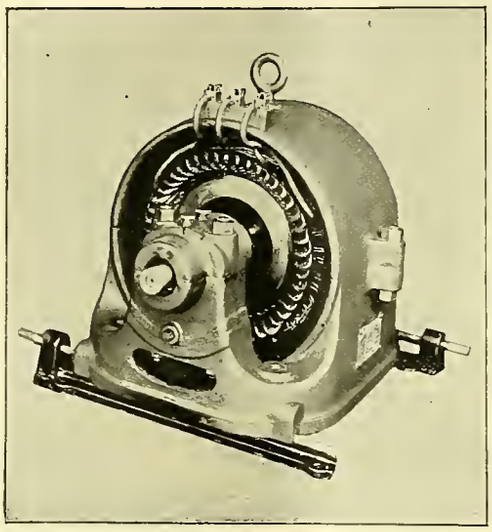

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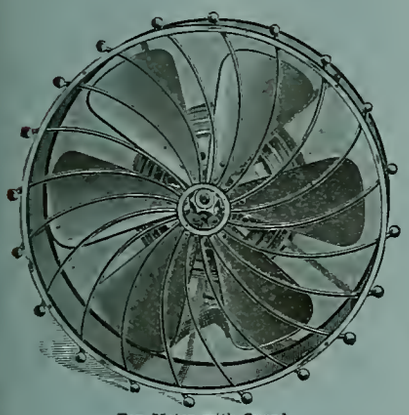

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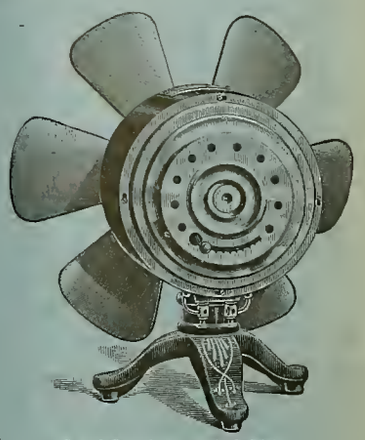

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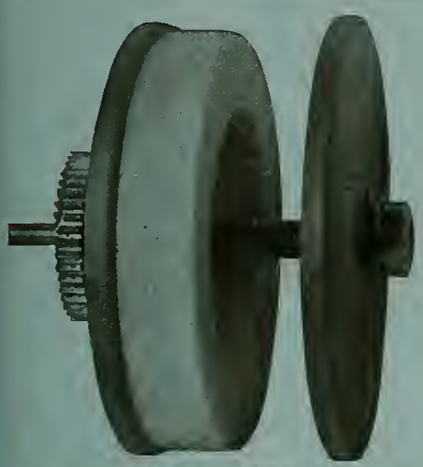

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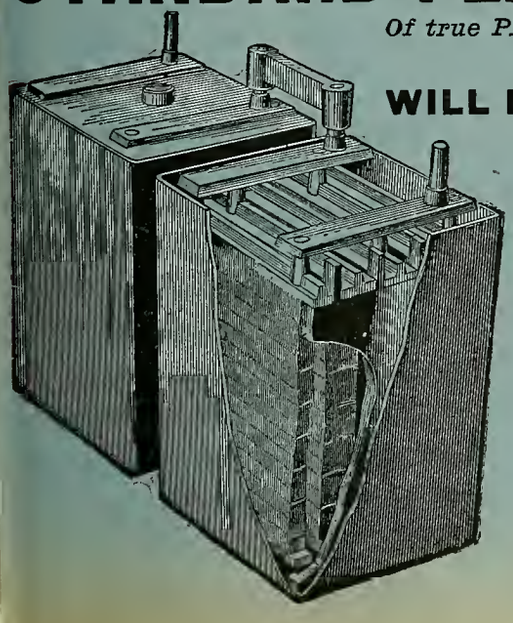

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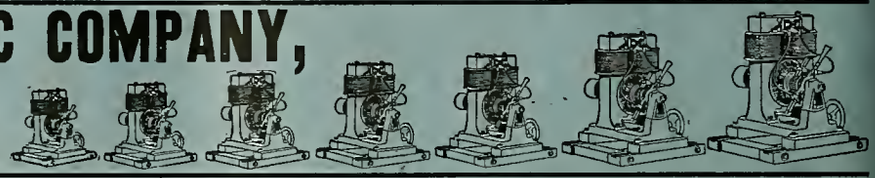

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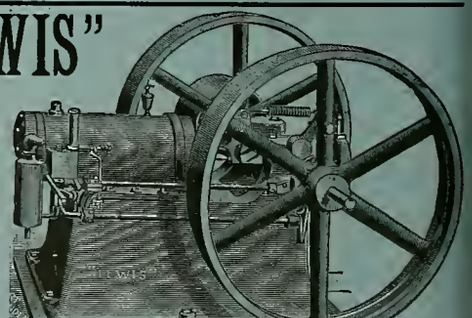

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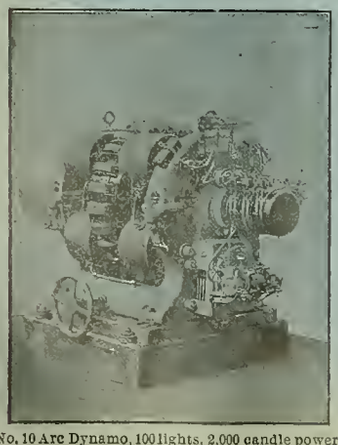

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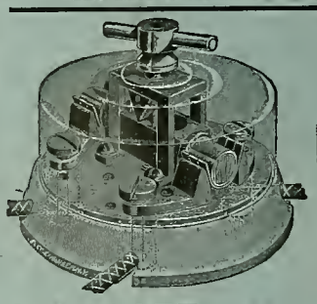

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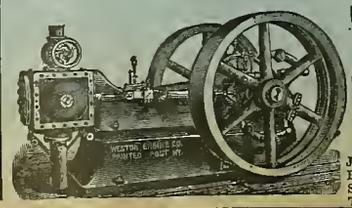

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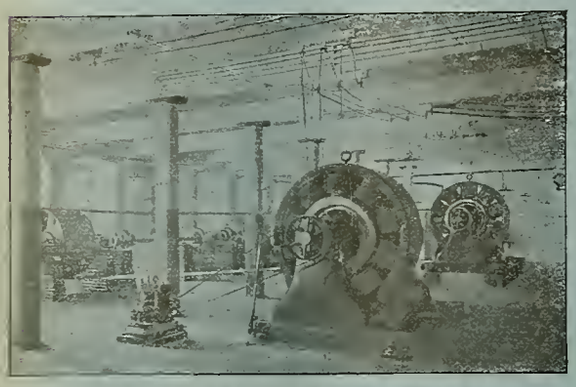

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## CLASSIFIED LIST.


**Accumulators.**
Boswell & Co., D. E.,
Brsdbury-Stone Elec. S. Co
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
Central Electric Co.
Dearborn Electric Co.
Electric Applisnce Co.
Ostrsnder & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.

**Arc Lamps.**
Am. Gas Engine Elec. Co.
C & C Electric Co.
Central Electric Co.
Clark Electric Co.
Corey, R. B.
Crocker-Wheeler Elec. Co,
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Perkins El. Switch Mfg. Co.
Standard Thermometer Co.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Hemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Dearborn Electric Co.
Electric Applisnce Co.
Gillette, E. & F.
Huebel & Manger.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Bicycles.**
Monarch Cycle Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Brownell & Co., The.
Clonbrock Steam Boiler Wks.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co., Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Corey, R. B.
General Electric Co.
Partridge Carbon Co.
Werlheim, Ed.
Western Electric Co.

**Compound.**
Eureks Compound Co.
Standard Paint Co.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins Co.
National Conduit Mfg. Co.

**Construction & Repairs.**
Allen-Hussey Co.
Amstutz, N. S.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El Const. Co.

**Contractors and Electric Light Plants.**
Allen-Hussey Co.
Amstutz, N. S.
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Clark Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Siemens & Halske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly &, Co., Chas. H.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Barrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brsdy, T. H.
Brodie Electric Co.
Central Electric Co.
Electric Applisnce Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec, Mfg, Co.
Electric Appliance Co.
Electric Protection Co.
Elec. Selec. & Signal Co.
Farr Tel. & Const. Supply Co,
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Desks.**
Montgomery Ward & Co.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Clark Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
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General Electric Co.
Interior Conduit & Ins. Co.
Roth & Eck.
Royal Electric Co.
Siemens & Halske Elec. Co.
Waldo-Hyde, Wm.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Allen-Hussey Co.
Amstutz, N. S.
Arnold, B. J.
Bain, Forea.
Bryan, Wm. H
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg, Co,
Ford, Owen.
Thayer Electric Co.

**Electrical Instruments.**
Anderson, Albert & J. M.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Norton. Chas. E.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Queen & Co. Inc.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Electrical Specialties.**
Allen, L. B.
Clark El. Specialty Mfg, Co.
Electric Protection Co.
Interstate Com. El. Const Co.
Nashold Cleat Co.
Proctor-Raymond Elec. Co.
Rockford Torch Co.

**Electrotlers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
General Electric Co.

**Engines, Gas.**
Am. Gas Engine Elec. Co.
Otto Gas Engine Wks.
Webster Mfg. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Brownell & Co., The.
Chuse & Co., J. F.
Erie City Iron Wks.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Central Electric Co.
Davis Elec. Co., W. J.
Diehl & Co.
Interior Conduit & Ins. Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Butler Mfg. Co.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
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Partrick & Carter Co.
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Platt, O. S.
Proctor-Raymond Elec. Co.
Queen & Co. Inc.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Thayer Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Edwards, W. S. Mfg. Co.
Hemingray Glass Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co.. The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co.. Eugene.
Nashold Cleat Co.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co..J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
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Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Aetna Electric Works.
Am. Electrical Mfg. Co.
Automatic Elec. Spec. Co.
Bernstein Electric Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Waldo-Hyde, Wm.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Engene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Andrae & Sons, J.
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec, Mfg, Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Works.
Roth & Eck.
Royal Electric Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.
Standard Paint Co.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm.Co. Ltd.

**Pianos and Organs.**
Beethoven Piano & Organ Co.

**Platinum.**
Baker & Co.

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Valentine-Clark Co.

**Porcelain.**
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General Electric Co.
Hemingray Glass Co.

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Electrician Publishing Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Separators.**
Goubert Mfg. Co.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co

**Speed Indicators.**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Boswell & Co., D. E.
Brsdbury-Stone Elec. S Co.
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones.**
Andrae & Sons, J.
Central Electric Co.
Farr Tel. & Const. Supply Co.
Gillette, E. & F.
Gustafson, W. A.
Jameson & Co., W. D.
M. & B. Telephone Co.
Mo. Telephone Mfg. Co.
Partrick & Carter Co.
Western Electric Co.
Western Tel. Const. Co.
Williams & Abbott Elec. Co.

**Transformers.**
Central Electric Co.
Diamond Electric Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hornberger Elec. Mfg. Co.
Louisville Elec. Works.
Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Trolley Cord.**
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Chi. Shorthand Institute.
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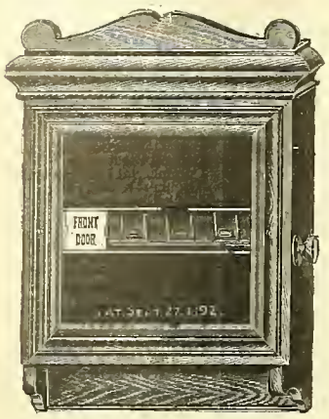
Scientific Machinist Co.

**Water Wheels.**
Smith, S. Morgan.

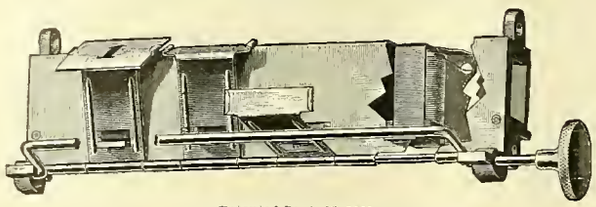
**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C.Co.




"C" STYLE.
Made in Sizes from 4 to 20 Drops.

# ANNUNCIATORS

That never fail to Annunciate.



Patented Sept. 27, 1892.

This illustrates the inside construction of our Gravity-Drop Annunciator as applied to the 4 Drop "Eclipse" Case.

No Springs. No Screws. Nothing to get out of adjustment. Simplicity itself.

*Our other Specialties:*

**REX** Wood-box Bells,
**ECLIPSE** Iron-box Bells,
**SPARK** Coils,
**WOOD** Push Buttons,
Floor Pushes,
Door Connections, etc., etc.

## PROCTOR-RAYMOND ELECTRIC CO.,

Rochester, N. Y.

# SAWYER-MAN INCANDESCENT LAMPS,

## With Bases to Fit Any Socket.

We have now resumed the manufacture of the well-known Sawyer-Man Lamps, on a scale to meet any possible demand.

We have adopted new methods of manufacture which add to the appearance and quality of our lamps, and make them by reason of their efficiency and long life, the cheapest and best lamps ever offered.

PRICES:

**PLAIN LAMPS.**

| | |
|---|---|
| 8, 10 and 16 candle power lamps | 25 cents each. |
| 20 and 25 candle power lamps | 30 " |
| 32 candle power lamps | 38 " |
| 16 candle power street car lamps | 25 " |
| 16 candle power street car lamps, anchored | 32 " |

**ORNAMENTAL LAMPS.**

| | |
|---|---|
| 8, 10 and 16 candle power lamps | 30 cents each. |
| 20 and 25 candle power lamps | 35 " |

Discounts according to quantity.
For etching the plain or ornamental lamps, 3½ cents each, net.

**COLORED LAMPS.**

"Dipped" lamps in red, blue or green, 5 cents each, net, additional.

Lamps with bases to fit Thomson-Houston sockets, 3 cents extra.
Boxing and packing at cost.
Prices are subject to change without notice.

# Westinghouse Electric & Manufacturing Company,

PITTSBURG, PA.

**Branch Offices in all Leading Cities.**

# WESTINGHOUSE ELECTRIC & MANUFACTURING CO.,

**PITTSBURGH, PA.**

We manufacture Complete Installations of

# ELECTRICAL APPARATUS

For **CENTRAL STATION ELECTRIC LIGHTING,**
**LONG DISTANCE TRANSMISSION OF POWER,**
**ELECTRIC RAILWAY AND ISOLATED PLANTS.**

**BRANCH OFFICES IN ALL LARGE CITIES.**

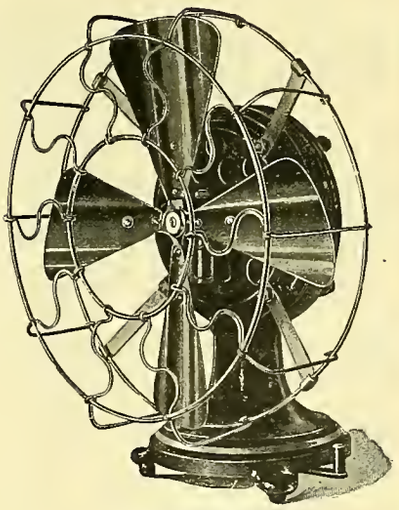
. . . . . "They can't hold a candle to it." . . . . . .

No other Fan Motor equals the

# . . . LUNDELL . . .

(For Direct or Alternating Currents.)

in perfection of design
harmony of proportion
excellence of finish
meritorious work
noiseless action
current economy
anything



ALTERNATING.

.....The proof===compare a LUNDELL with any other that you ever saw, and abide by your own judgment.

OKONITE IT NEVER DISAPPOINTS

## Central Electric Company,

173=175 Adams St.,
CHICAGO.

Branches: { Kansas City, Mo.: Gate City Electric Co.
St. Louis: Southern Electric Supply Co.

OKONITE IT NEVER DISAPPOINTS

# INCANDESCENT LAMPS.

WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

**GLOBE ELECTRIC LIGHT CO.,** General Offices: Carter Building, **BOSTON, MASS.**

AGENTS WANTED. WRITE US.

# RECEIVER'S SALE.

**WARING ELECTRIC COMPANY.**

The entire stock of

**NOVAK LAMPS,**

of ALL candle powers and voltages, together with a large amount of

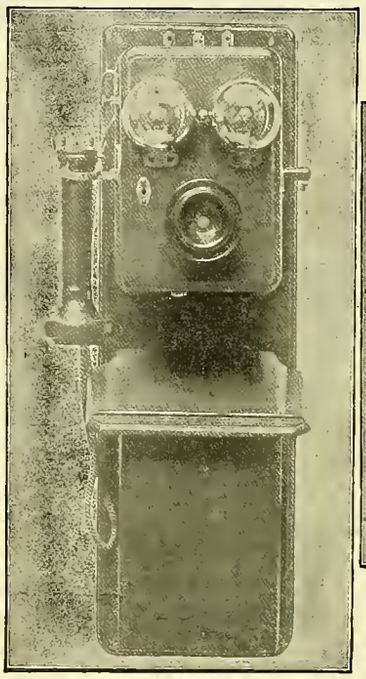
**MACHINERY,**

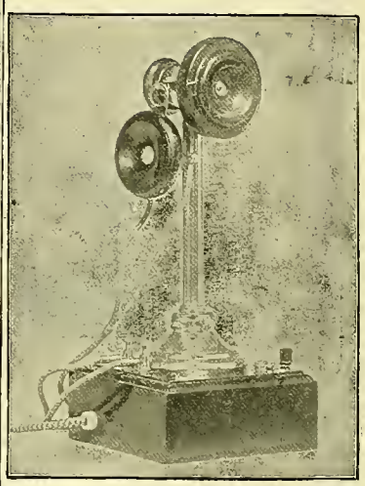
consisting of dynamos, pumps, etc., must be SOLD AT ONCE to close up the affairs of the company. For prices and terms address

**WM. WALDO-HYDE,** Receiver,

*Hartford, Conn.* *Manchester, Conn.*

**M. & B.**





**Desk Set.**

**Complete Exchange Plants.**
**Metallic or Ground Circuit.**

**SWITCHBOARDS ABSOLUTELY GUARANTEED.**

*STATE AGENTS WANTED.*

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**M. & B. TELEPHONE CO.,**

Bullitt Building, Philadelphia.

DO YOU WANT

The best made?

To be up to time?

Quick results from a 'phone?

To save time?

The most efficient?

The most durable? Then

Buy the "Gerson"

These 'phones are used on private lines between Boston and Chicago.

**TELEPHONE**

**Long Distance and Interior.**

**SATISFACTION GUARANTEED.**

U. S. Government gives the "Gerson" 99 per cent. for efficiency—highest given.

WRITE

**W. D. JAMESON & CO.,**

**150 Broadway, New York,**

SOLE AGENTS FOR

**THE GERSON Electrical Mfg. Co.,**

INCORPORATED,

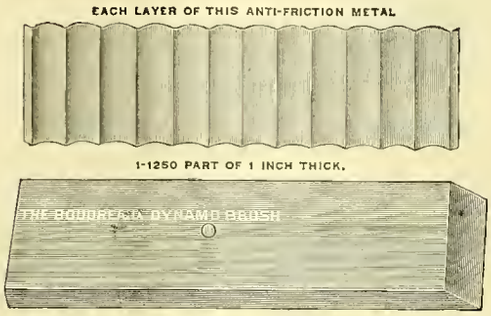
of Philadelphia, Pa.

# SAVE MONEY, TIME AND TROUBLE

ON **DYNAMOS** AND **MOTORS** BY USING

## The Boudreaux Dynamo Brush,

NO SPARKING
NO CUTTING
NO SPLUTTERING
NO HIGH RESISTANCE




NO GREASING
NO TRIMMING
NO SANDPAPERING
NO TURNING DOWN

**Declared Superior to Woven Wire, Gauze, Copper or Carbon by all who have tried it.**

## The Boudreaux Dynamo Brush Co.,

**Mallers Building, Chicago.** **Postal Telegraph Bldg., New York.**

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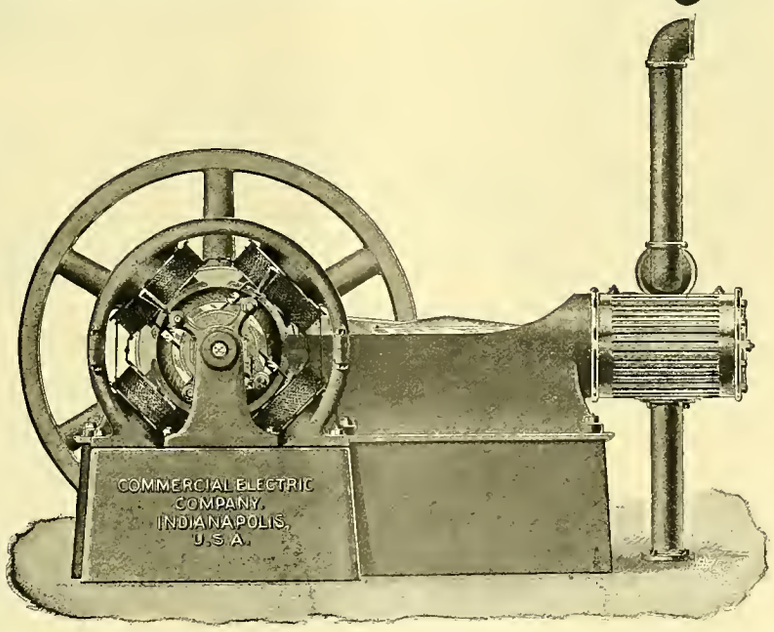
# COMMERCIAL
# Direct-Connected Dynamos.

## MOTORS

for Belting and Direct Coupling to all kinds of Machinery.




## LIGHTING AND RAILWAY GENERATORS.

Complete Power Transmission Plants.

**ARE THE MOST MODERN AND MOST ECONOMICAL OF ALL ELECTRIC LIGHTING APPARATUS.**

## Commercial Electric Co.,

**119 S. Tennessee St.,**
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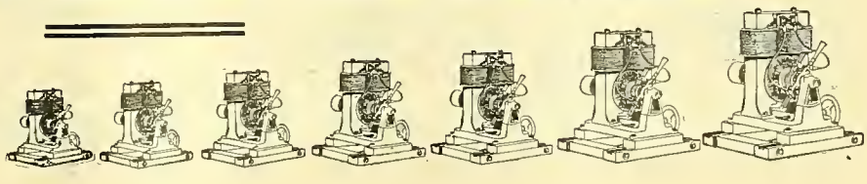

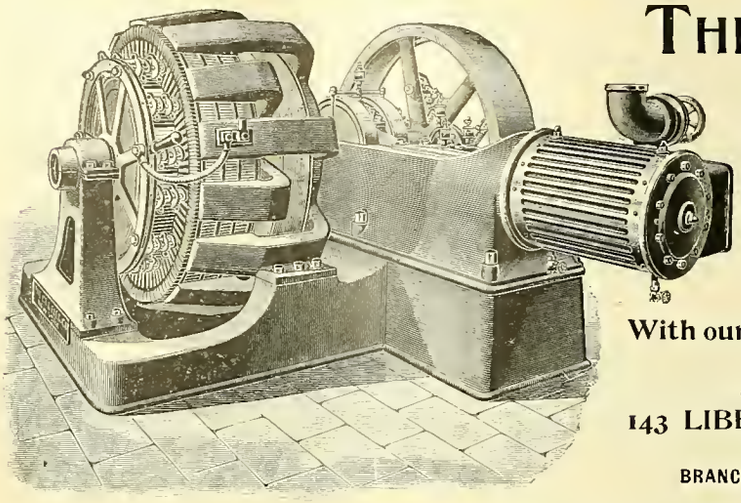

# THE C & C ELECTRIC CO.

MANUFACTURERS OF

## Bipolar AND Multipolar Dynamos,

Automatic and Hand Controlled Motors,
Complete Plants for Power Transmission,
Isolated Lighting Plants, Central Station Apparatus.

With our Extensive Works we are prepared to fill promptly all orders for 1 H.-P. to 250 H.-P.

GENERAL OFFICES: 143 LIBERTY ST., NEW YORK.

WORKS: GARWOOD, N. J. On Central R. R. of N. J.

BRANCH OFFICES: CHICAGO, Monadnock Building. BOSTON, 63 Oliver Street. CLEVELAND, Cuyahoga Building. PHILADELPHIA, 633 Arch Street.

# HELIOS ELECTRIC COMPANY,

Factory and Offices,

**1310 Filbert Street, Philadelphia, Pa.**

*We have no Stock nor Old Style Lamps that we must get rid of at any price—no junk.*

## THE HELIOS LAMPS

Are the latest patterns and newest type. Our Lamps are much in advance of any lamp now on the market, because they are New and of Latest Designs.

Our ALTERNATING LAMPS have Reflector Plates. Our DIRECT CURRENT Lamps do not see-saw. Our Focusing Lamps, both Direct and Alternating, are especially adapted for photo-engraving and stereopticon work.

Anchor Electric Co., New England Agents, Boston, Mass.
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Mountain Electric Co., Agents for Colorado, Utah, Wyoming and New Mexico, Denver, Col.
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W. T. M. Mottram, Agent for Texas, Dallas, Tex.
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## CHICAGO SHORTHAND INSTITUTE, 35th St. and Wabash Ave.

**A Central School of Shorthand and Typewriting of the most Modern and Complete Type.**

**A COMPLETE COURSE OF SHORTHAND.** We offer you shorthand instructions in abundance, and most excellent in quality Our course is graded and arranged in logical order. We claim not a new system but a new method of imparting the art of shorthand by which we can equip any ordinary intelligent person for the execution of any stenographic work devolving upon the expert stenographer or court reporter.

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Tuition, $10.00 per month Secure class seats immediately.

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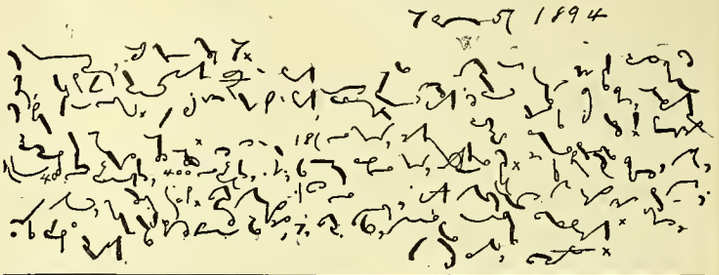
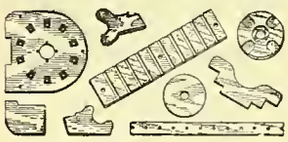


# VULCABESTON



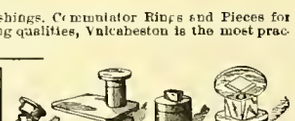
## CONTROLLER PARTS.

**We will furnish these for the Westinghouse and General Electric Companies' Controllers.**

Also Vulcabeston Field Magnet Spools Brushholder Bushings, Commutator Rings and Pieces for Special Purposes. Owing to its toughness and heat-resisting qualities, Vulcabeston is the most practical material for the above and similar purposes.

## Trolley Line Materials,

**Insulated with Moulded Mica, acknowledged to be the most durable and the best for practical service.**



Brushholder Bushings and Field Spools for the old Edison or Sprague Nos. 6, 8 and 14 Motors.

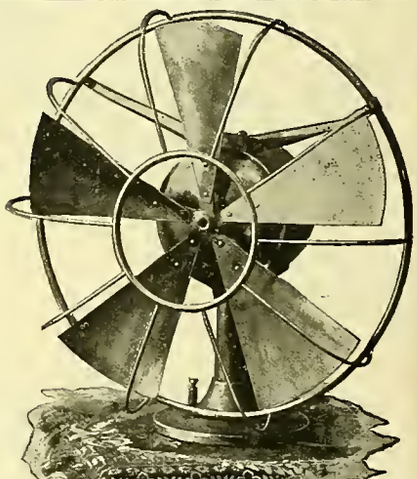
## H. W. JOHNS MFG. CO.,

NEW YORK, PHILADELPHIA, BOSTON.

240-242 Randolph St., CHICAGO.

# THE BEST ELECTRIC FAN On the Market.

**For Alternating Current, Wound for 50 or 100 volts.**



The Fan is 14 inches in diameter.
Will always start when current is on
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

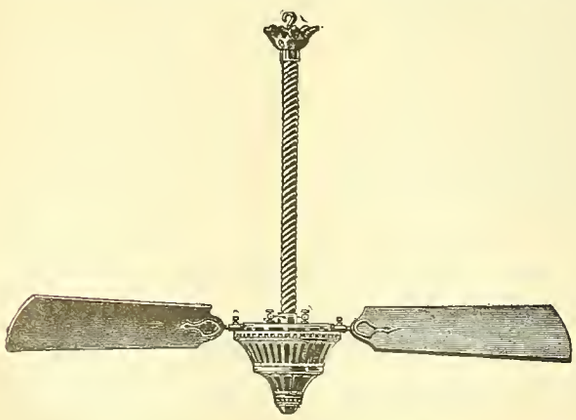
Agents Wanted in Different Localities.

For further information address

THE

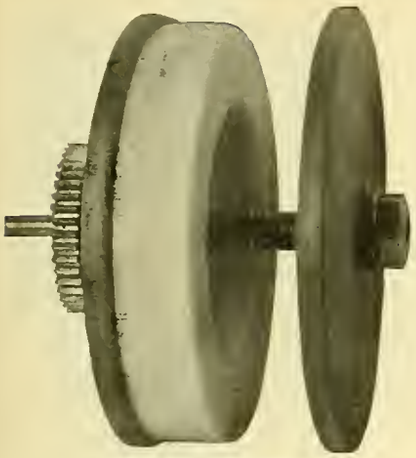
## W. J. Davis Electric Co.,

**PITTSFIELD, MASS.**



**AN EMPHATIC SUCCESS!**
**THE DIEHL ELECTRIC FANS**
**WIRED IN A SERIES OF**
**TWO OR MORE ON A**
**STREET RAILWAY CURRENT.**

**DIEHL & COMPANY, 385 BROADWAY, NEW YORK.**



"THE WAX WHEEL."

*Built for all types of currents.*
*Only one adjustment.*

**NO** *MAGNETS.*
*SPRINGS.*
*DASH POTS.*
*CLUTCHES.*

# The American Gas Engine Electric Co.

Hereby announces that it has acquired the manufactory of the Nutting Electric Company, and the sole rights for the United States under all of its patents.

We have increased our manufacturing facilities to such an extent that we can now quote the well known

## Wax Wheel Arc Lamp

Until further notice, as follows:—

| | |
|---|---|
| **Series Arc Light Circuits, direct current, net, - - -** | **$10.00.** |
| **Constant Potential Circuits, direct current, net, - -** | **10.00.** |
| **NOTE:—Resistance for Constant Potential Circuits will cost per lamp, extra,** | **$1.50.** |

*CONTRACTING AND CONSULTING ENGINEERS' DEPARTMENT FOR COMPLETE GAS ENGINE ELECTRIC PLANTS.*

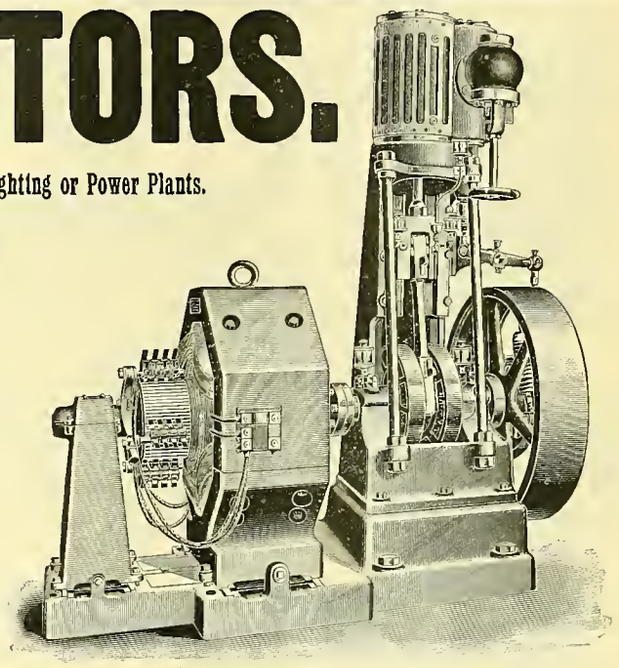
## THE KILMARNOCK-GRIFFIN DOUBLE ACTING GAS ENGINE

**IN SIZES FROM 1 TO 1,000 HORSE POWER.**

**Telephone Harrison 39.** **Offices: Dexter Building, 84 Adams Street, CHICAGO.**

# EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.



## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*

## THE EDDY ELECTRIC MFG. CO.,

*WINDSOR, CONN.*

**NEW YORK OFFICE, HAVEMEYER BLDG.**

*REPRESENTED BY:*

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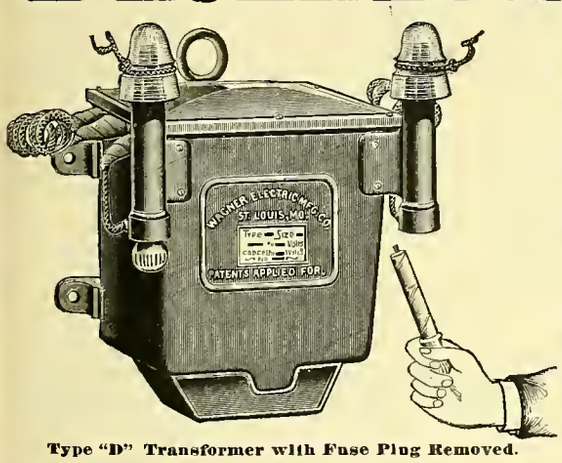
**D. P. GOSLINE, 30 Oliver St., Boston, Mass.**

**All Our Apparatus Guaranteed as Represented.**

# TRANSFORMERS.




**Type "D" Transformer with Fuse Plug Removed.**

***A New Type*—*Transformer, Primary Cut-outs and Insulator Brackets all combined.***

**No more brackets pulling off of walls.**

**With our wall or cross-arm hooks, transformer may be *Hung* and *Connected* in *Five minutes.***

**Our new fuse plugs will not hold an arc with 5,000 volts.**

***Our Transformers* are acknowledged by all experts to be the *Highest* in *Efficiency* ever made.**

**Adopted by the largest stations in the country.**

***We Challenge Competition* in any form of test, in laboratory or practical use.**

**Made in all sizes, 5 lights to 3,000 lights.**

**JOHN MUSTARD, Betz Building, Philadelphia, Pa.**
**1664 Monadnock Block, Chicago, Ill.**

## Wagner Electric Mfg. Co., ST. LOUIS, MO.

Standard sizes—from 5 to 500 lights—any voltage.

# PERFECTION!

HAS **ONLY** BEEN ATTAINED IN THE

# PHOENIX

**TRANSFORMER: The { Latest. Best.**

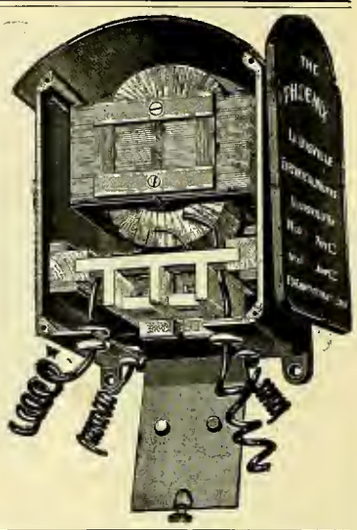
**EFFICIENCY—The Highest } Ever attained and GUARANTEED. | Mechanically Perfect. Simplicity Itself.**
**REGULATION—The Closest }**

Its many points of ***SUPERIORITY*** will be clearly demonstrated to you by writing for our ***Illustrated Catalogue*** and ***Price List.***

## Louisville Electrical Works,

**LOUISVILLE, KY.**

RESPONSIBLE AGENTS WANTED in New York, Chicago, Pittsburg, St. Louis, Denver, San Francisco, New Orleans, etc.




**CONTRACTORS FOR COMPLETE SUBWAY SYSTEMS FOR ELECTRIC RAILWAYS AND ELECTRIC LIGHT, TELEPHONE AND TELEGRAPH COMPANIES.**

**EDWARD S. PEROT, President.**
**C. GALLAGHER, Vice-Pres. & Gen. Mgr.**
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# THE NATIONAL CONDUIT MANUFACTURING CO.,

## MANUFACTURERS OF WROUGHT-IRON CEMENT-LINED TUBES FOR ELECTRIC SUBWAYS.

**Works, HASTINGS-ON-HUDSON.** **New York Office, TIMES BUILDING.**

We own Patent No. 395,584, covering Wrought-Iron Cement-Lined Pipe for Subways and the method of Laying. Also, Patents Nos. 416,234 and 416,235 for Distributing Boxes. Over 9,000,000 feet of this Subway Constructed by us ***now in use in the United States and Canada***

# BUCKEYE

QUALITY UNEQUALED.

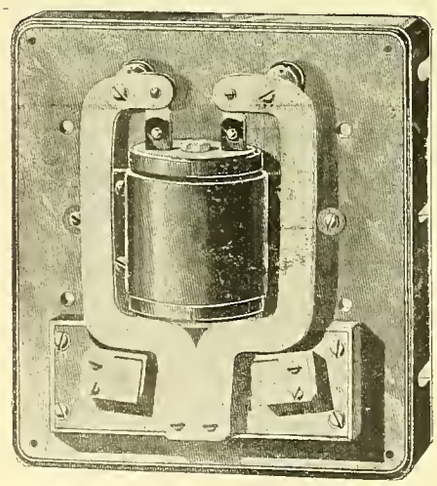
FACTORY PRODUCTION TRIPLED.

## INCANDESCENT LAMPS

Monadnock Building, Chicago. **THE BUCKEYE ELECTRIC CO., Cleveland, O.**

# SINCE MARCH 1st

# Our New (Model 1895) Electric Light and Power Controllers



HAVE BEEN ADOPTED BY CENTRAL STATIONS OPERATING

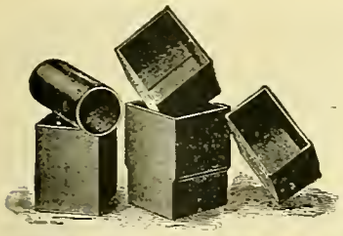
**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{On}{Out}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

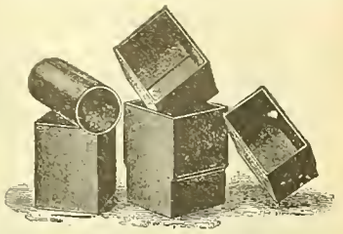
OUR GENERAL WESTERN AGENTS ARE

# WALLACE ELECTRIC CO., 307 DEARBORN ST., CHICAGO.

# ELECTRIC SELECTOR & SIGNAL CO., 45 Broadway, New York.

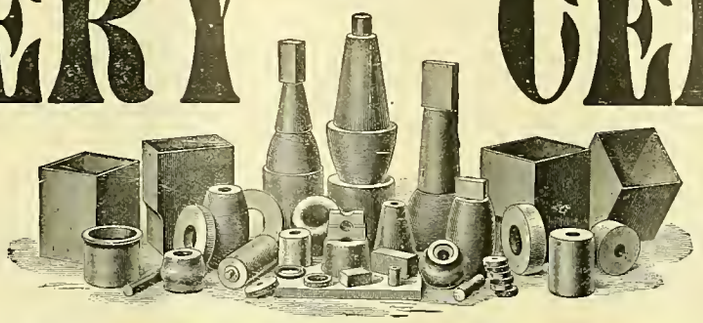


# THE FREEMAN



# BATTERY CELLS.

Estimates Furnished on Application. Prompt Delivery.



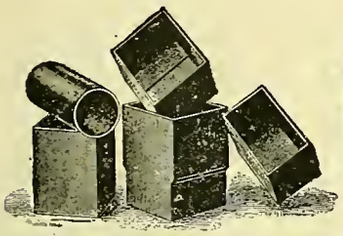
Standard Sizes Always on Hand.

The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplished, providing additional strengthto such an extent that this cell can be used where no other would be practical.

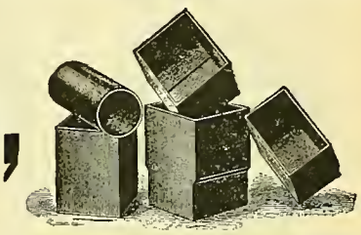
## THESE CELLS ARE A NEW PRODUCTION AND FULLY GUARANTEED.

**AGENTS WANTED IN ALL CITIES.** **WRITE US FOR INFORMATION AND CATALOGUE.**

THE



## Newton Rubber Works,



Newton Upper Falls, Mass.

# The W. W. LIGHTNING ARRESTER

## *WILL PROTECT YOUR APPARATUS.*

**PATENTED JUNE 27, 1893.**

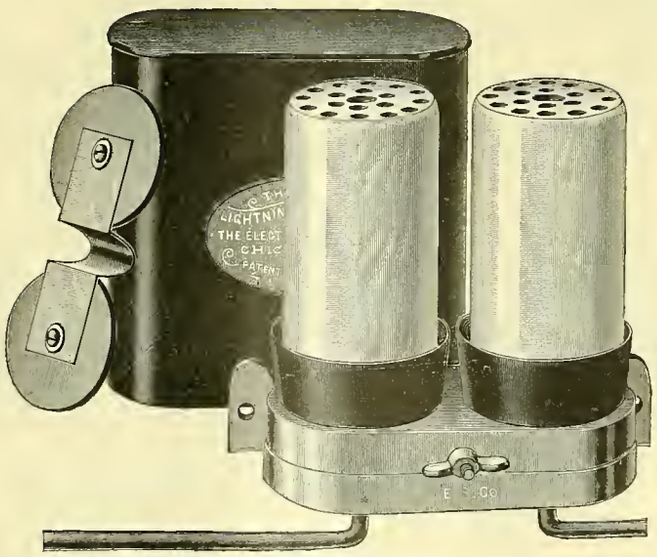
MADE IN TWO SIZES:

***No. 10 for circuits up to and including 1,000 volts.***

***No. 25 for circuits up to and including 3,000 volts.***

***For Power, Railway or Lighting Circuits, Arc or Incandescent, High or Low Tension, Direct or Alternating.***

**On Poles or in Buildings.**



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PROTECTS THE APPARATUS FROM LIGHTNING AND PREVENTS INTERRUPTION OF SERVICE.

No Operative Mechanism.

No Parts to Wear Out.

Absolutely Weatherproof

*SOLE MANUFACTURERS*

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and burns out transformers, arc lamps and armatures. Heve you ever stopped to think that one transformer or armature saved will psy for an entire equipment of lightniog srresters? We are offering the

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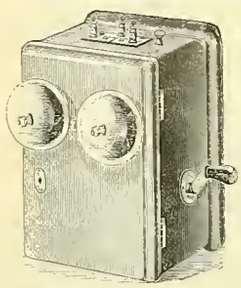

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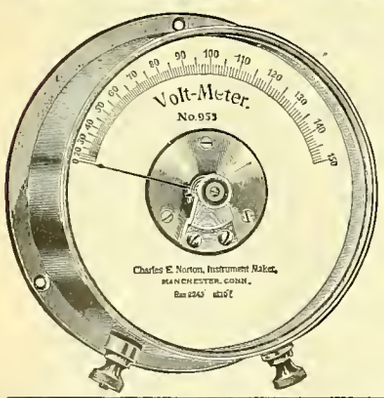


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For Arc Light and Trolley Cord.

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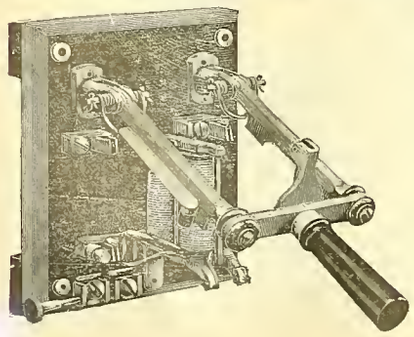

You can prevent them from burning out by using

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It combines in one piece of apparatus a double-pole switch, adjustable limit-switch and automatic cut-out, and instantly disconnects the motor whenever it is overloaded and whenever the circuit fails from any cause.

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AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

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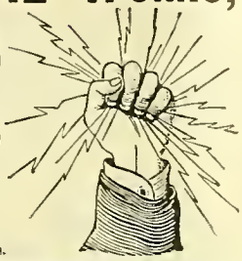

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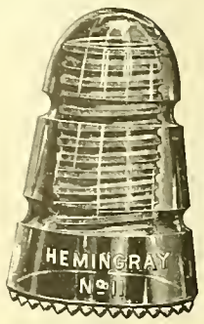


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**Can be Used for Transposing.**

The points or teats on the lower rim of the petticoat attracts the water on the outer surface of the insulator into drops. The water drops from these points on to the cross-arm, thereby preventing the moisture from creeping up on the inner petticoat, and thence to the pin. Owing to the great success of our Patent Teat Insulator in Telegraph Work, where the efficiency of the Insulator has proven to be more than twice that of the ordinary insulator, we have concluded to apply the device to all Insulators for Telegraph, Telephone and Street Railway Work.

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Send Model or Drawing and we will furnish estimates.

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TRADE MARK.

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The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

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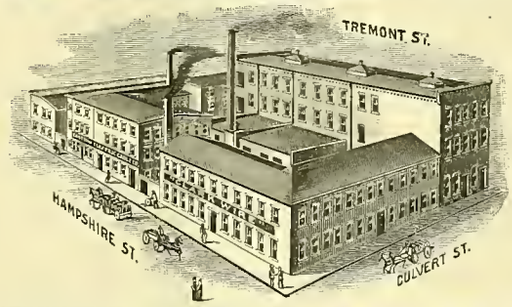


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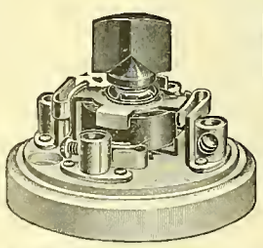

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Of any of the above sizes, either on single plates or with any number of switches upon one plate.

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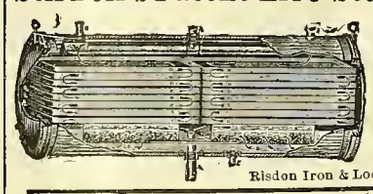
**Stilwell's Patent Live Steam-Feed Water Purifier.**



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I make prices to suit the construction man, for I want his trade.

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*To Steam Users, and others interested in the manufacture, purchase, or use of, and sale, of Steam Boilers.*

Having been granted Letters Patent on a "Safety Water Tube Boiler," of the "type" and "class" in which the Steam and Water drums are arranged and located transversely to the flow of products of combustion in their travel from the furnace to out-take to stack, of which the "Stirling" and "Pierepoint" are examples. My patents covering, in a fundamental degree, devices and arrangements, for the maintenance of continuous circulation throughout the entire boiler system, and, it having become known to me that certain parties are offering for sale boilers of this class, for which boilers they claim such continuous circulation, it is, therefore, necessary for me to notify manufacturers, users, buyers and sellers, and those who may be acting as agents for the sale of such boilers, that the same are a direct infringement of my patents, which it is my purpose to protect to the utmost extent, at the same time to guarantee to all purchasers of my Boilers the fullest protection against claims or litigation on the part of any and all patentees of Water Tube Boilers.

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Electrical engineer (29), married, wants position with small manufacturing company or in central station; eight years' practical experience in the manufacture, installation and running of lighting, traction and electric welding machinery. First-class references. Address "C. E.,"
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Young married man, a practical all-round electrical mechanic, wishes position as electrician or superintendent of electric light plant or street railway. Have had years of experience in all branches, including armature and field winding, arc, incandescent, generator and motor. Will work for moderate salary and can furnish the best of references. Address "E. R.,"
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**$24.00 SPECIAL**

To introduce our Dynamos and Motors of larger capacity, we are making a specialty of a high-grade 8-light, 16 C. P., 110 volt Dynamo, retaining all the special features of our larger machines at a surprising low price. Send for circular No. 22.

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Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.

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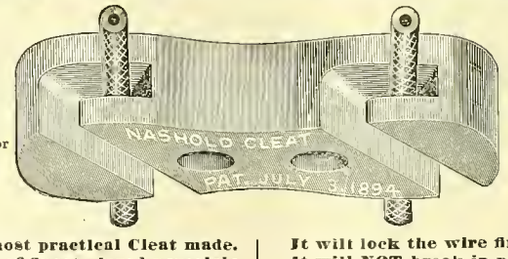
Patented in U. S., Canada, England, France, And Applied for In Germany.

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It is the most practical Cleat made.
It is made of finest glazed porcelain.
It is in one piece.
It has the strength.
It will lock the wire firmly.
It will NOT break in putting up.
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NON CORROSIVE, CONVENIENT and EFFECTIVE.

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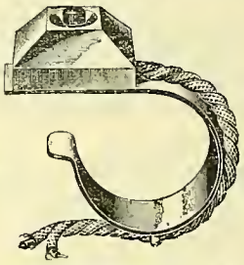

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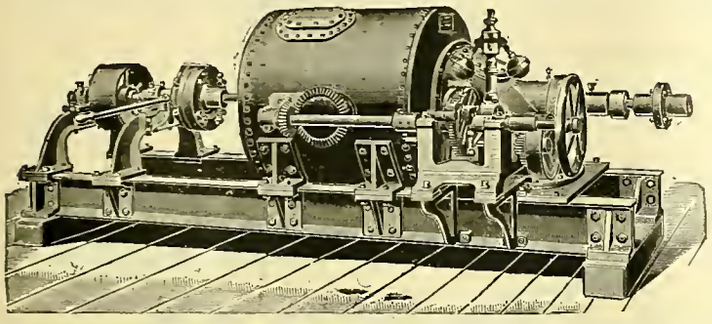
# VICTOR TURBINE WATER WHEEL.



Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.

The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

***SEND FOR CATALOGUE AND PARTICULARS.***

The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 36 H. P. under 38 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs, on horizontal shafts, and where the situation admits of their use we recommend them.

**The Stilwell-Bierce & Smith-Vaile Co., Dayton, Ohio.**

Risdon Iron & Locomotive Works, San Francisco, Cal., Pacific Coast Agents.

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**Series Lamps. Series Sockets. Street Fixtures.**

## Incandescent Lamps for Arc and Multiple Circuits.

Trial orders mean permanent business. Correspondence solicited.

## BERNSTEIN ELECTRIC CO., - Boston, Mass.

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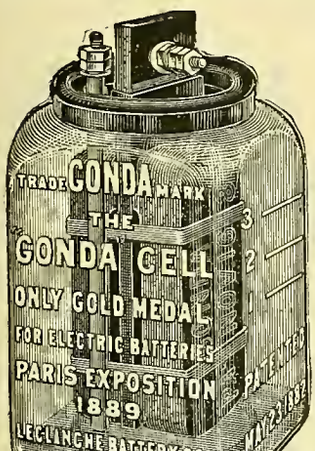


***The Standard Open Circuit Batteries of the World.***

SEND FOR CIRCULAR AND PRICES.

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111 to 117 East 131st St., N. Y.

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# CEDAR POLES, STREET R. R. TIES.

*The Valentine-Clark Co.,*

704-706 ROOKERY, - - - CHICAGO.

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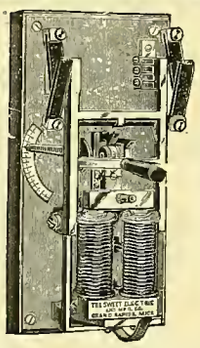
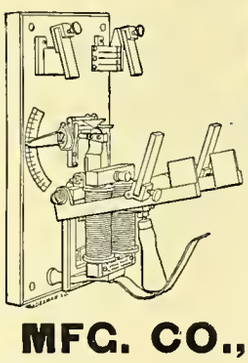
# HOT STUFF.



No! we make the final break off from carbons so that it is impossible to get heat enough to fuse points of your copper contact plates; no filing off of rough points, no hanging on after you have had a short circuit or over load, bound to work as easily after opening 1,000 times as it does when opened the first time.

**WE KNOW YOU NEED OUR CIRCUIT BREAKER,** and do not see why you should delay writing us any longer. One burn out will pay for a dozen of our instruments. **To be used on the Alternating or Direct Current Systems.**

**Write us at once.**



**SWEET ELECTRIC & MFG. CO.,**

*GRAND RAPIDS, MICH.*

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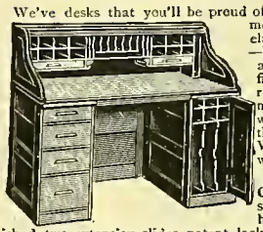
# Change Desks!

**—isn't it almost time?**



We've desks that you'll be proud of—that ornament the most elaborate office—best material and splendid finish. We'll return the money if you want to send the desk back. You won't want to.

**Roll Top Office Desk,** solid oak, highly polished, two extension slides, patent lock and perfect flexible slide, roll top, antique finished, castered, high curtain, 4 ft., $17.50; 4 ft. 6 in., $18.50; 5 ft., $20.50. Low curtain, 4 ft., $14.75; 4 ft. 6 in., $17.00; 5 ft., $18.75.

**Flat Top Desk,** solid oak, highly polished, two extension slides, antique finish, castered, 4 ft., $9.50; 4 ft. 6 in., $10.00; 5 ft., $10.50. Send for descriptive circular.

**Montgomery Ward & Co.,**

**111-118 Michigan Ave., Chicago.**

**TERMS.** Cash with order, or will ship to our own address and draw through your bank with draft attached to Bill of Lading.

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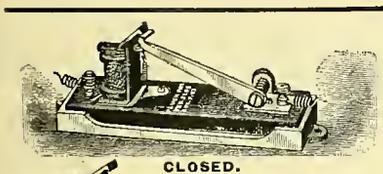
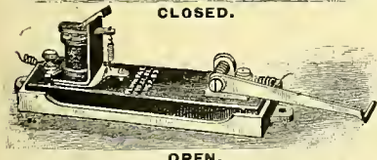


CLOSED.



OPEN.

**Regular Size, 6 inches long, 2¾ inches high, 1 to 1¾ inches wide.**

In a suit brought against F. Stevens by the Cutter Company, claiming an infringement on an Electric Flush Switch, it was decided in his favor by the United States Court in December last, the Court dismissing the case with costs.

# THE ELECTRIC PROTECTION CO.,

**1028 FILBERT STREET, PHILADELPHIA, PA.**

Owners and Manufacturers of

## THE PLUSH PROTECTORS.

## THE STEVENS FLUSH SWITCHES.

**And General Electrical Work.**

Special attention given to the construction of models and inventors' experimental work.

**WE CLAIM**

**For the Plush Protectors,** simplicity, sure action, ready adjustment, and interchange of parts.

**For the Stevens Flush Switch,** fire and damp proof. Mechanism is simplicity itself. Nothing to get out of order. Make and break so wide that no arc can form. Wired without removing casing. Buttons made of mother of pearl. Base made of vulcabestos with porcelain cases.

**Impossible for them to get out of order.**

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# New York Insulated Wire Co.,

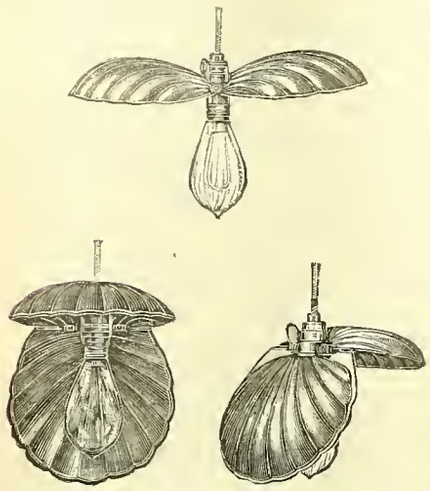
**Sole Manufacturers,**

Grimshaw White Core and Raven Core Wires, Grimshaw Underground Lead Covered Cables,
Competition Line Wires, Grimshaw Tapes and Splicing Compound,
Vulca Bushings, all sizes, Vulca Electrical Wire Ducts for Interior Construction.

**New York Insulated Wire Company,**

MAIN OFFICE: 13-17 Cortlandt Street, New York.

BRANCHES: CHICAGO: 78-82 Franklin Street. BOSTON: Congress Street. SAN FRANCISCO: 102 Sacramento Street.



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**(PRESERVE YOUR EYESIGHT.)**

Have you seen the Curtis-Donnally Lamp Shade? Here it is. It is made in two parts, like a clam-shell, see? It's a double reflector, each half adjustable at any angle. Try a sample. The price will be all right.

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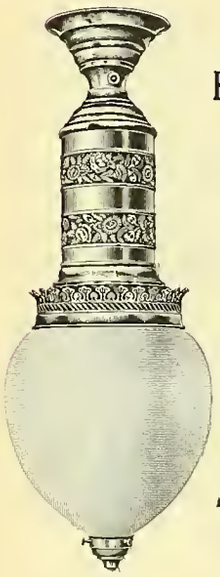

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For Direct Incandescent Circuits.

## The Most Economical Lamp Made.

Write for CATALOGUE and PRICES.

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|---|---|---|
| *1536 Monadnock.* | *806 Walnut St.* | *182 Summer St.* |
| G. W. Conover, Mgr. | O. D. Pierce, Mgr. | F. B. Smith, Mgr. |

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19th St. and Allegheny Ave., Philadelphia,

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Complete Alternating Current Equipment for Central Stations.
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Correspondence Solicited.

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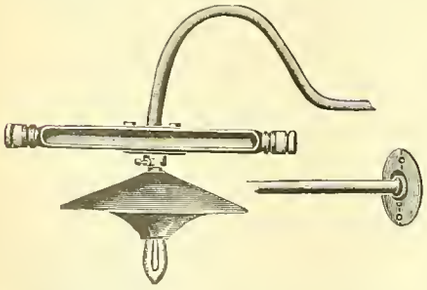
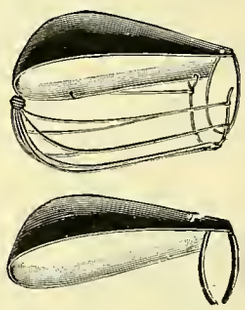


## WHAT ARE THEY?



*Send for Catalogue 894 and see.*

## BUTLER MANUFACTURING CO., 46 S. Clinton Street, CHICAGO.

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**186 and 188 Fifth Ave., Chicago, U. S. A.**

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WEATHERPROOF
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**Batteries, Bells, Annunciators, Metropolitan Incandescent Lamps, Mac Tape, Etc., Etc., Etc.**

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Don't let your contracts until you get our prices.
Prompt attention given to all orders.

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***Absolutely The Best.***

***Strictly Up-to-date.***

LIGHT,
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$85.00,
$100.00.

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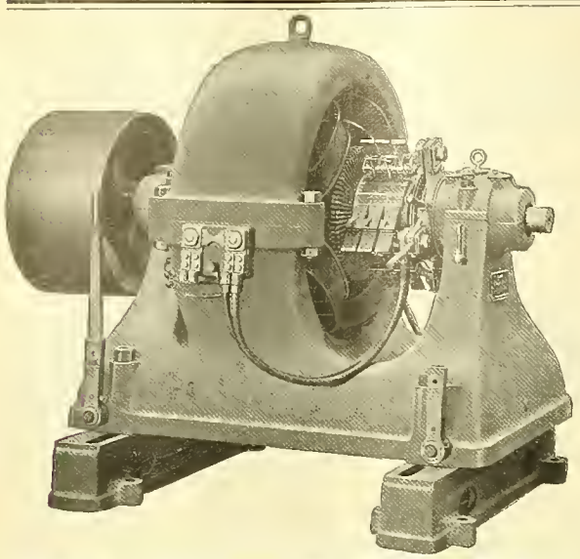

# The Walker Mfg. Company,

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Manufacturers of all kinds of Electrical Apparatus, specially large size

## GENERATORS,

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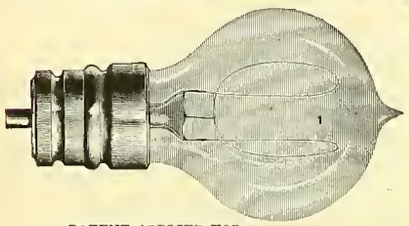
# THE NEW ÆTNA LAMP.



PATENT APPLIED FOR.

**YOU DON'T SEE THE TWIST IN THE FILAMENT.**

*THIS LAMP is specially adapted to street and general railway and steamboat use, because it is absolutely non-vibratable, and we guarantee for it 50 per cent. longer life and better service than any other lamp now on the market. The filament will not droop or get out of shape while in use, no matter at what angle it is burned.*

*A good lamp at a fair price. Ordinary lamps at ordinary prices.*

**AGENTS WANTED IN LEADING CITIES.**

**WRITE US.** **Ætna Electric Works,** Hartford, Conn.

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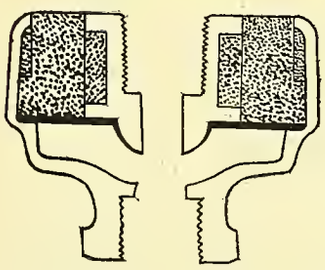

Sectional View—Patented July 10, 1894—Full Size.

**For Insulating Fixtures.**

This joint conforms to the requirements of Underwriters' rules. Write for prices and circulars.

Interstate Complete Electric Construction Co.,

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FOR ALL PURPOSES.

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Two Wires in a Single Tube, the Standard Method of Electric Wiring.

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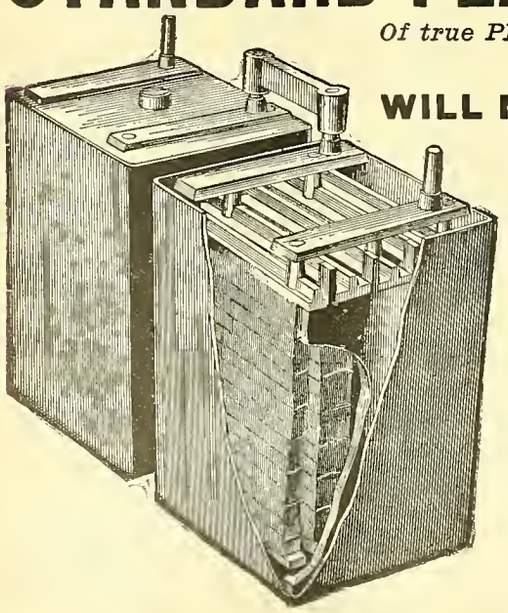
*Of true PLANTE Type and CRYSTALLINE FORMATION.*

Will give or receive without injury, currents that would destroy other batteries.



**WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.**

Contain no asbestos or other separating material to increase their internal resistance.

**ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.**

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

**Highest efficiency, largest delivery, lowest internal resistance.**

For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

**Cannot be damaged by excessive charge or discharge currents.**

A 400 ampere current has been taken from a 120 ampere hour cell.

☞ **CHALLENGE:** We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

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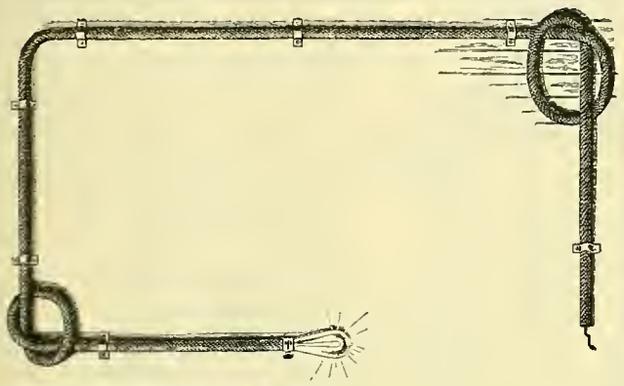

# CIRCULAR LOOM CONDUIT.

## FLEXIBLE . . . CONDUIT . . . .

The present stiff tubes furnished for this purpose have long been found imperfect and unsatisfactory to the electrical engineer and constructor. The ***rigidity*** of the tube makes it an impossibility to install in buildings already constructed, without cutting the surface of the wall or ceiling; and the ***numerous*** joints and elbows make the drawing in of wires very difficult.

In any system of interior tubing, the first cost of the tube is in a measure immaterial; but the cost of the connections and elbows and the cost of labor in applying same, is the most important factor. There is also an equity to be figured in the ***waste*** of ***short*** and ***damaged*** lengths, hich are practically worthless.

The ***Flexible Conduit*** recommends itself, because:—

1. It is thoroughly flexible.
2. It is thoroughly waterproof.
3. It requires no joints or elbows.
4. It will not readily ignite.
5. Wires will not stick in it.
6. It can be furnished in any length.

While the first cost of our tubing may seem high, we would suggest that consumers figure the cost of a ***short, stiff tube,*** the cost of ***joint sleeves,*** the cost of the ***elbows,*** the cost of the ***labor*** in applying same, and the probable ***waste*** in odd and damaged lengths; and net cost will show the economy of Flexible Conduit.

## IRON ARMORED CONDUIT . . . . . .

*Iron Armored* Circular Loom Conduit will be ready for delivery *May first,* and orders are now being entered for shipment on that date.

As is the case with the *flexible* conduit, experiment shows that the *Armored* Conduit will be the *most economical* and *satisfactory* conduit on the market.

ORDERS FILLED FROM NEW YORK OR CHICAGO AT MANUFACTURERS' PRICES.

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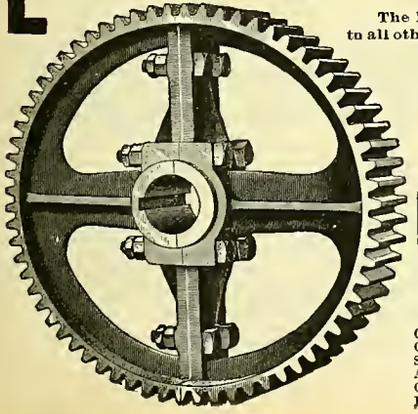
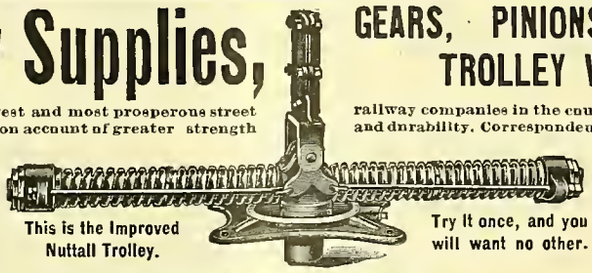
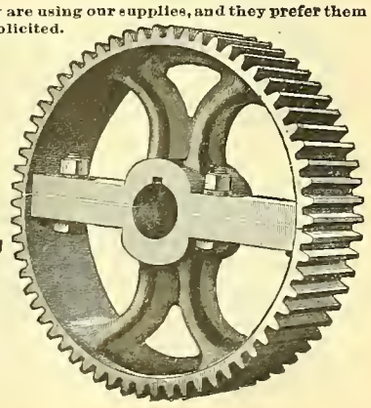




This is the Improved Nuttall Trolley.

Try it once, and you will want no other.



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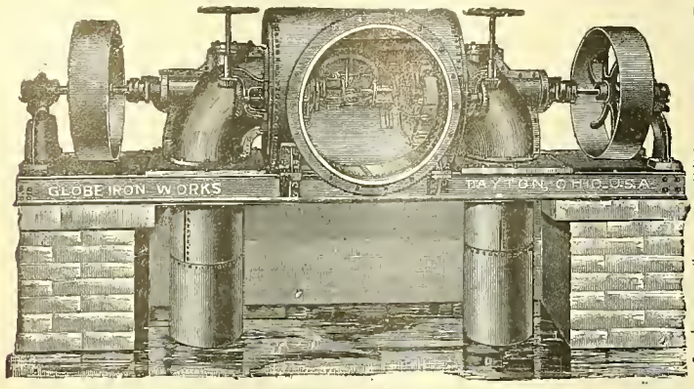


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Recent improvements made in the New American Turbine have increased the power as per their diameter, and produced greater efficiency from whole to half water than any other turbine, as evidenced by the following, copied from certified tests made at Holyoke, Mass., on the dates named, and signed by A. F. Sickman, engineer in charge of experiments, and E. S. Waters, hydraulic engineer.

The originals of these certificates and tests of other sized wheels can be seen at our office.

Test of a 45-inch Wheel—July 9, 1894.

| | | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|---|
| Whole | Gate | 16.06 | 119.17 | 141.68 | 205.27 | 79 76 |
| ⅞ | " | 16.42 | 122.00 | 127.18 | 195.19 | 82.68 |
| ¾ | " | 16.78 | 117.33 | 112.60 | 175.74 | 82.18 |
| ⅝ | " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ | " | 16.88 | 118.67 | 82.07 | 118.40 | 75.52 |

Test of a 42-inch Wheel—July 14, 1894.

| | | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|---|
| Whole | Gate | 16.33 | 128.00 | 134.18 | 199.56 | 80.60 |
| ⅞ | " | 16.56 | 134.80 | 120.85 | 188.14 | 83.09 |
| ¾ | " | 16.69 | 129.33 | 104.85 | 162.89 | 82.77 |
| ⅝ | " | 17.13 | 125.25 | 92 76 | 142.40 | 79 21 |
| ½ | " | 17.48 | 121.00 | 70.80 | 98.85 | 70.60 |

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Empire China Works.
144-156 Greene St
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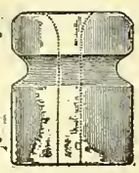
BROOKLYN, N.Y.
GENUINE HARD PORCELAIN, CUT-OUTS, SWITCH BASES, INSULATORS &c.



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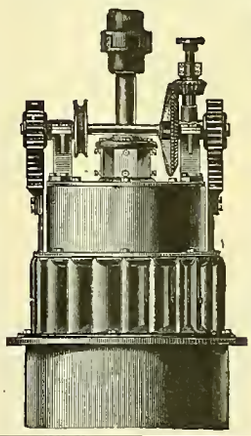

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On Vertical or Horizontal Shaft,
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**Gives more power as to diameter with a higher percentage of useful effect than any other water-wheel heretofore made.** All sizes, right and left hand, are built from patterns perfected under systematic tests in the Holyoke Testing Flume.

Parties having power plants which are unsatisfactory, and those contemplating the improvement of powers, will find it to their interest to confer with me, **as I am willing to guarantee results where others have failed, no matter what make of turbine has been in use. STATE REQUIREMENTS AND SEND FOR CATALOGUE.**

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Estimates furnished for complete power plants and results guaranteed.

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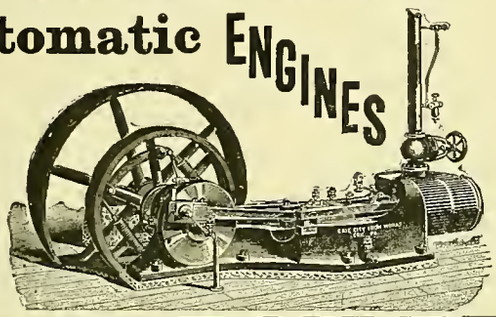

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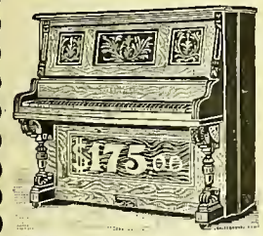

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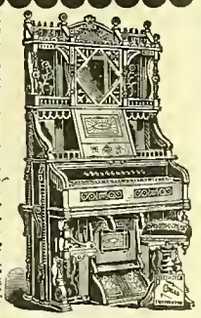

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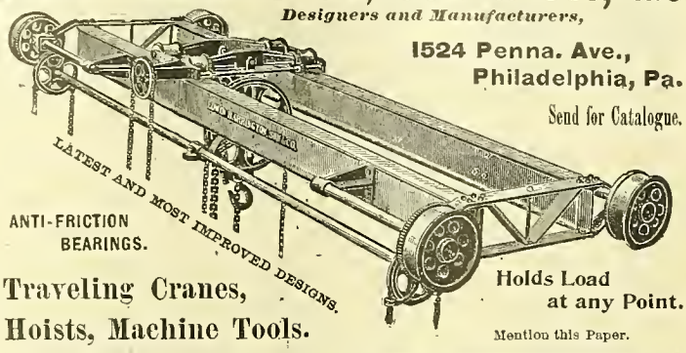


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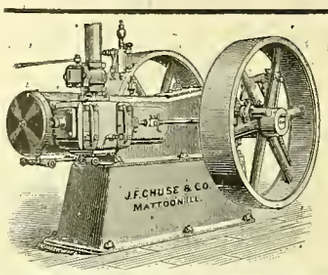


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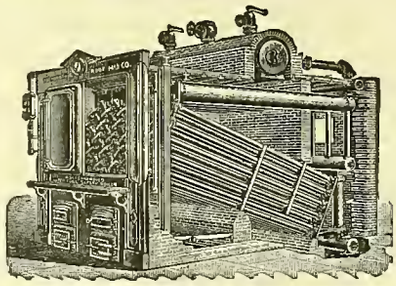

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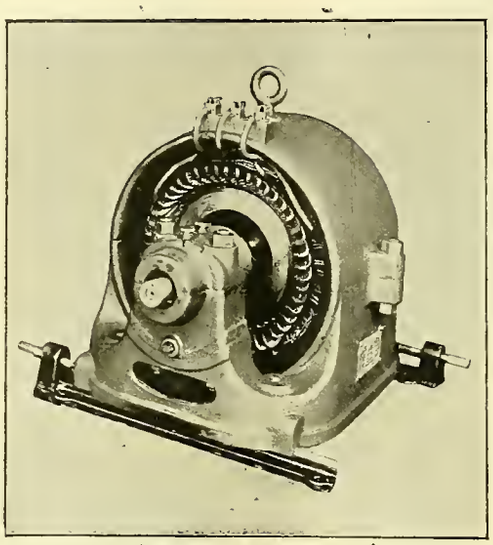

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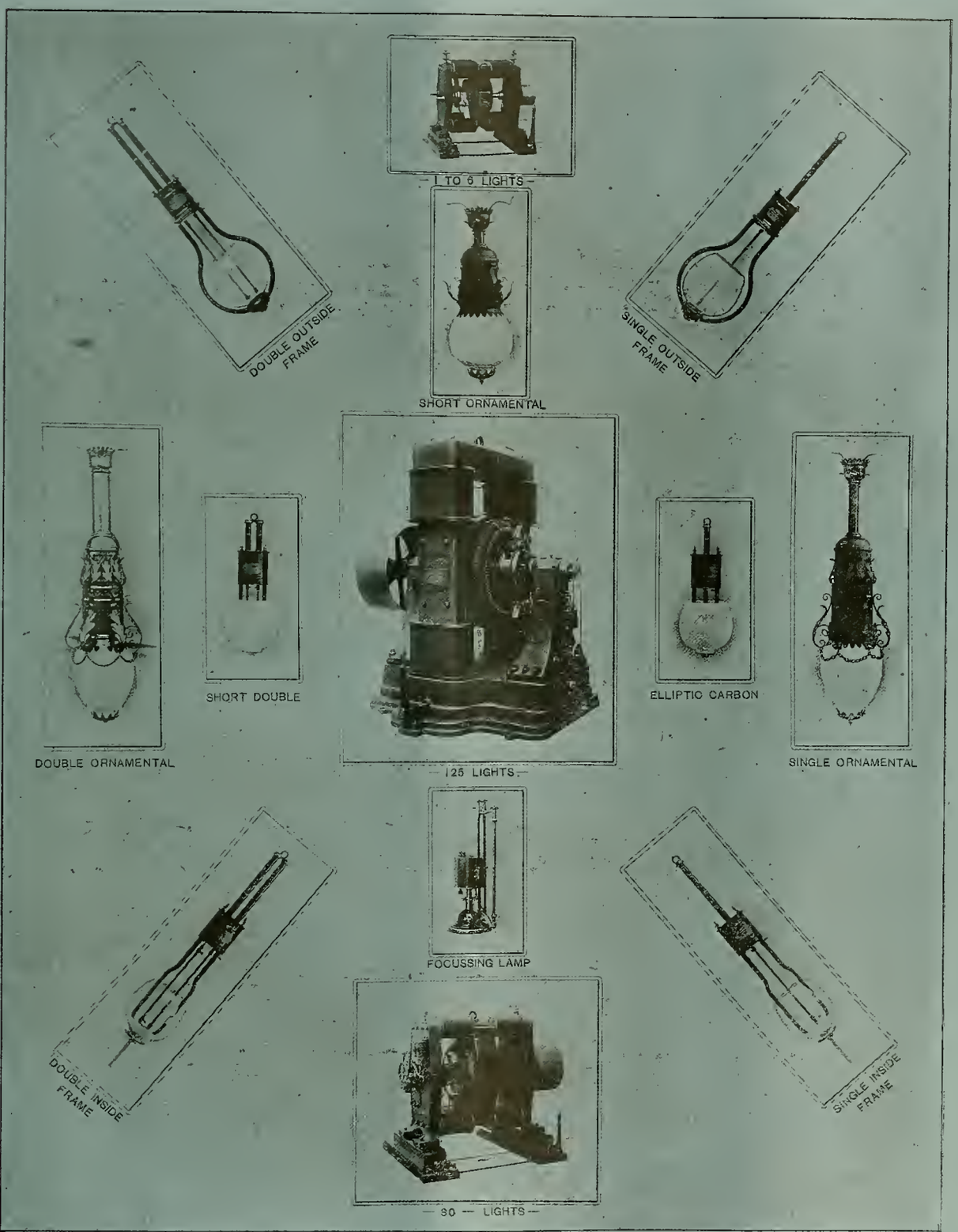


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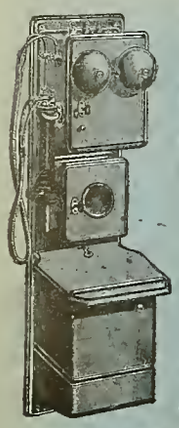

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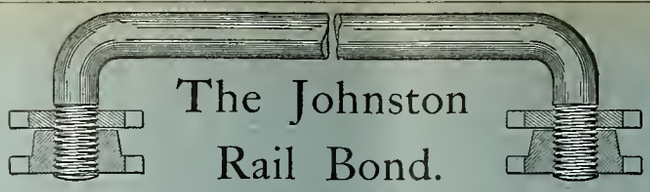

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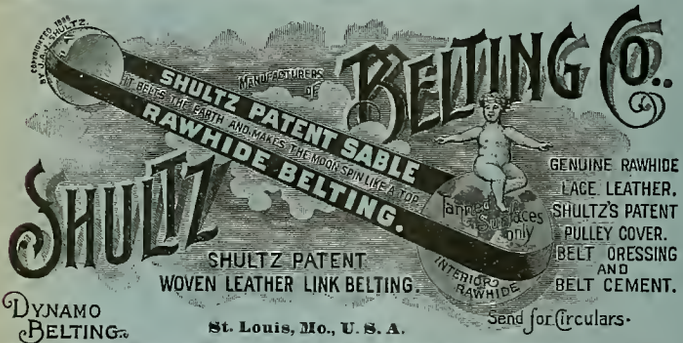


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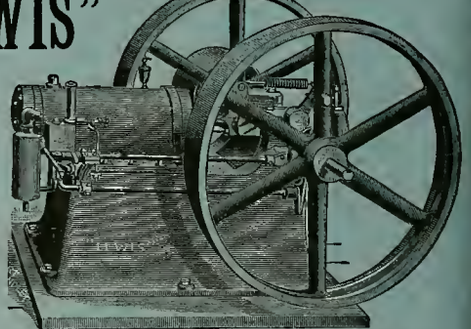

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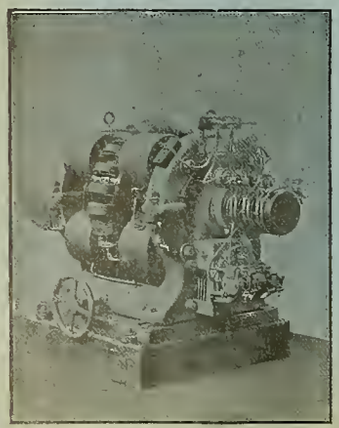

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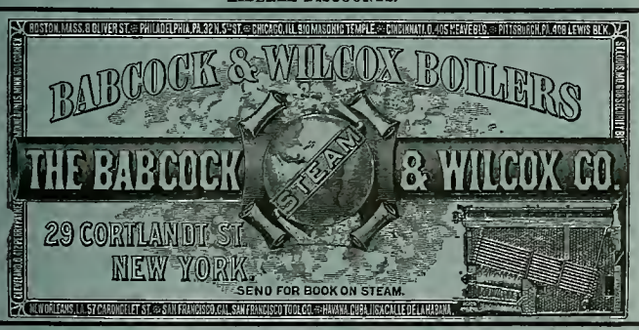


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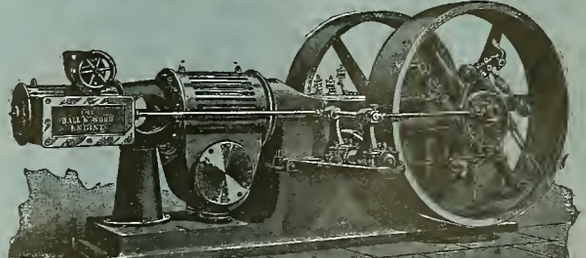

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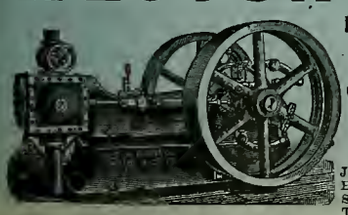

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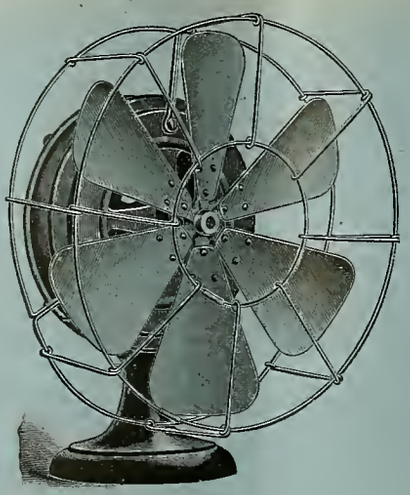

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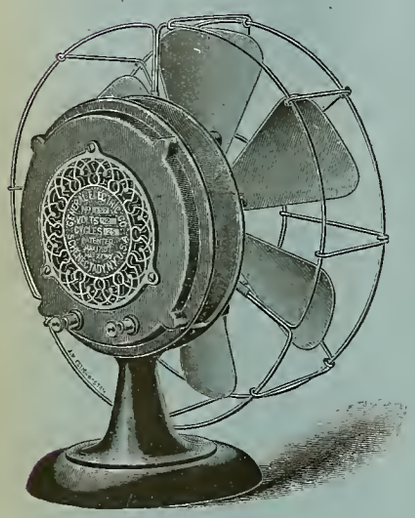

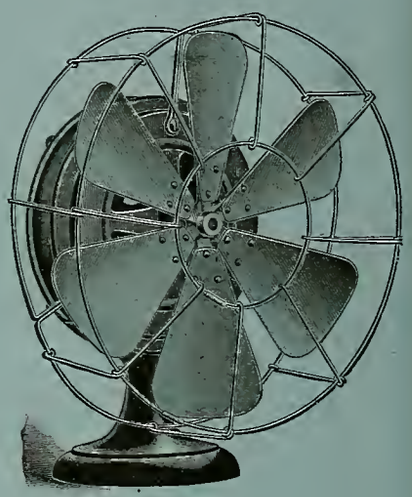

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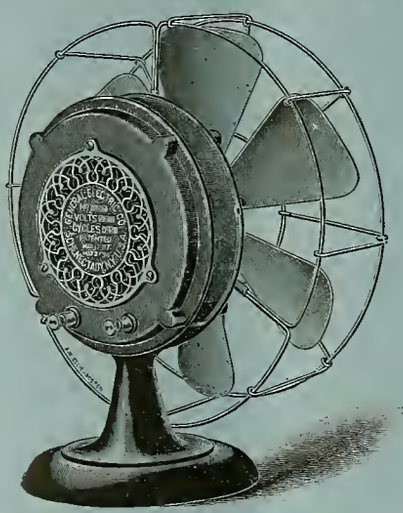

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## CLASSIFIED LIST.


**Accumulators.**
Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.

**Arc Lamps.**
Am. Gas Engine Elec. Co.
C & C Electric Co.
Central Electric Co.
Clark Electric Co.
Corey, R. B.
Crocker-Wheeler Elec. Co,
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Perkins El. Switch Mfg. Co.
Standard Thermometer Co.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Hemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Gillette, E. & F.
Huebel & Manger
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Bicycles.**
Monarch Cycle Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Brownell & Co., The.
Clonbrock Steam Boiler Wks.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Corey, R. B.
General Electric Co.
Partridge Carbon Co.
Werthelm, Ed.
Western Electric Co.

**Compound.**
Eureka Compound Co.
Standard Paint Co.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.
National Conduit Mfg. Co.

**Construction & Repairs.**
Allen-Hussey Co.
Amstutz, N. S.
G & C Electric Co.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El. Const. Co.

**Contractors and Electric Light Plants.**
Allen-Hussey Co.
Amstutz, N. S.
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Clark Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Siemens & Halske Elec. Co.
United Elec. Improvement Co
Westinghouse Elec. & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Bonnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Brodie Electric Co.
Central Electric Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Electric Protection Co.
Elec. Selec. & Signal Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Desks.**
Montgomery Ward & Co.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Clark Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth & Eck.
Royal Electric Co.
Siemens & Halske Elec. Co.
Waldo-Hyde, Wm.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Allen-Hussey Co.
Amstutz, N. S.
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg, Co,
Ford, Owen.
Thayer Electric Co.

**Electrical Instruments.**
Anderson, Albert & J. M.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Norton, Chas. E.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Queen & Co. Inc.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Electrical Specialties.**
Allen, L. B.
Clark El. Specialty Mfg. Co.
Electric Protection Co.
Interstate Com. El. Const Co.
Nashold Cleat Co.
Proctor-Raymond Elec. Co.
Rockford Torch Co.

**Electroliers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
General Electric Co.

**Engines, Gas.**
Am. Gas Engine Elec. Co.
Otto Gas Engine Wks.
Webster Mfg. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Brownell & Co., The.
Chuse & Co., J. F.
Erie City Iron Wks.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Central Electric Co.
Davis Elec. Co., W. J.
Diehl & Co.
Dietericks-Warwick El Co
Interior Conduit & Ins. Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Vulcanized Fibre Co.

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Butler Mfg. Co.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Dietericks-Warwick El. Co.
Electric Appliance Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Morris & MacCurdy;
Nashold Cleat Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Proctor-Raymond Elec. Co.
Queen & Co Inc.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Thayer Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Edwards, W. S. Mfg. Co.
Hemingray Glass Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co.. Eugene.
Nashold Cleat Co.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Aetna Electric Works.
Am. Electrical Mfg. Co.
Automatic Elec. Spec. Co.
Bernstein Electric Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Waldo-Hyde, Wm.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.

**Mica.**

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Andrae & Sons, J.
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Dietericks-Warwick El. Co.
Eddy Elec, Mfg, Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Works.
Roth & Eck.
Royal Electric Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.
Standard Paint Co.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd.

**Pianos and Organs.**
Beethoven Piano & Organ Co.

**Platinum.**
Baker & Co.

**Poles.**
Morris, Tasker & Co.
Nuttall Co., R. D.
Valentine-Clark Co.

**Porcelain.**
Empire China Works.
General Electric Co.
Hemingray Glass Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Separators.**
Goubert Mfg. Co.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co

**Speed Indicators.**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones.**
Andrae & Sons, J.
Central Electric Co.
Farr Tel. & Const. Supply Co.
Gillette, E. & F.
Gustafson, W. A.
Jameson & Co., W. D.
M. & B. Telephone Co.
Mo Telephone Mfg. Co.
Partrick & Carter Co.
Public Telephone Co.
Western Electric Co.
Western Tel. Const. Co.
Williams & Abbott Elec. Co.

**Transformers.**
Central Electric Co.
Diamond Electric Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hornberger Elec. Mfg. Co.
Lonisville Elec. Works.
Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Trolley Cord.**
Samson Cordage Wks.

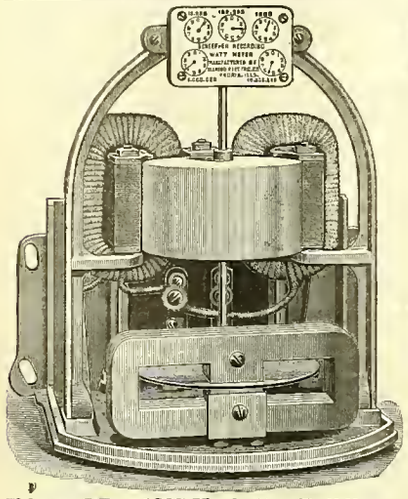
**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Chi. Shorthand Institute.
Int. Corr. Schools.
Scientific Machinist Co.

**Water Wheels.**
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co,
Brixey, W. R
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.



Chicago Office, 1307 Manhattan Building,
Central Electric Co., Selling Agents.

# SCHEEFFER'S RECORDING WATT-METER.

For Alternating Circuits. No Commutator. No Brushes.

Registers Direct Actual Power Consumed.

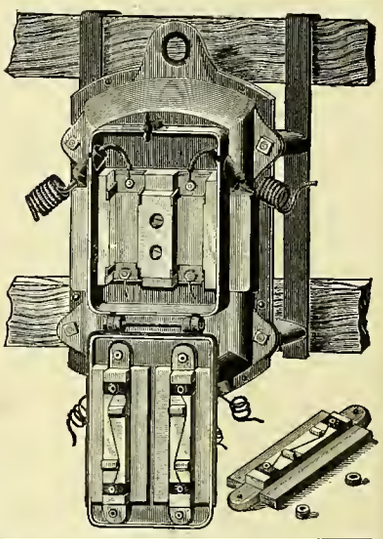
EASILY ADJUSTED. ABSOLUTELY RELIABLE.

# DIAMOND TRANSFORMER.

Simplest, Safest and Best.

FOR ANY VOLTAGE. FOR ALL SYSTEMS.

## DIAMOND ELECTRIC CO., Peoria, Ill.



# SAWYER-MAN INCANDESCENT LAMPS,

## With Bases to Fit Any Socket.

We have now resumed the manufacture of the well-known Sawyer-Man Lamps, on a scale to meet any possible demand.

We have adopted new methods of manufacture which add to the appearance and quality of our lamps, and make them by reason of their efficiency and long life, the cheapest and best lamps ever offered.

PRICES:

**PLAIN LAMPS.**

| | |
|---|---|
| 8, 10 and 16 candle power lamps | 25 cents each. |
| 20 and 25 candle power lamps | 30 " |
| 32 candle power lamps | 38 " |
| 16 candle power street car lamps | 25 " |
| 16 candle power street car lamps, anchored | 32 " |

**ORNAMENTAL LAMPS.**

| | |
|---|---|
| 8, 10 and 16 candle power lamps | 30 cents each. |
| 20 and 25 candle power lamps | 35 " |

Discounts according to quantity.
For etching the plain or ornamental lamps, 3½ cents each, net.

**COLORED LAMPS.**

"Dipped" lamps in red, blue or green, 5 cents each, net, additional.

Lamps with bases to fit Thomson-Houston sockets, 3 cents extra.
Boxing and packing at cost.
Prices are subject to change without notice.

# Westinghouse Electric & Manufacturing Company,

PITTSBURG, PA.

**Branch Offices in all Leading Cities.**

# WESTINGHOUSE ELECTRIC & MANUFACTURING CO.,

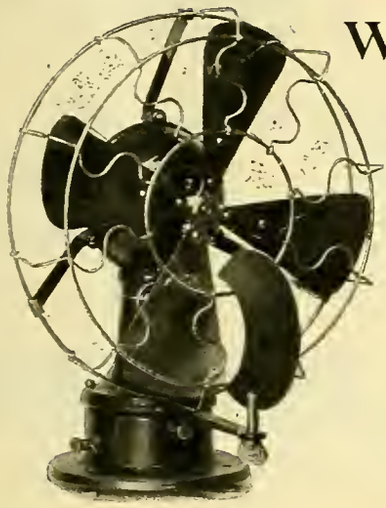
**PITTSBURGH, PA.**

We manufacture Complete Installations of

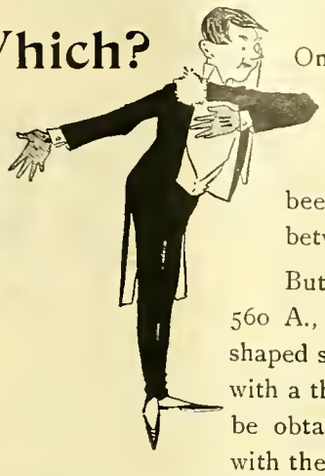
# ELECTRICAL APPARATUS

For **CENTRAL STATION ELECTRIC LIGHTING,**
**LONG DISTANCE TRANSMISSION OF POWER,**
**ELECTRIC RAILWAY AND ISOLATED PLANTS.**

**BRANCH OFFICES IN ALL LARGE CITIES.**



# Which?



One man contends that the crescent-shaped piece is a "rudder." Another argues, and proves to his *own* satisfaction, that it's a "sail." We give it up—leave it to you—our nautical education has been neglected, and we probably couldn't distinguish between a rudder and a squall.

But we know **results.** This is a regular **Lundell,** 560 A., mounted on a ball-bearing stand; the crescent-shaped sail? or rudder? is braced to an ornamental spar with a thumb-screw. Any speed of gyration desired can be obtained by taking a reef in the sail (for instance) with the thumb-screw.

**And what a delight** the motor is! There is more breezy joy lurking in its wake than we can begin to tell of. *Must be seen to be fully appreciated.*

---

A dozen styles to select from for all kinds of circuits, direct, alternating, battery. 50 to 250 volts. If our Special Fan Motor Catalogue has not reached you, write for it.

OKONITE IT NEVER DISAPPOINTS

## Central Electric Company,

### 173-175 Adams St.,
### CHICAGO.

Branches: { Kansas City, Mo.: Gate City Electric Co.
{ St. Louis: Southern Electrical Supply Co.

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**ECONOMY.**

**FLEXIBILITY.**

# CIRCULAR LOOM CONDUIT.

**No Waste.**
**No Elbows or Fittings.**
**No Bad Joints.**

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# WESTERN ELECTRIC COMPANY,

**CHICAGO, 227 to 275 S. Clinton St.** **NEW YORK, Greenwich and Thames Sts.**

# INCANDESCENT LAMPS.

WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

## GLOBE ELECTRIC LIGHT CO., General Offices: Carter Building. BOSTON, MASS.

AGENTS WANTED. WRITE US.

# RECEIVER'S SALE.

## WARING ELECTRIC COMPANY.

The entire stock of

## NOVAK LAMPS,

of ALL candle powers and voltages, together with a large amount of

## MACHINERY,

consisting of dynamos, pumps, etc., must be SOLD AT ONCE to close up the affairs of the company. For prices and terms address

**WM. WALDO-HYDE,** Receiver,

*Hartford, Conn.* *Manchester, Conn.*

**Alternating Current**

## ARC LAMPS.

## The Kester '95

**IS THE LAMP YOU HAVE HOPED FOR.**

It is the only perfected Arc Lamp for the alternator, either high or low frequency.

It comprises all that is desired in an Arc Lamp.

Write for pamphlet and prices to

## THE F. P. LITTLE

## Electrical Construction & Supply Company,

**135 SENECA STREET,**

**BUFFALO, N. Y.**

# IMPORTED CARBONS!

GENERAL INCANDESCENT ARC LAMP CO.'S

## BERGMANN LAMPS. KNIGHT ARC LAMP.

**The Above Lines Include ARC LAMPS for Every Service.**

Address Inquiries to **R. B. COREY,** General Sales Agent,

Room 714 Havemeyer Building, NEW YORK CITY.

The Boudreaux Dynamo Brush Co. NO GAUZE.

NAPOLEON LUNDELL

AS WELL AS

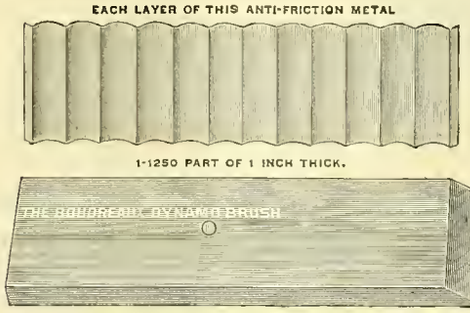
Knew that victories could only be gained by the use of the best material.

That is why all *LUNDELL MOTORS* are equipped with

THE BOUDREAUX DYNAMO BRUSH.

The Boudreaux Dynamo Brush Co. NO CARBON.

EACH LAYER OF THIS ANTI-FRICTION METAL




NO SPARKING.

NO CUTTING.

NO TRIMMING.

NO GREASING.

**TESTIMONIAL.**

R. E. T. PRINGLE, MONTREAL, CAN.—"Your favor of the 20th inst. is to hand, also Brushes, which I have tried and which have proved to be more than satisfactory, as the machine they were put on was used for storing batteries and kept up a continual sparking. Since your brushes were put on there has not been a single spark seen, nor has the commutator cut in the least."

The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

# THE BOUDREAUX DYNAMO BRUSH CO.,

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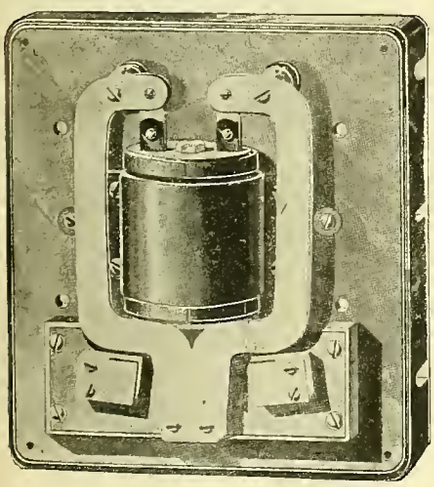
**Postal Telegraph Building, NEW YORK.**

The Boudreaux Dynamo Brush Co. NO COPPER.

# SINCE MARCH 1st

# Our New (Model 1895) Electric Light and Power Controllers



HAVE BEEN ADOPTED BY CENTRAL STATIONS OPERATING

**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{\text{On}}{\text{Out}}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

OUR GENERAL WESTERN AGENTS ARE

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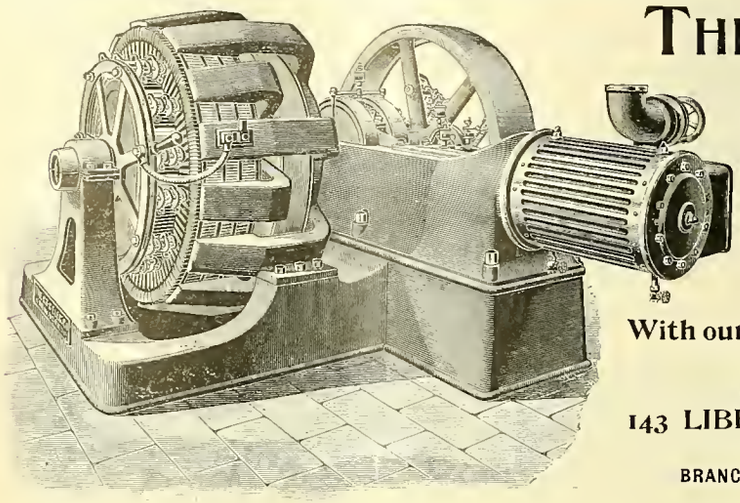

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MANUFACTURERS OF

## Bipolar AND Multipolar Dynamos,

Automatic and Hand Controlled Motors,
Complete Plants for Power Transmission,
Isolated Lighting Plants, Central Station Apparatus.

With our Extensive Works we are prepared to fill promptly all orders for 1 H.-P. to 250 H.-P.

GENERAL OFFICES: 143 LIBERTY ST., NEW YORK.

WORKS: GARWOOD, N. J. On Central R. R. of N. J.

BRANCH OFFICES: CHICAGO, Monadnock Building. BOSTON, 63 Oliver Street. CLEVELAND, Cuyahoga Building. PHILADELPHIA, 633 Arch Street.

# HELIOS ELECTRIC COMPANY,

Factory and Offices,

**1310 Filbert Street, Philadelphia, Pa.**

*We have no Stock nor Old Style Lamps that we must get rid of at any price—no junk.*

## THE HELIOS LAMPS

Are the latest patterns and newest type. Our Lamps are much in advance of any lamp now on the market, because they are New and of Latest Designs.

Our ALTERNATING LAMPS have Reflector Plates. Our DIRECT CURRENT Lamps do not see-saw. Our Focusing Lamps, both Direct and Alternating, are especially adapted for photo-engraving and stereopticon work.

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Central Electric Co., Western Agents, Chicago.
Moore & Baylis, Agents for Western New York, Buffalo, N. Y.,
Globe Electrical Supply & Construction Co., New York City Agents, Vandem and Greenwich Streets, New York.
Mountain Electric Co., Agents for Colorado, Utah, Wyoming and New Mexico, Denver, Col.
Machinery Supply Co., Agents for Southern California and Arizona, Los Angeles, Cal.
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**A Central School of Shorthand and Typewriting of the most Modern and Complete Type.**

**A COMPLETE COURSE OF SHORTHAND.** We offer you shorthand instructions in abundance, and most excellent in quality. Our course is graded and arranged in logical order. We claim not a new system, but a new method of imparting the art of shorthand by which we can equip any ordinary intelligent person for the execution of any stenographic work devolving upon the expert stenographer or court reporter.

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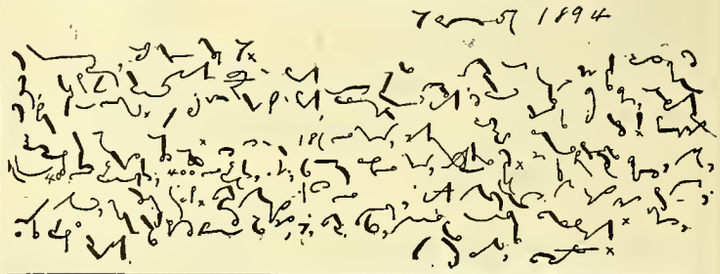

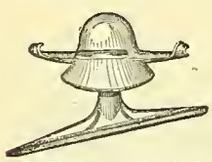

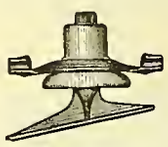

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*Hangers, Pull-Overs, Bracket Arm Insulators, Guard Wire, Feed Wire, Giant Strain and Section Insulators, Frogs, Crossings, Rail Bonds, Etc., Etc.*

**VULCABESTON** Heat-proof Insulation for Magnet Spools, Bushings, Controller Parts, Etc.

**ASBESTOS** for Fire-Proofing and Electrical Purposes.

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NEW YORK. PHILADELPHIA. BOSTON.

# THE BEST ELECTRIC FAN On the Market.

**For Alternating Current, Wound for 50 or 100 volts.**

The Fan is 14 inches in diameter.
Will always start when current is on
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

Agents Wanted in Different Localities,

For further information address

THE

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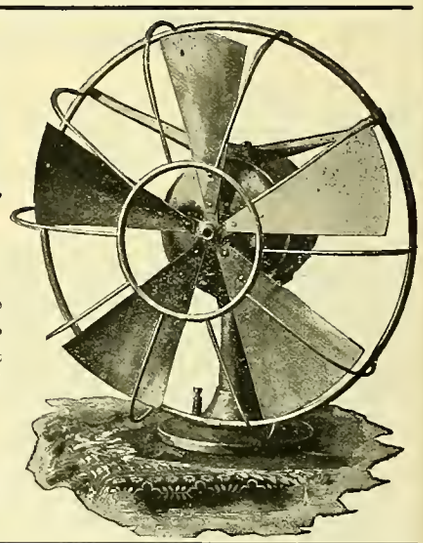
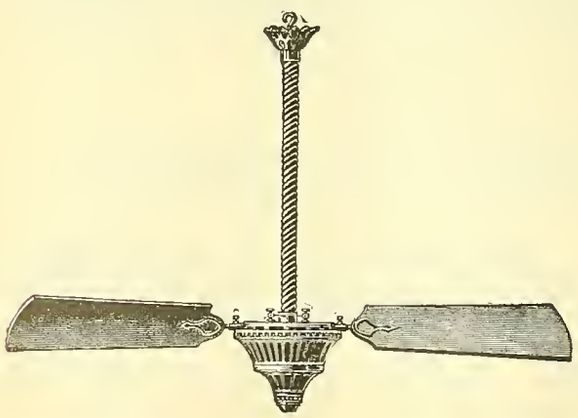
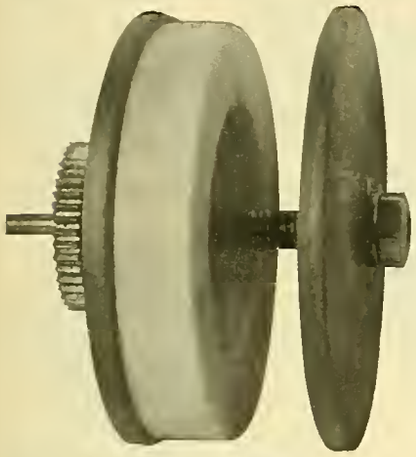




**AN EMPHATIC SUCCESS!**
**THE DIEHL ELECTRIC FANS WIRED IN A SERIES OF TWO OR MORE ON A STREET RAILWAY CURRENT.**

**DIEHL & COMPANY, 385 BROADWAY, NEW YORK.**



"THE WAX WHEEL."

*Built for all types of currents.*
*Only one adjustment.*

**NO** *MAGNETS.*
*SPRINGS.*
*DASH POTS.*
*CLUTCHES.*

# The American Gas Engine Electric Co.

Hereby announces that it has acquired the manufactory of the Nutting Electric Company, and the sole rights for the United States under all of its patents.

We have increased our manufacturing facilities to such an extent that we can now quote the well known

## Wax Wheel Arc Lamp

Until further notice, as follows:—

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| **Series Arc Light Circuits, direct current, net, - - -** | **$10.00.** |
| **Constant Potential Circuits, direct current, net, - -** | **10.00.** |
| **NOTE:—Resistance for Constant Potential Circuits will cost per lamp, extra,** | **$1.50.** |

*CONTRACTING AND CONSULTING ENGINEERS' DEPARTMENT FOR COMPLETE GAS ENGINE ELECTRIC PLANTS.*

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**IN SIZES FROM 1 TO 1,000 HORSE POWER.**

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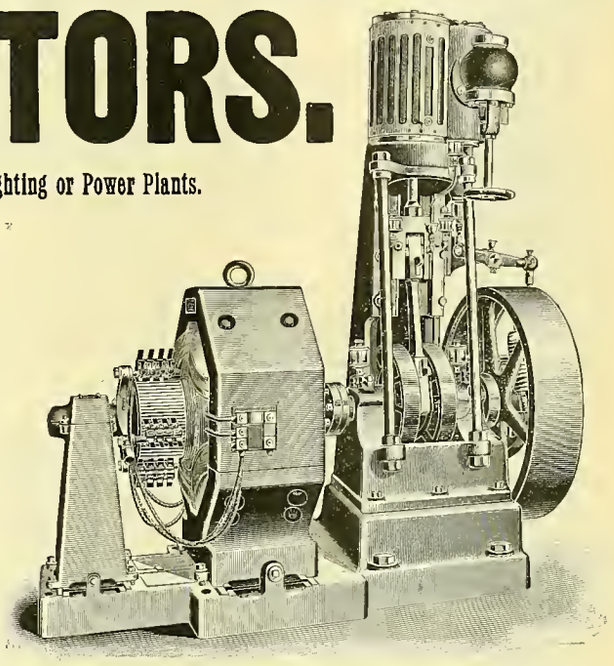
Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*



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**NEW YORK OFFICE, HAVEMEYER BLDG.**

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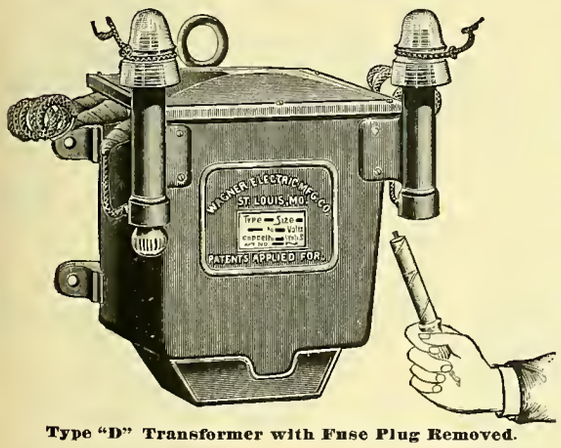
**All Our Apparatus Guaranteed as Represented.**

# TRANSFORMERS.




**Type "D" Transformer with Fuse Plug Removed.**

***A New Type*—*Transformer, Primary Cut-outs and Insulator Brackets all combined.***

No more brackets pulling off of walls.

With our wall or cross-arm hooks, transformer may be *Hung* and *Connected* in *Five minutes.*

Our new fuse plugs will not hold an arc with 5,000 volts.

*Our Transformers* are acknowledged by all experts to be the *Highest* in *Efficiency* ever made.

Adopted by the largest stations in the country.

*We Challenge Competition* in any form of test, in laboratory or practical use.

Made in all sizes, 5 lights to 3,000 lights.

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# THE UPTON ARC LAMP

**For All Circuits.**

## The Cheapest to Buy, Use and Maintain.

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| Direct current lamps, constant potential, with globe and resistance, to burn 8, 11, 14 hours, | $12.00 |
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PEABODY, MASS.

The Original Manufacturers of the

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**Supplies of Every Description.**

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Western Agents for DANBURY ELECTRICAL WORKS.

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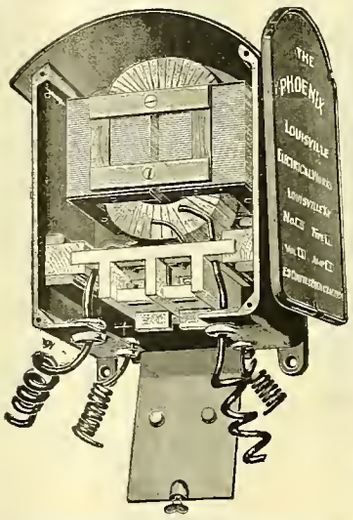


THE LATEST. THE BEST.

THE

# PHOENIX

## TRANSFORMER.

*Embodies every point essential to A PERFECT Transformer.*

**WE GUARANTEE**
THE HIGHEST EFFICIENCY AND CLOSEST REGULATION
**EVER ATTAINED.**

**Its Mechanical Construction makes it the SIMPLEST Transformer made.**

To try one is to adopt it for your
FUTURE STANDARD.

## Louisville Electrical Works,

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NOTICE! We will sell 10,000 Knsel's
**LONG DISTANCE CARBON TELEPHONE**

## TRANSMITTERS at $1.50 Each, Complete,

In oak or walnut cases. This Transmitter is guaranteed the most powerful Battery Transmitter made or money refunded. Order a sample pair. Send for our Telephone catalogue.

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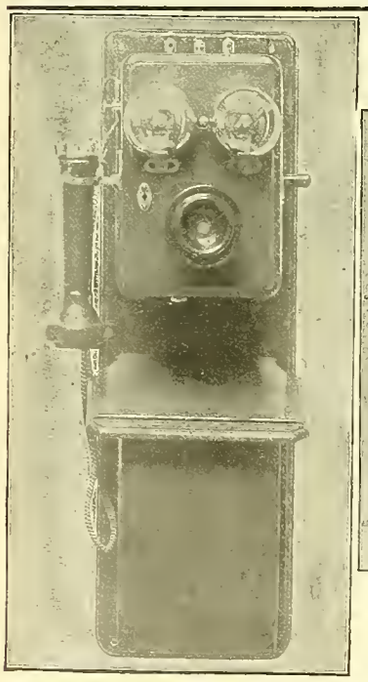
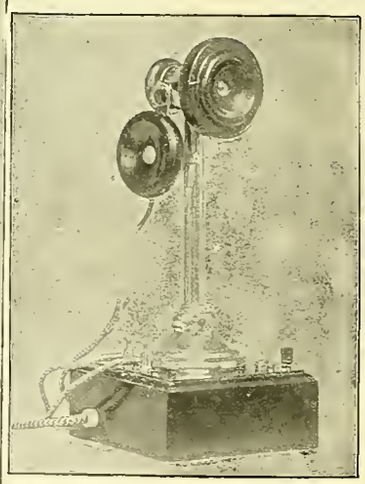


## M. & B.



## Desk Set.

**Complete Exchange Plants.**
**Metallic or Ground Circuit.**

**SWITCHBOARDS ABSOLUTELY GUARANTEED.**

*STATE AGENTS WANTED.*

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## M. & B. TELEPHONE CO.,

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## Telephone Outfits.

(LONG and SHORT DISTANCE)

I make prices to suit the construction man, for I want his trade.

**W. A. GUSTAFSON,**
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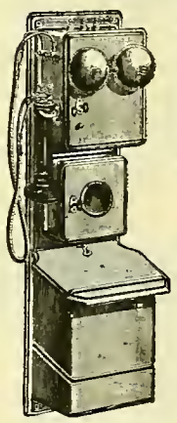

TELEPHONES,
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MAGNETO and
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The most Complete Stock.

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Our Instruments are absolutely

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This company is manufacturing **A Compound Magneto Telephone**
Which it sells outright under a guarantee both as to efficiency and as against infringement of patents.
It talks as well over one hundred miles as any other Telephone talks over one mile.
This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists.

**WESTERN TELEPHONE CONSTRUCTION CO.,**
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## HIGH-GRADE TELEPHONES

We make a strictly first-class instrument for exchange service and private lines. It is a **BATTERY TELEPHONE** and is guaranteed not to infringe. Write for catalogue and prices.

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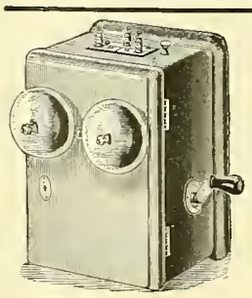

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AND

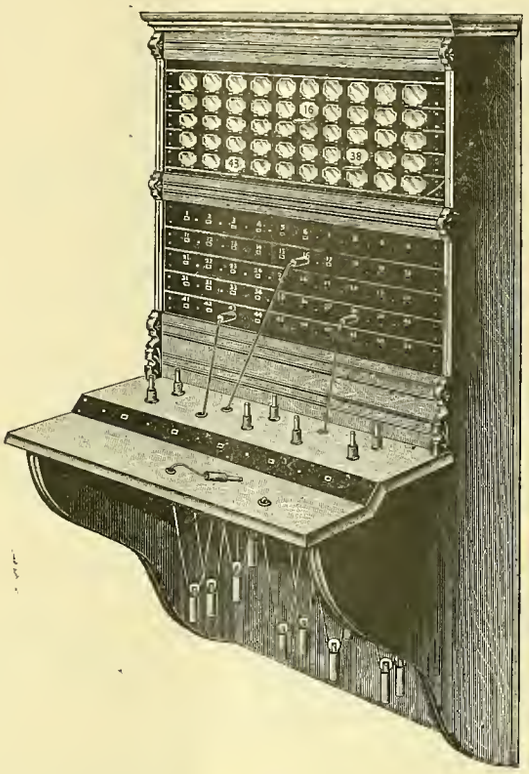
Standard Goods. No Infringements.

## TELEPHONES.

Get Our Prices Before Purchasing Elsewhere.

**E. & F. GILLETTE,**
**BAYPORT, CONN.**

# AMERICAN TELEPHONE SWITCHBOARD.



Our American Telephone Switchboard embodies all of the late improvements that have been made in Telephone Switchboards, and is superior in many respects to any outfit that has been offered to the trade up to date.

## OUR COMPLETE SWITCHBOARD INCLUDES

| | |
|---|---|
| Answering Plug. | Connecting Plug. |
| Ringing and Listening Plug. | Ringing and Listening Jack. |
| Push Button for connecting Generator in Line. | Automatic Ground Switch. |
| Telephone Transmitter. | Generator. |
| | Telephone Receiver. |

Nothing but the very best material and workmanship is employed in the manufacture of this board, and we offer it as particularly adapted to large telephone exchange work.

The use of our ***Improved Hunnings Telephone*** and ***American Switchboard*** insures a

## PERFECTLY EQUIPPED EXCHANGE.

We are prepared to make close estimates on material for complete equipments, including Telephones, Switchboards, Line Material, etc.

Our prices are low and our appliances substantial and first-class in every respect.

# Electric Appliance Company,

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Paranite Wires and Cables, "O. K." Weatherproof Wires and Cables.

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MANUFACTURERS OF THE PACKARD LAMP;

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WIRES AND CABLES

WIRES AND CABLES

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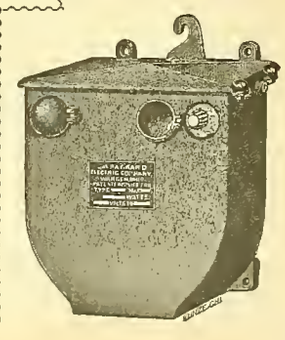

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For Arc Light and Trolley Cord.

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**USE THE BEST!**

**Eureka Commutator Compound.**

A perfect Compound for Dynamos and Motors. Works on any Commutator with Copper or Carbon Brushes. Send for sample; price 75c per stick.

Eureka Compound Co.,
SIOUX FALLS, S. D.

**Boswell Storage Battery.**

For Traction Work, Electric Lighting, Electric Launch, Telegraph, Phonograph, Surgical, and for all purposes where Light and Power are required.

Prices on Application.

D. E. BOSWELL & CO.,
154 Lake St., Chicago.

**The Brady Mast Arms.**

T. H. Brady, New Britain, Conn., U. S. A.,

Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work. — *Catalogues and Prices furnished on application.*

**THE DEARBORN LONG DISTANCE TELEPHONE**

Is just what you want for your line or exchange. Will operate up to 500 miles. Handsomely mounted in every respect, with polished oak case, it will be found an ornamental as well as a useful instrument. **OUR PRICES** on them will be found satisfactory to you and all that you would ask for.

**WE GUARANTEE**

Them in every respect, and if you need any telephones, order a pair from us and give them a thorough test. If not satisfactory we will take them back.

**AGENTS WANTED EVERYWHERE.**

**DO NOT FORGET**

That we carry a full line of Wire and Electrical Supplies. *Prices the Lowest.*

**DEARBORN ELECTRIC COMPANY,** 19 Quincy St., CHICAGO.

**Public Telephone Co.,**

This system does not infringe the patents of the Bell Telephone or Western Electric Co. We build exchanges complete for local companies, or will install and operate exchanges ourselves at a low monthly rental. We keep in stock Blake transmitters and all kinds of supplies.

MANUFACTURERS OF THE SHAVER LONG DISTANCE PULVERIZED CARBON

**TELEPHONE**

For Exchanges, Etc.

Correspondence Solicited.

**PUBLIC TELEPHONE CO.,**

Office and Factory:
Thames Building, 27 Thames Street, NEW YORK.

**BEWARE** of the so-called insulating compounds claiming to be as good as

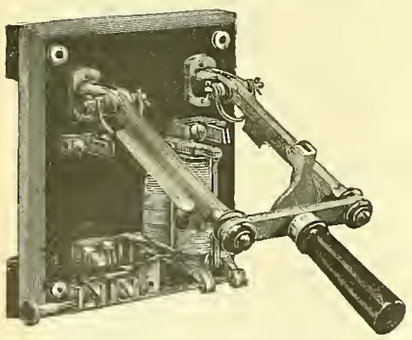
**P. & B.**

**There are None Just as Good.**

THE STANDARD PAINT CO.,
Sole Manufacturers P. & B Products,
*2 Liberty Street, New York.*

CHICAGO: Metropolitan Electric Company, 186-188 Fifth Ave.

**MOTOR ARMATURES COST MONEY**



You can prevent them from burning out by using

**THE BRODIE AUTOMATIC MOTOR-SWITCH.**

It combines in one piece of apparatus a double-pole switch, adjustable limit-switch and automatic cut-out, and instantly disconnects the motor whenever it is overloaded and whenever the circuit fails from any cause.

Agents wanted in all sections of the country.

For circulars and prices, address

**THE BRODIE ELECTRIC CO., - Manchester, N. H.**

THIS IS ONE OF THE

**Bryant Weatherproof Sockets.**

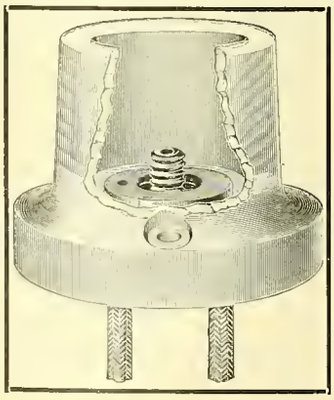
Ask your dealer for them.

Dealers, send us your Business Card.

BRYANT ELECTRIC COMPANY,
Bridgeport, Conn., and Chicago, Ill.

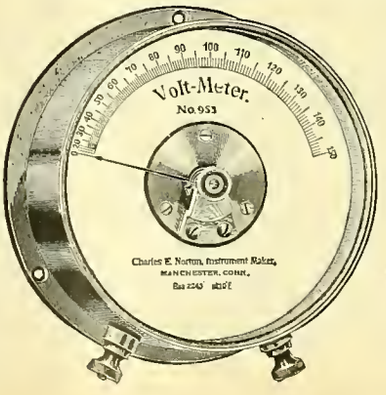
We represent The R. Thomas & Sons Co.

**PORCELAIN.**



THOS. G. GRIER, EDWARD R. GRIER, } GRIER BROTHERS.
Managers Western Office.

**"THE NORTON" Ammeters and Voltmeters.**




A standard instrument.
Perfect in construction.
The best instrument made for general work.
Satisfaction guaranteed.
New catalogue.
Agents wanted in leading cities.
Write us for prices and you will purchase.

**Charles E. Norton,**
INSTRUMENT MAKER,
Manchester, Conn.

EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Secy.

# AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.

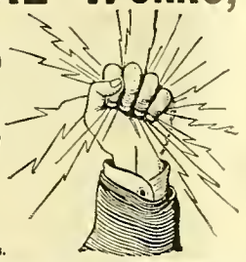
## BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,

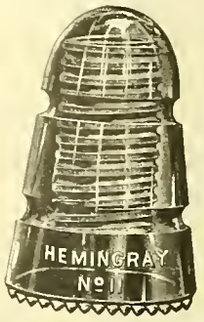
## Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

CABLES FOR AERIAL AND UNDERGROUND USE.



NEW YORK STORE, P. C. Ackerman, 10 Cortlandt St.
CHICAGO STORE, F. E. Donohoe, 241 Madison St.
MONTREAL BRANCH Eugene F. Phillips' Electrical Works.




## No. 11 DOUBLE GROOVE PONY INSULATOR.

**Can be Used for Transposing.**

The points or teats on the lower rim of the petticoat attracts the water on the outer surface of the insulator into drops. The water drops from these points on to the cross-arm, thereby preventing the moisture from creeping up on the inner petticoat, and thence to the pin. Owing to the great success of our Patent Test Insulator in Telegraph Work, where the efficiency of the Insulator has proven to be more than twice that of the ordinary Insulator, we have concluded to apply the device to all Insulators for Telegraph, Telephone and Street Railway Work.

Standard Screw Glass Insulators.
Floor Insulators, Glass Break Knobs, Battery Jars, Arc Light Globes for all Systems.
Colored Glass Insulators to designate different currents.

**WORK ON SPECIAL DESIGNS A FEATURE.**

Send Model or Drawing and we will furnish estimates.

## HEMINGRAY GLASS CO.,

Office, Covington, Ky. —ESTABLISHED 1848.— Factories, Muncie, Ind.

THE

# "CLARK" WIRE.

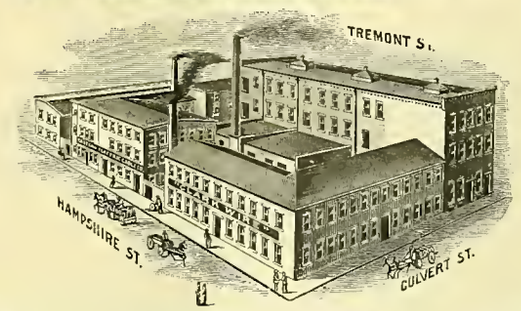
TRADE MARK.

For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

**BRANCH OFFICE:**

1649, 1650, 1651 MONADNOCK BLDG.,
CHICAGO, ILLINOIS.




**In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."**

The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire.

We shall be pleased to mail Catalogues with Terms and Discounts for Quantities.

## EASTERN ELECTRIC CABLE CO.,

61 and 63 Hampshire St., Boston, Mass.

HENRY A. CLARK, Treas. and Gen'l Mgr.
HERBERT H. EUSTIS, Prest. and Electrician.

## Clark Electric Specialty Mfg. Co.,

606 Temple Ct., Minneapolis, Minn.,

MANUFACTURERS OF

Switch Boards, Battery Boxes, Push Buttons, Rosette Mouldings, Etc.

Correspondence solicited.

## THE CONSOLIDATED ELECTRIC STORAGE COMPANY.

44 Broad Street, NEW YORK.

## SPEAKING TUBES AND WHISTLES.

Oral, Electric, Pneumatic and Mechanical

**ANNUNCIATORS AND BELLS.**

Full Line Always in Stock.

## W. R. OSTRANDER & CO.,

204 Fulton St., New York.

Factory, 1461 and 1463 DeKalb Ave., Brooklyn, N. Y.
Send for NEW CATALOGUE. Out August 1st.

## PHOENIX RUBBER INSULATING PAINT

Water, Acid and Practically Fire Proof.

A strictly first-class insulating paint for armatures, fields, switchboards, conduits, iron and wood poles, connections, mouldings, wires, cut-out boxes, lamp hoods and all other kinds of electrical appliances where high insulation is desired. Write for further particulars.

## Morris & MacCurdy, SOLE MANUFACTURERS,

Indianapolis, Ind., U. S. A.

Devere Electric Co., 18 Pinn St., Cincinnati, O.; Standard Ry. Supply Co., 1115 Monadnock Block, Chicago, Ill.; Partrick & Carter Co., Philadelphia; John C. Dolph, 125 Liberty St., New York; Western Electrical Supply Co., St. Louis, Mo.; Cuyahoga Electrical Supply Co., Cleveland, O; Fred Steinkamp, Dayton, O.; and Bergthell & Young of London, Eng.

## BINDERS —FOR THE— WESTERN ELECTRICIAN, ONE DOLLAR.

# Siemens & Halske Electric Company of America,

Siemens & Halske, Berlin, Charlottenburg, Vienna, St Petersburg.

MANUFACTURERS OF

# DIRECT CURRENT SLOW SPEED MULTIPOLAR GENERATORS AND MOTORS.

These machines are constructed with **external armatures.** They have proved remarkably efficient and economical. Used largely in American and European Lighting and Railway Plants. Slow speed machines, made for direct-connection in sizes from 20 H. P. to 2000 H. P.

**Advantages of our External Armature Type.** Maximum peripheral speed of armature with slowest engine speed. Shortest possible winding on armature. Lowest internal resistance of Armature. Only three to four volts difference of potential between commutator bars. Greatest weight of copper per ampere of current. Greatest radiating surface possible. Maximum magnetic effect. Armatures cannot burn out. Great compactness. Correct mechanical design. (The centrifugal force is counteracted effectively by the inward pull of the internal field magnets.) Finest quality of iron, excellent finish, absence of binding wire. **In 8 years' continuous service not one armature has been replaced or repaired.**

**OVER 200,000 H. P. IN USE for Railway, Lighting and Motor Service.** World's Fair Diploma and Medal for **best** direct connected Generator.

## MODERATE SPEED BIPOLAR GENERATORS AND MOTORS,

With Siemens Drum Armatures, which are copied extensively in this country. We are building these machines in sizes from 1 H. P. to 150 H. P.

**See our new Catalogues. Correspondence solicited.**

**GENERAL OFFICES, MONADNOCK BUILDING, CHICAGO.**

Sales Offices:

New York, 136 Liberty St.
New Orleans, 42 Union St.
Cincinnati, Perin Bldg.
Troy, N. Y., 43 Fourth St.
Philadelphia, 531 Chestnut St.
St. Louis, Bank of Commerce Bldg.
San Francisco, 508 California St.
Toledo, Ohio, 518 Summitt St.
Boston, 31 Milk St.
Denver, 608 Boston Block.
Detroit, 47 State St.
Buffalo, N. Y., Erie Co. Bank Bldg.
St. Paul, 59 Oilfillan Block.

# PHILLIPS INSULATED WIRE COMPANY,

## PAWTUCKET, R. I.,

—MANUFACTURERS OF—

## "O. K." INSULATED WEATHERPROOF WIRE

**For Electric Railway and Electric Light Work.**

CHICAGO AGENTS:
Electric Appliance Company.

Superior Quality. Perfect Insulation. Handsome Finish.

**New York Office, 39 and 41 Cortlandt St.**

# INCANDESCENT LAMPS.

# "The Best is the Boston."

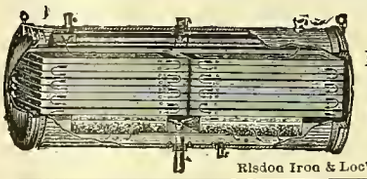
*Burned out lamps repaired by cleaning bulb, inserting the regular Boston filament and exhausting the air—saving glass and base.*

GENERAL WESTERN AGENTS:

## Wallace Electric Company,

**305 Dearborn Street, CHICAGO, ILL.**

## Stilwell's Patent Live Steam-Feed Water Purifier.



**Removes all Impurities.**

Entirely prevents *scale* in Steam Boilers. Catalogue on application.

The Stilwell-Bierce & Smith-Vaile Co.,
**DAYTON, OHIO.**

Risdon Iron & Loc'tive W'ks, San Francisco, Cal., Pacific Coast Agt.

THE
## Allen Soldering Stick.

NON CORROSIVE,
CONVENIENT and EFFECTIVE.

***Price, 25 Cents.***

Agencies:
The E. S. Graeley & Co., N. Y. & Boston.
Vallee Bros., Philadelphia.

L. B. ALLEN, Sole Manufacturer,
**43-45 S. Canal St., Chicago, Ill.**

## FOR SALE CHEAP.

One 60 H. P. Westinghouse Compound Engine.
One 50 H. P. Westinghouse Junior Engine.
One 35 H. P. W. H. Payne & Son's Automatic Engine.
All in first class condition.

**A. L. IDE & SON,**
SPRINGFIELD, ILL.

## FOR SALE.

1 50 Lt. Rigg Armature, T.-H. Dynamo, 2,000 c. p.
4 30 Lt. Ball Armature, T.-H. Dynamo, 2,000 c. p.
250 2,000 c. p. T.-H. Double Lamps.
50 2,000 c. p. T.-H. Single Lamps.
300 Hammerstein Lamp Supports.
300 Hoods and Hood Hanging Boards.
40 Miles No. 6 Insulated Wire, second-hand but in good order.

The above is for sale for want of use, having lost street lighting; is in good order and will be sold reasonable for cash or on time for good bankable paper. Address

TERRE HAUTE ELECTRIC LIGHT & POWER CO.,
EDWIN ELLIS, Sec'y, Terre Haute, Ind.

## NOTICE.

*To the Managers, Superintendents and other officers of the Gas and Electric Companies of Texas:*

GENTLEMEN:—In response to a circular letter sent out some weeks ago relative to an organization of the Texas Gas and Electric men, on lines similar to the "Ohio," "National," "American," and other well known organizations of lighting men, many prominent men have expressed their approval of the move, and join in a call for a meeting. Several have written at length expressing the most hearty approval of the move, and urging that each officer of a gas or electric company, and especially those connected with the smaller companies, be invited to attend and take part in the preliminary as well as permanent organization.

All interested in the Gas or Electric business are cordially invited to attend our meeting, and as it will probably be deemed wise to arrange for associate members, those wishing to do so may join as associate members.

The meeting will be a strictly business affair—no banquets, excursions, or "blow-outs" of any description, but we all expect to have a thoroughly enjoyable time, nevertheless

Membership fee will be small, annual dues not burdensome, and expenses must be kept at a minimum.

Arrange to be with us at the first meeting at

**Houston, Tex., May 22, at 10 a. m.,**

"Mason's Hall," Mason block, corner Main St. and Rusk Ave. Or, if you can not be present, send in your application for membership, that we may know that you wish to be identified with us.

Many favored Houston and May as the place and time for meeting, and the very low excursion rates, on account of Confederate Veterans' Reunion (one fare for round trip, with maximum of $5.00 within the State), makes it especially desirable to meet there.

AUSTIN, TEX., April 20th, 1895.

## T.-H. Transformers Cheap.

Are changing our voltage and have for sale 20,000 lights' capacity, sizes from 10 to 150 lights, 1,000 volts primary, 52 or 104 volts secondary, all in excellent condition. Write for prices.

New Omaha T.-H. Electric Light Co.,
OMAHA, NEB.

## WANTED.

Man to take full charge of an electric lighting plant of a city of 7,000, with no investment. A good thing for the right man. Correspond with

*Box 352*, GALENA, ILL.

## Dynamos and MOTORS.

25 to 800 Lights. ½ H. P. and upward.

The Elliott-Lincoln Electric Co.,
**1124 Payne Avenue,**
**CLEVELAND, OHIO.**

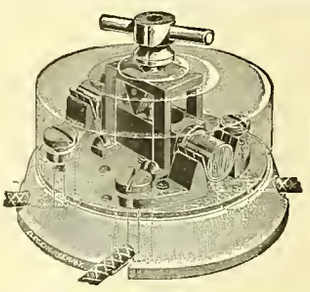
## IRON ARMORED INSULATING CONDUITS.

Two Wires in a Single Tube, the Standard Method of Electric Wiring.

## INTERIOR CONDUIT & INSULATION CO.,

**General Offices and Works: 527 W. 34th St., New York.**

Edwd. H. Johnson, Prest. E. W. Little, Vice-Prest. and Gen. Mgr. Chas. P. Geddes, Sec'y and Treas.



## MANY SWITCHES

HAVE COME AND GONE, BUT THE

## NEW ENGLAND SWITCH

IS STILL THE

## PEER OF ALL.

TRY THEM AND WONDER WHY YOU EVER USED ANY OTHER.

**O. S. PLATT, - 88-102 Cannon St., Bridgeport, Conn.**

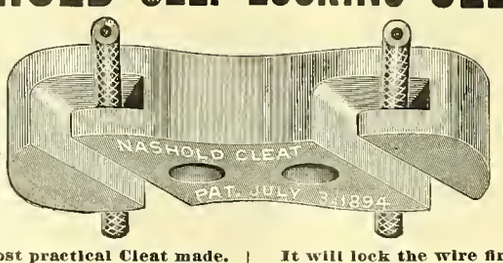
## Proposals.

Notice is hereby given to all electric light companies supplying light to cities, that the contract by which the city of Johnstown, Pa., is now lighted will expire in September, 1895, and the councils of the city of Johnstown hereby invite proposals for the furnishing of light to the city for a term of three or five years. About two hundred (2,000 candle power) arc lamps will be required. The right of way over and through the streets and alleys will be granted for the erection of poles A plant can be centrally located and supplied with coal at less than one dollar per ton All communications to be addressed to

JNO. J. BROWN,
City Controller. JOHNSTOWN, PA.

## NASHOLD SELF-LOCKING CLEAT.

Patented in U. S., Canada, England, France, And Applied for in Germany.




FOR SALE BY ALL ELECTRICAL SUPPLY HOUSES.

**It is the most practical Cleat made.**
**It is made of finest glazed porcelain.**
**It is in one piece.**
**It has the strength.**
**It will lock the wire firmly.**
**It will NOT break in putting up.**
**It will NOT hold moisture.**
**It will NOT hurt the insulation.**

The wire can easily be put in place or removed without loosening the Cleat. It is a great saver in Time and Labor over any other Cleat in use for putting up Electric Light or other Wires.

## The Nashold Cleat Company,

Telephone, Harrison 636. 934-935 Monadnock Bldg., CHICAGO, ILL.

*JAEGER*

## MINIATURE INCANDESCENT LAMPS.

For Series and Battery Current.

½ TO 10 CANDLE POWER.

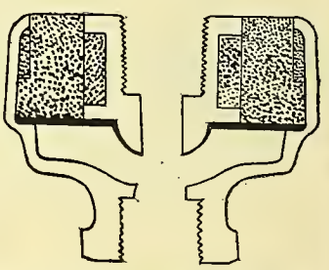
*High Efficiency. Long Life.*

Series Lamps a Specialty.

**AUTOMATIC**
## ELECTRICAL SPECIALTY CO.,

General Sales Agents,
**136 Liberty St., New York.**

## NEW INSULATING JOINT.



Sectional View—Patented July 10, 1894—Full Size.

**For Insulating Fixtures.**

This joint conforms to the requirements of Underwriters' rules. Write for prices and circulars.

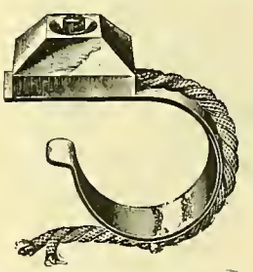
Interstate Complete Electric Construction Co.,
809 to 817 So. 7th St., ST. LOUIS, MO.

## Storage Batteries

FOR ALL PURPOSES.
Bradbury-Stone Electric Storage Co.,
LOWELL, - MASS.

## Table Push.

SOMETHING NEW.

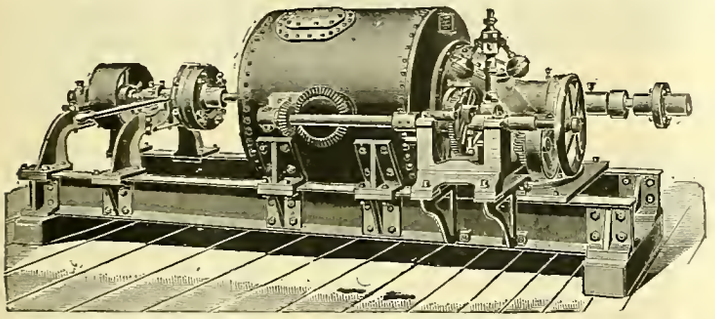


SEND FOR NEW CATALOGUE.

**BELLS, PUSH BUTTONS, ETC.**

**HUEBEL & MANCER,**
MANUFACTURERS
Electrical and Brass Goods,
286-290 Graham St., Brooklyn, N. Y.

# VICTOR TURBINE WATER WHEEL.



Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.

The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double the power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

***SEND FOR CATALOGUE AND PARTICULARS.***

The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 36 H. P. under 38 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs, on horizontal shafts, and where the situation admits of their use we recommend them.

**The Stilwell-Bierce & Smith-Vaile Co., Dayton, Ohio.**

Risdon Iron & Locomotive Works, San Francisco, Cal., Pacific Coast Agents.

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*The Standard Open Circuit Batteries of the World.*

SEND FOR CIRCULAR AND PRICES.

**THE LECLANCHE BATTERY CO.,**

111 to 117 East 131st St., N. Y.

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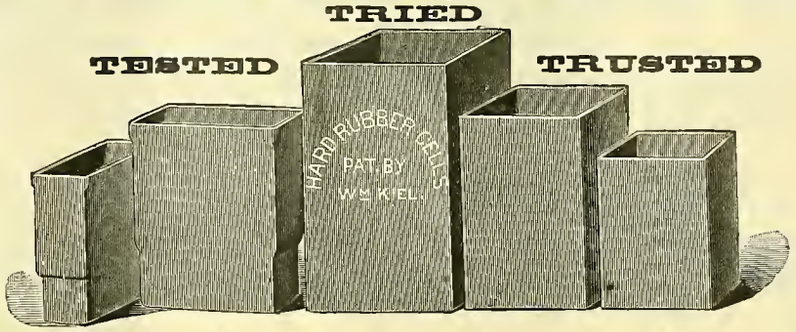
## Most Durable Battery Cells Produced.

TRIED

TESTED TRUSTED




**ROD SHEET, TUBING.**

Flexible Hard Rubber Tubing.

**INSULATOR HOOKS.**

Telephone Receivers, Battery Syringes, Bushings, Etc.

**Manufactured by The Butler Hard Rubber Co., 33 Mercer St., N. Y.**

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## BINDERS

For the "WESTERN ELECTRICIAN,"

—$1.00.—

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## C-S SPECIALTIES.

**C-S Flush Double Push Switch.**

Single Pole—Double Pole—Commutation; 3 Wire, 4 Wire.

**C-S Flush Key Switch.**

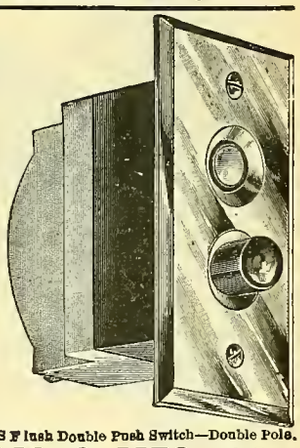
Single Pole—Double Pole—3 Wire.

**C-S Flush Automatic Switch.**

Single Pole.

ELECTRICALLY
MECHANICALLY
ARTISTICALLY

**PEERLESS.**



C-S Flush Double Push Switch—Double Pole.

**THE CUTTER ELECTRICAL & MFG. CO.,**

*27 So. 11th Street, Philadelphia, Pa., U. S. A.*

---

## THE CLARK ELECTRIC CO., 192 Broadway, New York,

Is the only concern in the world that makes

**Arc Lighting**

Apparatus for every purpose, and for use on every current.

Our Arc Lamps can be used on any current whatever

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## CHICAGO INSULATED WIRE CO.,

**414-416 Northern Building, CHICAGO.**

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## MICA

**Eugene Munsell & Co.**

218 WATER ST., N. Y.

W. H. SILLS, 153 E. Lake St., Chicago.

CUT AND UNCUT
India and Amber
Stamped Solid Sheet
SEGMENTS
AND RHEOSTAT

TAPER RINGS, TUBES, SEGMENTS, TROUGHS, PLATES, CLOTH, &c.

## MICANITE

**Mica Insulator Co.**

218 WATER ST., N. Y.

Send for Catalogue and Prices.

AGENTS WITH FULL STOCKS OR SAMPLES:

A. S. PARTRIDGE, B'k Commerce Bl'g, St. Louis.
SINCLAIR RANDALL, 59 W. 4th St., Cincinnati.
CUYAHOGA SUPPLY CO., 10 S. Water St., Cleveland.
J. W. BROOKS & CO., 628 Market St., San Francisco.

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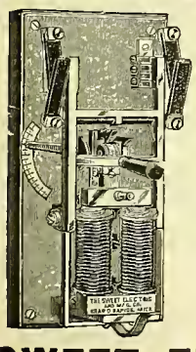
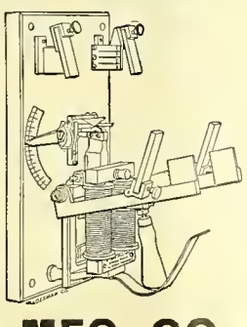
## HOT STUFF.



No! we make the final break off from carbons so that it is impossible to get heat enough to fuse points of your copper contact plates; no filing off of rough points, no hanging on after you have had a short circuit or over load, bound to work as easily after opening 1,000 times as it does when opened the first time.

**WE KNOW YOU NEED OUR CIRCUIT BREAKER,** and do not see why you should delay writing us any longer. One burn out will pay for a dozen of our instruments. **To be used on the Alternating or Direct Current Systems.**

**Write us at once.**



**SWEET ELECTRIC & MFG. CO.,**

*GRAND RAPIDS, MICH.*

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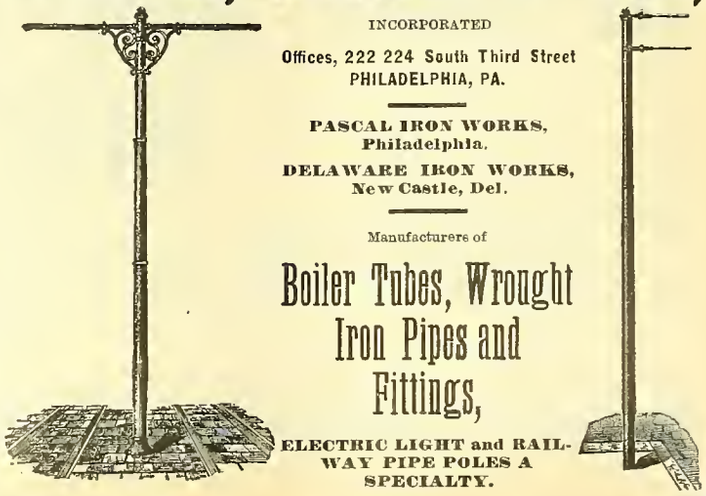

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If you have no copy of our circular No. 580 describing Cable Testing Apparatus, we should be pleased to mail you one upon application.

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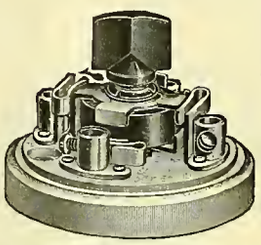
STANDARD SWITCHES, 5 and 10 ampere S. P.
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



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Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

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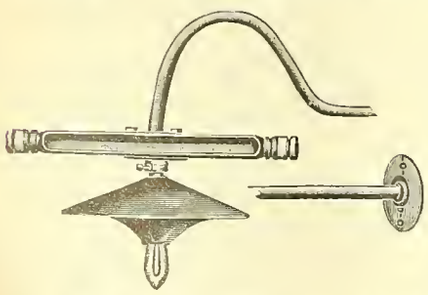
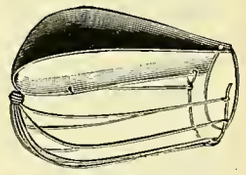
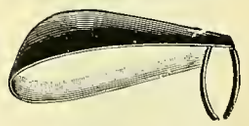


## WHAT ARE THEY?





*Send for Catalogue 894 and see.*

## BUTLER MANUFACTURING CO., 46 S. Clinton Street, CHICAGO.

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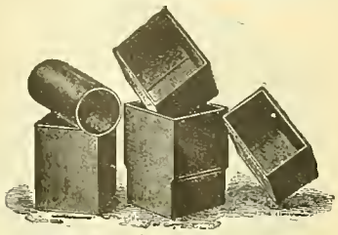
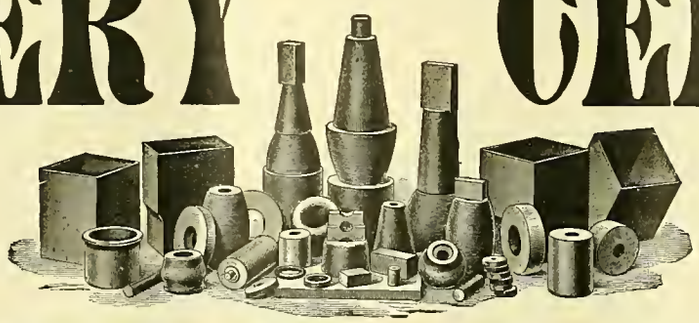


# BATTERY CELLS.



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The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomlpished providing additional strength to such an extent that this cell can be used where no other would be practical.

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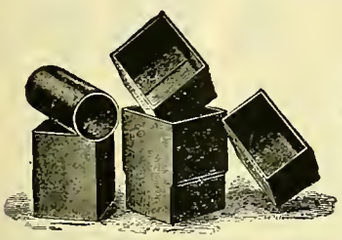
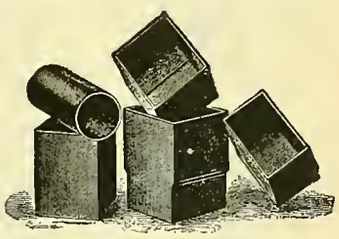


## Newton Rubber Works,



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LIGHT,
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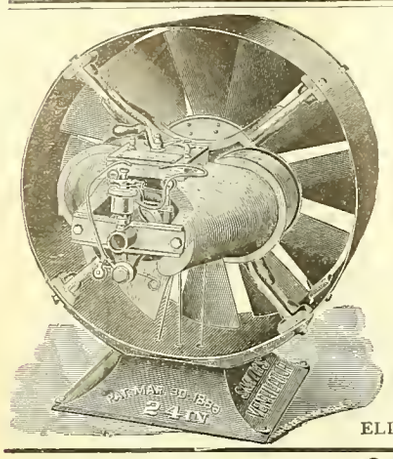

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Now is the time to place your orders for **Ventilating Apparatus.**
Sizes: 18 inches to 96 inches in diameter. Wound for 110, 220 and 500 volts.

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For public buildings, theaters, hotels, restaurants, factories, churches, and all places where fresh air is necessary.
What you want is **FRESH AIR,** not the same air churned over and over again, as is the case with toy Fan Motors of 10 and 12 inch variety.

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## WE MAKE STORAGE BATTERIES,

POWER & FAN MOTORS 1/8 TO 20 H.P.

DYNAMOS, 5 TO 500 LIGHT.

We repair the bad work of others. & do it good.

Brass, 12-inch, $15.00.

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*Ship at once 10 more Warwick Fan Motors C.O.D. They keep me cool, and dont burn out.*
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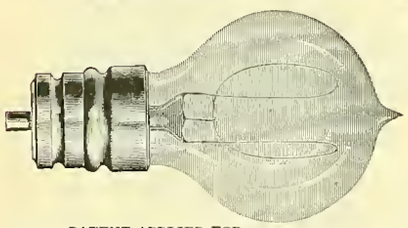

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**YOU DON'T SEE THE TWIST IN THE FILAMENT.**

*THIS LAMP is specially adapted to street and general railway and steamboat use, because it is absolutely non-vibratable, and we guarantee for it 50 per cent. longer life and better service than any other lamp now on the market. The filament will not droop or get out of shape while in use, no matter at what angle it is burned.*
*A good lamp at a fair price. Ordinary lamps at ordinary prices.*

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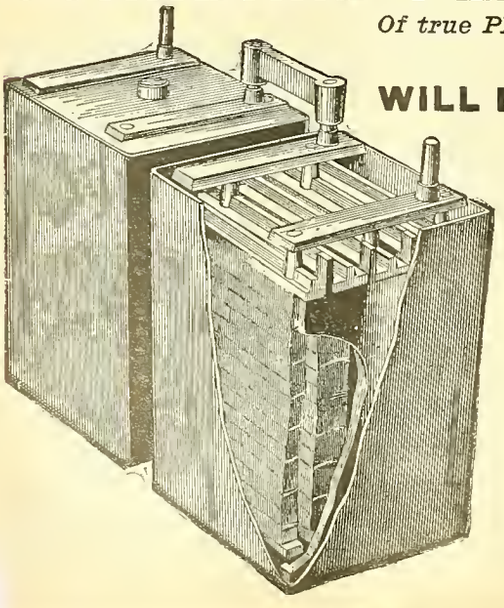
# STANDARD PLANTE STORAGE BATTERIES



*Of true PLANTE Type and CRYSTALLINE FORMATION.*

Will give or receive without injury, currents that would destroy other batteries.

**WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.**

Contain no asbestos or other separating material to increase their internal resistance.

**ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.**

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

**Highest efficiency, largest delivery, lowest internal resistance.**

For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

**Cannot be damaged by excessive charge or discharge currents.**

A 400 ampere current has been taken from a 120 ampere hour cell.

☞ **CHALLENGE:** We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

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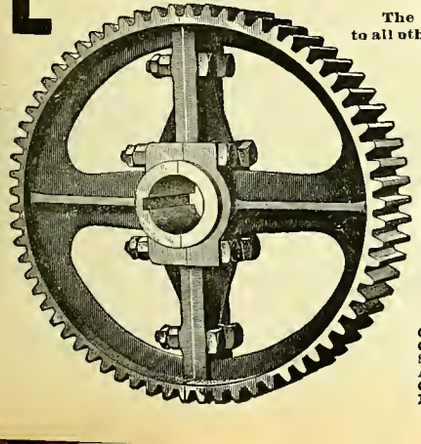
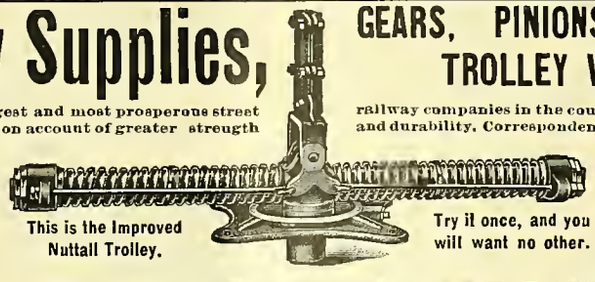
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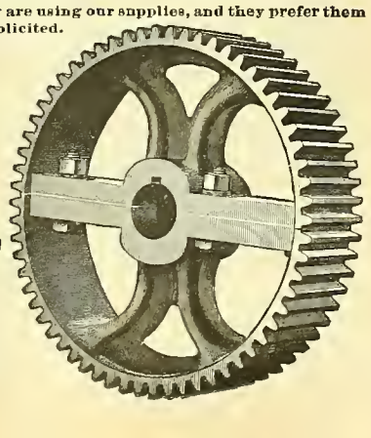
Try it once, and you will want no other.

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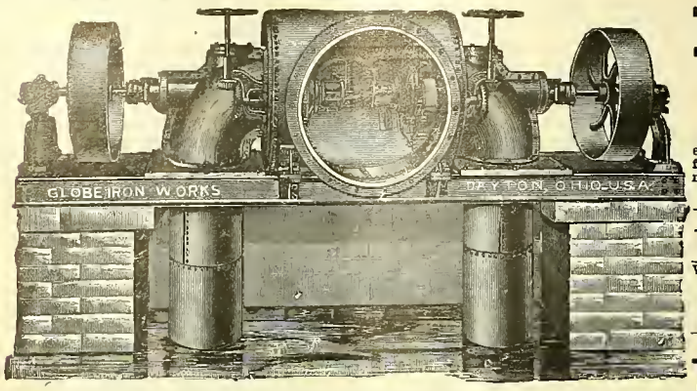


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Recent improvements made in the New American Turbine have increased the power as per their diameter, and produced greater efficiency from whole to half water than any other turbine, as evidenced by the following, copied from certified tests made at Holyoke Mass., on the dates named, and signed by A. F. Stickmao, engineer in charge of experiments, and E. S. Waters, hydraulic engineer.

The originals of these certificates and tests of other sized wheels can be seen at our office.

**Test of a 45-inch Wheel—July 9, 1894.**

| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.06 | 119.17 | 141.68 | 205.27 | 79 76 |
| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.68 |
| ¾ " | 16.78 | 117.33 | 112.60 | 176.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118.40 | 75.52 |

**Test of a 42-inch Wheel—July 14, 1894.**

| | Head. | Rev. per Mio. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.33 | 128.00 | 134.18 | 199.56 | 80.60 |
| ⅞ " | 16.66 | 134.80 | 120.85 | 188.14 | 83.09 |
| ¾ " | 16.59 | 129.33 | 104.85 | 162.89 | 82.77 |
| ⅝ " | 17.13 | 125.25 | 92 76 | 142.40 | 79 21 |
| ½ " | 17.48 | 121.00 | 70.80 | 98.85 | 70.60 |

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Storage batteries for traction work *sold with guarantee* of 20,000 miles without repairs. Installation of storage battery lighting plants a specialty

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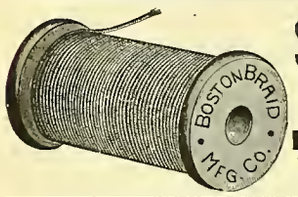


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The greatest care taken in producing a uniform article.

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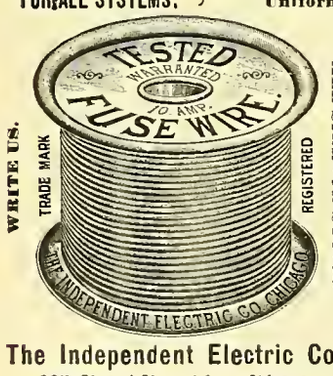
**FUSE WIRE AND LINKS FOR ALL SYSTEMS.** Correct Carrying Capacity. Absolutely Uniform.

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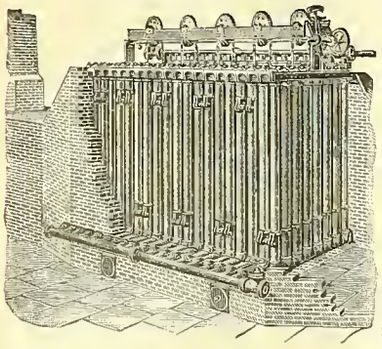

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Can be applied to any type of boiler without stoppage of works.

High temperature of feedwater much above boiling point.

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ORANGE, N. J., February 6, 1894.

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DEAR SIRS:—Your letter of the 30th ultimo is received. I have a Climax boiler, and it is giving great satisfaction. Taking everything in consideration, it is, in my opinion, practically and theoretically, the best boiler so far invented.

THOS. A. EDISON.

Every Light and Power reader of the Western Electrician would do well to commit to memory the above testimonial.

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**CLIMAX STEAM GENERATOR**

Has been acknowledged by all practical minds the best boiler invented.

MANUFACTURED BY

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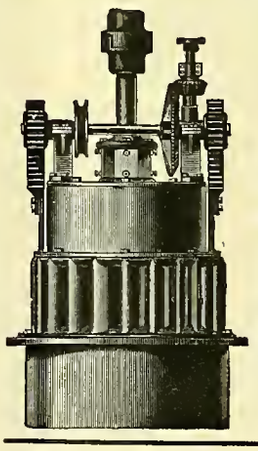

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**On Vertical or Horizontal Shaft, Especially Adapted for Electric Work.**

**Gives more power as to diameter with a higher percentage of useful effect than any other water-wheel heretofore made.** All sizes, right and left hand, are built from patterns perfected under systematic tests in the Holyoke Testing Flume.

Parties having power plants which are unsatisfactory, and those contemplating the improvement of powers, will find it to their interest to confer with me, **as I am willing to guarantee results where others have failed, no matter what make of turbine has been in use. STATE REQUIREMENTS AND SEND FOR CATALOGUE.**

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Estimates furnished for complete power plants and results guaranteed.

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THE

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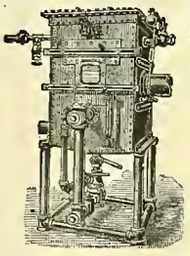

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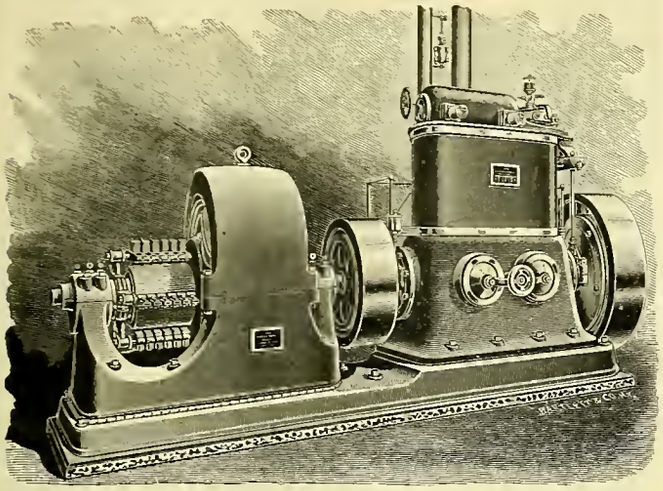

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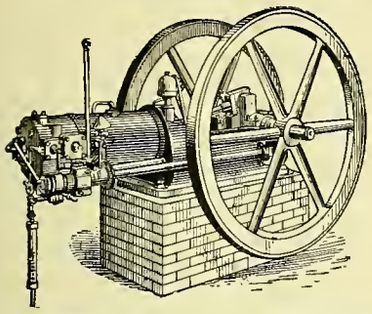

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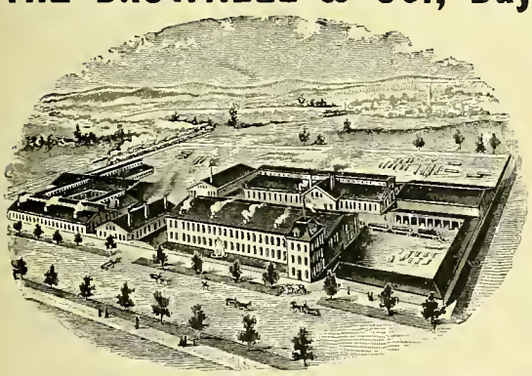

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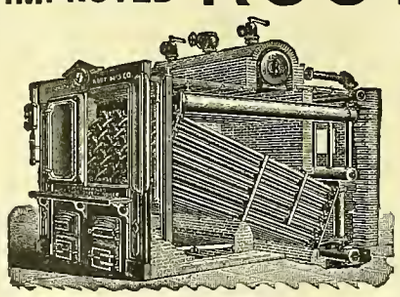

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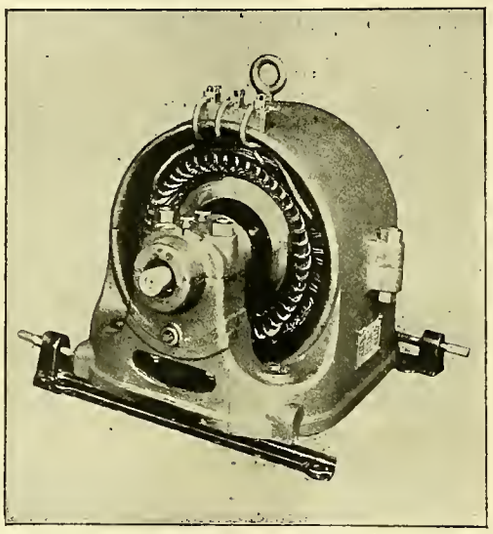

# NOTICE IS GIVEN

That induction motors operated by the so-called "Monocyclic" system offered for sale by the General Electric Company are in fact multiphase motors and are broadly covered by the patents of Nikola Tesla owned by the Westinghouse Electric & Manufacturing Company.

The motors and system of distribution advertised by the Stanley Electric Company of Pittsfield are also an infringement of the Tesla patents.

Suits have been brought against each of these companies, and are being pressed to a hearing as rapidly as possible.

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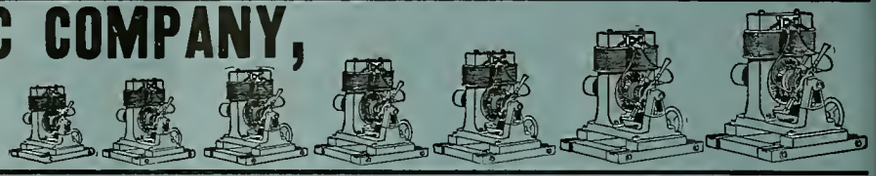

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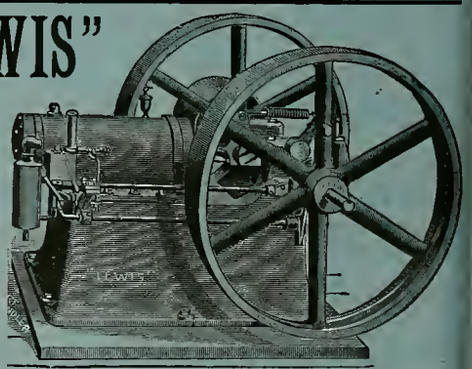

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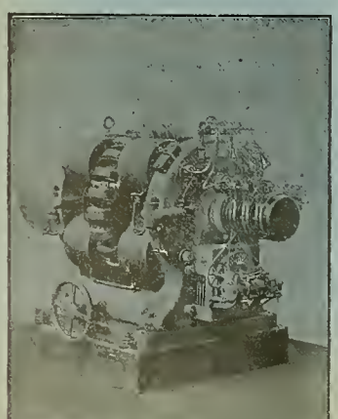

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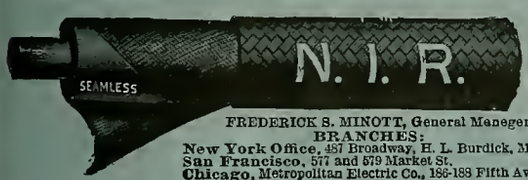


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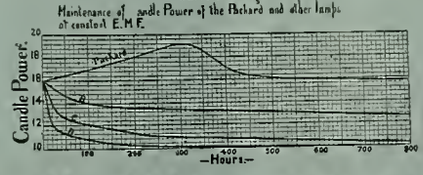


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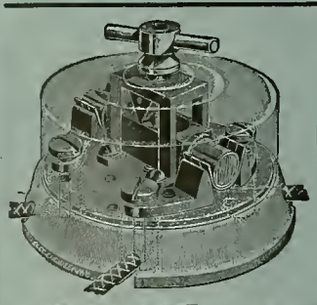

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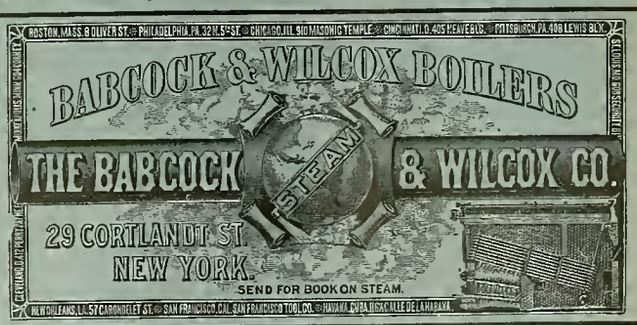


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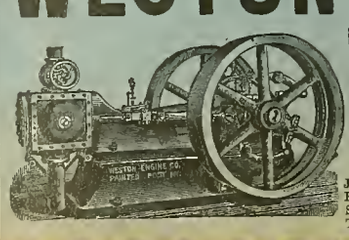

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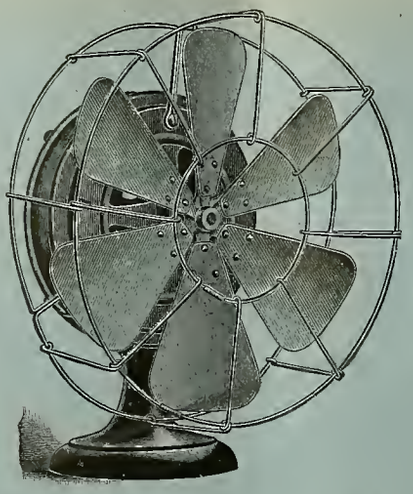

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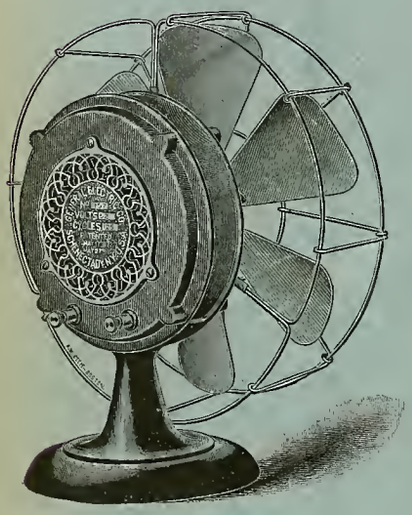

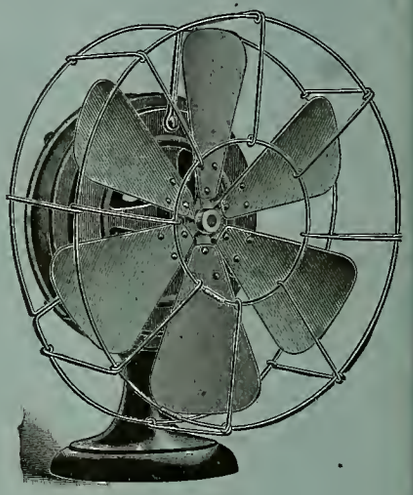

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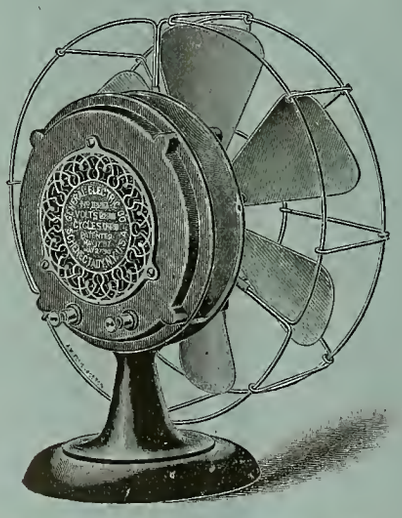

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Foreign Dept. { Schenectady, N. Y.
NewYork Office, 44 Broad St.

Canada, Canadian General Electric Company, Ltd., Toronto, Ont.

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## CLASSIFIED LIST.

**Accumulators.**
- Boswell & Co., D. E.
- Bradbury-Stone Elec. S. Co
- Cons. Electric Storage Co.
- Electric-Power Storage Co.
- Electric Storage Battery Co.
- Porter & Buerdorf.

**Annunciators.**
- Central Electric Co.
- Dearborn Electric Co.
- Electric Appliance Co.
- Ostrander & Co., W. R.
- Partrick & Carter Co.
- Proctor-Raymond Elec. Co.

**Arc Lamps.**
- Am. Gas Engine Elec. Co.
- C & C Electric Co.
- Central Electric Co.
- Clark Electric Co.
- Corey, R. B.
- Crocker-Wheeler Elec. Co.
- Ft. Wayne Elec. Corporation.
- General Electric Co.
- Helios Electric Co.
- Little, F. P. Elec. C. & S. Co.
- Perkins El. Switch Mfg. Co.
- Standard Thermometer Co.
- Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
- Samson Cordage Wks.

**Batteries and Jars.**
- Andrae & Sons, J.
- Boswell & Co., D. E.
- Bradbury-Stone Elec. S. Co.
- Bunnell & Co., J. H.
- Butler Hard Rubber Co.
- Central Electric Co.
- Dearborn Electric Co.
- Edgerton Pottery Co.
- Electric Appliance Co.
- Electric-Power Storage Co.
- Electric Storage Battery Co.
- Hemingray Glass Co.
- Leclanche Battery Co., The.
- Miamisburg Electric Co.
- Newton Rubber Wks.
- Partrick & Carter Co.
- Wallace Electric Co.
- Western Electric Co.

**Bells.**
- Andrae & Sons, J.
- Central Electric Co.
- Dearborn Electric Co.
- Electric Appliance Co.
- Gillette, E. & F.
- Huebel & Manger
- Ostrander & Co., W. R.
- Partrick & Carter Co.
- Proctor-Raymond Elec. Co.
- Western Electric Co.

**Belting.**
- Shultz Belting Co.

**Bicycles.**
- Monarch Cycle Co.

**Boilers.**
- Abendroth & Root Mfg. Co.
- Babcock & Wilcox Co., The.
- Brownell & Co., The.
- Erie City Iron Wks.
- Fulton Steam Boiler Wks.
- Moyes, L. M.
- Racine Hardware Co.
- Weston Engine Co.

**Books, Electrical.**
- Electrician Publishing Co.

**Bronze.**
- Besly & Co., Chas. H.
- Phosphor Bronze Sm.Co., Ltd.

**Brushes.**
- Boudreaux Dyn. Brush Co.
- Central Electric Co.
- Partridge Carbon Co.

**Burglar Alarms.**
- Central Electric Co.
- Electric Appliance Co.
- Partrick & Carter Co.
- Wallace Electric Co.
- Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
- American Elec. Works.
- Brixey, W. R.
- Central Electric Co.
- Dearborn Electric Co.
- Eastern Electric Cable Co.
- Moore, Alfred F.
- New York Ins. Wire Co.
- Roebling's Sons Co., J. A.
- Simplex Electrical Co.
- Standard Underground C.Co.
- Wallace Electric Co.
- Western Electric Co.

**Carbons, Points & Plates.**
- Central Electric Co.
- Corey, R. B.
- General Electric Co.
- Partridge Carbon Co.
- Reisinger, Hugo.
- Wertheim, Ed.
- Western Electric Co.

**Compound.**
- Eureka Compound Co.
- Standard Paint Co.

**Conduits.**
- Central Electric Co.
- Interior Conduit & Ins Co.
- National Conduit Mfg. Co.

**Construction & Repairs.**
- Allen-Hussey Co.
- Amstutz, N. S.
- C & C Electric Co.
- Crocker-Wheeler Elec. Co.
- Ft. Wayne Elec. Corporation.
- Interstate Com. El Const. Co.

**Contractors and Electric Light Plants.**
- Allen-Hussey Co.
- Amstutz, N. S.
- Arnold, B. J.
- Bain, Foree.
- Brush Electric Co.
- Bryan, Wm. H.
- C & C Electric Co.
- Clark Electric Co.
- Crocker-Wheeler Elec. Co.
- Eddy Elec. Mfg. Co.
- Fontaine Crossing & El. Co.
- Ft Wayne Elec. Corporation.
- General Electric Co.
- Interior Conduit & Ins. Co.
- Siemens & Halske Elec. Co.
- United Elec Improvement Co
- Westinghouse Elec & Mfg. Co.
- Western Electric Co.

**Copper.**
- Besly & Co., Chas. H.
- Miamisburg Electric Co.

**Copper Wires.**
- American Electrical Works.
- [illegible]
- Bunnell & Co., J. H.
- Central Electric Co.
- Chicago Ins. Wire Co.
- Dearborn Electric Co.
- Electric Appliance Co.
- Fiberite Co., The.
- General Electric Co.
- Independent Electric Co.
- National India Rubber Co.
- Okonite Co. The.
- Phillips Insulated Wire Co.
- Roebling's Sons Co., J. A.
- Simplex Electrical Co.
- Standard Underground C. Co.
- Wallace Electric Co.
- Western Electric Co.

**Cordage.**
- Samson Cordage Wks.

**Cranes.**
- Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
- Anderson, Albert & J. M.
- Brady, T. H.
- Brodie Electric Co.
- Central Electric Co.
- Electric Appliance Co.
- Farr Tel. & Const. Supply Co.
- Fiberite Co., The.
- Nuttall Co., R. D.
- Partrick & Carter Co.

**Cut-Outs and Switches.**
- Anderson, Albert & J. M.
- Andrae & Sons, J.
- Brodie Electric Co.
- Bryant Electric Co.
- Bunnell & Co., J. H.
- Central Electric Co.
- Chicago Edison Co.
- Colgate Co., Geo. L.
- Crocker-Wheeler Elec. Co.
- Cutter Electrical & Mfg. Co.
- Dearborn Electric Co.
- Diamond Electric Co.
- Eddy Elec. Mfg. Co.
- Electric Appliance Co.
- Electric Protection Co.
- Elec. Selec. & Signal Co.
- Farr Tel. & Const. Supply Co.
- Fiberite Co., The.
- Forest City Elec. Wks.
- Ft. Wayne Elec. Corporation.
- General Electric Co.
- Hart & Hegeman Mfg. Co.
- Huebel & Manger.
- Interior Conduit & Ins. Co.
- Little, F. P. Elec. C. & S. Co.
- Louisville Elec. Works.
- Nuttall Co., R. D.
- Partrick & Carter Co.
- Perkins El. Switch Mfg. Co.
- Platt, O. S.
- Sweet Elec. & Mfg. Co.
- Wagner Elec. Mfg. Co.
- Wallace Electric Co.

**Desks.**
- Montgomery Ward & Co.

**Dynamos.**
- Brush Electric Co.
- C & C Electric Co.
- Central Electric Co.
- Clark Electric Co.
- Commercial Electric Co.
- Crocker-Wheeler Elec. Co.
- Eddy Elec. Mfg. Co.
- Elliott-Lincoln Elec. Co.
- Fontaine Crossing & El. Co.
- Ft. Wayne Elec. Corporation.
- General Electric Co.
- Interior Conduit & Ins. Co.
- Roth Bros. & Co.
- Royal Electric Co.
- Siemens & Halske Elec. Co.
- Walker Mfg. Co.
- Western Electric Co.
- Westinghouse Elec. & Mfg.Co.

**Economizers.**
- Fuel Economizer Co.

**Electric Railways.**
- Brush Electric Co.
- General Electric Co.
- Siemens & Halske Elec. Co.
- Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
- Allen-Hussey Co.
- Amstutz, N. S.
- Arnold, B. J.
- Bain, Foree.
- Bryan, Wm. H.
- Crocker-Wheeler Elec. Co.
- Eddy Elec. Mfg. Co.
- Ford, Owen.
- Thayer Electric Co.

**Electrical Instruments.**
- Anderson, Albert & J. M.
- Brodie Electric Co.
- Bunnell & Co., J. H.
- Central Electric Co.
- Colgate Co., Geo. L.
- Dearborn Electric Co.
- Diamond Electric Co.
- Electric Appliance Co.
- Interior Conduit & Ins. Co.
- Nuttall Co., R. D.
- Partrick & Carter Co.
- Platt, O. S.
- Queen & Co. Inc.
- Sweet Elec. & Mfg. Co.
- Wagner Elec. Mfg. Co.
- Wallace Electric Co.

**Electrical Specialties.**
- Allen, L. B.
- Clark El. Specialty Mfg. Co.
- Electric Protection Co.
- Interstate Com. El. Const Co.
- Nashold Cleat Co.
- Proctor-Raymond Elec. Co.
- Rockford Torch Co.

**Electroliers, etc.**
- Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
- Besly & Co., Chas. H.
- General Electric Co.

**Engines, Gas.**
- Am Gas Engine Elec. Co.
- Otto Gas Engine Wks.

**Engines, Steam.**
- Ball & Wood Co., The.
- Brownell & Co., The.
- Chuse & Co., J. F.
- Erie City Iron Wks.
- Racine Hardware Co.
- Westinghouse Machine Co.
- Weston Engine Co.

**Fan Outfits.**
- Central Electric Co.
- Davis Elec. Co., W. J.
- Diehl & Co.
- Dieterichs-Warwick El Co.
- Interior Conduit & Ins. Co.
- Roth Bros. & Co.

**Feed Water Heaters**
- Goubert Mfg. Co.

**Fibre.**
- [illegible]

**Fire Alarms.**
- Partrick & Carter Co.
- Western Electric Co.

**Fuse Wire.**
- Brixey, W. R.
- Central Electric Co.
- Electric Appliance Co.
- Fiberite Co., The.
- General Electric Co.
- Independent Electric Co.

**Gas Lighting, Electric.**
- Partrick & Carter Co.

**Gears.**
- Besly & Co., Chas. H.
- Nuttall Co., R. D.

**General Elec. Supplies.**
- Anderson, Albert & J. M.
- Andrae & Sons, J.
- Besly & Co., Chas. H.
- Brodie Electric Co.
- Bryant Electric Co.
- Bunnell & Co., J. H.
- Butler Mfg. Co.
- Central Electric Co.
- Chicago Edison Co.
- Colgate Co., Geo. L.
- Cutter Electrical & Mfg. Co.
- Dearborn Electric Co.
- Dieterichs-Warwick El. Co.
- Electric Appliance Co.
- Electric Protection Co.
- Elliott-Lincoln Elec. Co.
- Farr Tel. & Const. Supply Co.
- Forest City Elec. Wks.
- General Electric Co
- Interior Conduit & Ins. Co.
- Little, F. P. Elec. C. & S. Co.
- Louisville Elec. Works.
- Metropolitan Electric Co.
- Morris & MacCurdy.
- Nashold Cleat Co.
- Partrick & Carter Co.
- Perkins El. Switch Mfg. Co.
- Platt, O. S.
- Proctor-Raymond Elec. Co.
- Queen & Co Inc.
- Sioux City Brass Works.
- Sweet Elec. & Mfg. Co.
- Thayer Electric Co.
- Wallace Electric Co.

**Globes and Electrical Glassware.**
- Edgerton Pottery Co.
- Edwards, W. S. Mfg. Co.
- Hemingray Glass Co.

**Graphite Specialties.**
- Besly & Co., Chas. H.
- Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
- Butler Hard Rubber Co.
- Fiberite Co.. The.
- Newton Rubber Wks.

**Insulators and Insulating Materials.**
- Anderson, Albert & J. M.
- Andrae & Sons, J.
- Brixey, W. R.
- Brodie Electric Co.
- Bunnell & Co., J. H.
- Butler Hard Rubber Co.
- Central Electric Co.
- Crocker-Wheeler Elec. Co.
- Cutter Elec. & Mfg. Co.
- Dearborn Electric Co.
- Electric Appliance Co.
- Empire China Works.
- Farr Tel. & Const. Supply Co.
- Fiberite Co., The.
- Hart & Hegeman Mfg. Co.
- Hemingray Glass Co.
- Interior Conduit & Ins. Co.
- Johns Mfg. Co., H. W.
- Little, F. P. Elec. C. & S. Co.
- Munsell & Co.. Eugene.
- Nashold Cleat Co.
- National India Rubber Co.
- Newton Rubber Wks.
- New York Insulated Wire Co.
- Nuttall Co., R. D.
- Okonite Co., The.
- Partrick & Carter Co.
- Phillips Insulated Wire Co.
- Platt, O. S.
- Roebling's Sons Co., J. A.
- Simplex Electrical Co.
- Standard Paint Co.
- Standard Underground C.Co.
- Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
- American Electrical Works.
- Brixey, W. R.
- Brodie Electric Co.
- Bunnell & Co.. J. H.
- Central Electric Co.
- Dearborn Electric Co.
- Eastern Electric Cable Co.
- Electric Appliance Co.
- Farr Tel. & Const. Supply Co.
- General Electric Co.
- Independent Electric Co.
- Louisville Elec. Works.
- Metropolitan Electric Co.
- Moore, Alfred F.
- National India Rubber Co.
- New York Insulated Wire Co.
- Okonite Co., The.
- Partrick & Carter Co.
- Phillips Insulated Wire Co.
- Roebling's Sons Co., J. A.
- Simplex Electrical Co.
- Standard Underground C.Co.
- Wallace Electric Co.
- Western Electric Co.

**Lamps, Incandescent.**
- Aetna Electric Works.
- Am. Electrical Mfg. Co.
- Automatic Elec. Spec. Co.
- Buckeye Electric Co.
- Central Electric Co.
- Columbia Inc. Lamp Co.
- Dearborn Electric Co
- Electric Appliance Co.
- Ft. Wayne Elec. Corporation.
- General Electric Co.
- Globe Electric Light Co.
- New York & Ohio Co.
- Partrick & Carter Co.
- United Elec. Imp. Co.
- Westinghouse Elec.&Mfg Co.

**Lightning Arresters.**
- Colgate Co., Geo. L.
- Diamond Electric Co.
- Electric Appliance Co.
- General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
- Besly & Co., Chas. H.
- Harrington, Son & Co., E.
- Lukens Iron & Steel Co.

**Mica.**
- Johns Mfg. Co., H. W.

**Mining Apparatus, Elec.**
- General Electric Co.
- Independent Electric Co.
- Westinghouse El. & Mfg. Co.

**Motors.**
- Andrae & Sons, J.
- Brush Electric Co.
- C & C Electric Co.
- Central Electric Co.
- Commercial Electric Co.
- Crocker-Wheeler Elec. Co.
- Dieterichs-Warwick El. Co.
- Eddy Elec. Mfg. Co.
- Elliott-Lincoln Elec. Co.
- Fontaine Crossing & El. Co.
- Ft. Wayne Elec. Corporation.
- General Electric Co.
- Interior Conduit & Ins. Co.
- Louisville Elec. Works.
- Roth Bros. & Co.
- Royal Electric Co.
- Sioux City Brass Works.
- Stanley Elec. Mfg. Co.
- Wagner Elec. Mfg. Co.
- Walker Mfg. Co.
- Wallace Electric Co.
- Westinghouse El. & Mfg. Co.

**Packing.**
- Besly & Co., Chas. H.
- Garlock Packing Co.

**Paints.**
- Morris & MacCurdy.
- Standard Paint Co.

**Patents.**
- Gooch, Chas. J.

**Phosphor Bronze.**
- Phosphor Bronze Sm.Co. Ltd

**Pianos and Organs.**
- Beethoven Piano & Organ Co.

**Platinum.**
- Baker & Co.

**Poles.**
- Morris, Tasker & Co.
- Nuttall Co., R. D.
- Valentine-Clark Co.

**Porcelain.**
- Empire China Works.
- General Electric Co.
- Hemingray Glass Co.

**Publishers, Electrical.**
- Electrician Publishing Co.

**Push Buttons.**
- Central Electric Co.
- Electric Appliance Co.
- Partrick & Carter Co.

**Rheostats.**
- Central Electric Co.
- General Electric Co.

**Sal Ammoniac.**
- Klipstein & Co., A.

**Separators.**
- Goubert Mfg. Co.

**Silk Braid.**
- Boston Braid Mfg. Co.

**Speaking Tubes.**
- Central Electric Co.
- Electric Appliance Co.
- Ostrander & Co., W. R.
- Partrick & Carter Co

**Speed Indicators.**
- Besly & Co., Chas. H.
- Colgate Co., Geo. L.
- Diamond Electric Co.
- Queen & Co. Inc.

**Steam Heating.**
- Goubert Mfg. Co.
- Webster & Co., Warren.

**Storage Batteries.**
- Boswell & Co., D. E.
- Bradbury-Stone Elec. S. Co.
- Cons. Electric Storage Co.
- Electric-Power Storage Co.
- Electric Storage Battery Co.
- Porter & Buerdorf.

**Street Cars.**
- Brill, J. G. Co.

**Tapes, Insulating.**
- American Electrical Works.
- Brixey, W. R.
- Central Electric Co.
- Electric Appliance Co.
- Moore, Alfred F.
- New York Insulated Wire Co.
- Okonite Co., The.
- Phillips Insulated Wire Co.
- Roebling's Sons Co., J. A.
- Simplex Electrical Co.
- Standard Paint Co.

**Telegraph Apparatus.**
- Electric Appliance Co.
- Partrick & Carter Co.
- Western Electric Co.

**Telephones.**
- Andrae & Sons, J.
- Central Electric Co.
- Farr Tel. & Const. Supply Co.
- Gillette, E. & F.
- Gustafson, W. A.
- Jameson & Co., W. D.
- M. & B. Telephone Co.
- Mo Telephone Mfg. Co.
- Partrick & Carter Co.
- Public Telephone Co.
- Western Electric Co.
- Western Tel. Const. Co.

**Transformers.**
- Central Electric Co.
- Diamond Electric Co.
- Ft. Wayne Elec. Corporation.
- General Electric Co.
- Hornberger Elec. Mfg. Co.
- Louisville Elec. Works.
- Royal Electric Co.
- Stanley Electric Mfg. Co.
- Wagner Elec. Mfg. Co.
- Wallace Electric Co.

**Trolley Cord.**
- Samson Cordage Wks.

**Trucks, Electric Car.**
- General Electric Co.
- Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
- Dayton Globe Iron Works Co.
- Smith, S. Morgan.
- Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
- Chi. Shorthand Institute.
- Int. Corr. Schools.
- Scientific Machinist Co.

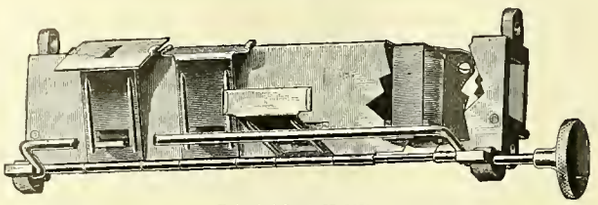
**Water Wheels.**
- Smith, S. Morgan.

**Wire, Bare.**
- Anderson, Albert & J. M.
- Besly & Co., Chas. H.
- Bishop Gutta Percha Co.
- Brixey, W. R.
- Central Electric Co.
- Electric Appliance Co.
- Independent Electric Co.
- National India Rubber Co.
- Nuttall Co., R. D.
- Okonite Co., The.
- Phillips Insulated Wire Co.

"C" STYLE.
Made in Sizes from 4 to 20 Drops.

# ANNUNCIATORS

That never fail to Annunciate.



Patented Sept. 27, 1892.

This illustrates the inside construction of our Gravity-Drop Annunciator as applied to the 4 Drop "Eclipse" Case.

No Springs. No Screws. Nothing to get out of adjustment. Simplicity itself.

*Our other Specialties:*

**REX** Wood-box Bells,
**ECLIPSE** Iron-box Bells,
**SPARK** Coils,
**WOOD** Push Buttons,
Floor Pushes,
Door Connections, etc., etc.

## PROCTOR-RAYMOND ELECTRIC CO.,

Rochester, N. Y.

# SAWYER-MAN INCANDESCENT LAMPS,

## With Bases to Fit Any Socket.

We have now resumed the manufacture of the well-known Sawyer-Man Lamps, on a scale to meet any possible demand.

We have adopted new methods of manufacture which add to the appearance and quality of our lamps, and make them by reason of their efficiency and long life, the cheapest and best lamps ever offered.

PRICES:

**PLAIN LAMPS.**

| | |
|---|---|
| 8, 10 and 16 candle power lamps | 25 cents each. |
| 20 and 25 candle power lamps | 30 " |
| 32 candle power lamps | 38 " |
| 16 candle power street car lamps | 25 " |
| 16 candle power street car lamps, anchored | 32 " |

**ORNAMENTAL LAMPS.**

| | |
|---|---|
| 8, 10 and 16 candle power lamps | 30 cents each. |
| 20 and 25 candle power lamps | 35 " |

Discounts according to quantity.
For etching the plain or ornamental lamps, 3½ cents each, net.

**COLORED LAMPS.**

"Dipped" lamps in red, blue or green, 5 cents each, net, additional.

Lamps with bases to fit Thomson-Houston sockets, 3 cents extra.
Boxing and packing at cost.
Prices are subject to change without notice.

# Westinghouse Electric & Manufacturing Company,

PITTSBURG, PA.

**Branch Offices in all Leading Cities.**

# WESTINGHOUSE ELECTRIC & MANUFACTURING CO.,

**PITTSBURGH, PA.**

We manufacture Complete Installations of

# ELECTRICAL APPARATUS

For **CENTRAL STATION ELECTRIC LIGHTING,**
**LONG DISTANCE TRANSMISSION OF POWER,**
**ELECTRIC RAILWAY AND ISOLATED PLANTS.**

**BRANCH OFFICES IN ALL LARGE CITIES.**

## THE FAN MOTOR.

As much ingenuity has been bestowed on the fan motor of late years, in this country, as upon any other piece of electrical apparatus, without exception. It is peculiarly an American idea, not only in the skill with which it has been rapidly perfected, but the swiftness with which it has been introduced, and the variety of its adaptations. Our climate in summer made it welcome with everybody here, but even in Europe there is a loud call for it and the demand from the tropics keeps up and grows the year around.

Large as the output of fan motors has been in past seasons, there are many indications that the market this spring and summer will be broader than ever. Many reasons exist for this. In the first place, fan motors are cheaper and are better built than in bygone days, and they are certainly far more economical of current. For so small a piece of mechanism, the average efficiency of many of them now popular is amazingly high. Moreover, they will run a whole season through without attention, after first setting up in May; and if any repairs are needed in occasional instances, they are slight. Greater care is now paid to the finish; and the ingenious variety of shape and adjustment enables the installer and customer to meet almost any condition, no matter how small or narrow the room. It is curious to note also, that many men who have become accustomed to fan motors in their offices, have learned to use them in their homes, whenever current is available; and wives and families are found to be equally appreciative of a little steady cool air. Many are the bedrooms also, nowadays, into which fan motors have found their way as pleasant, soothing aids to sleep during the sultry summer nights.

There are still a great number of central station managers who have not worked up a summer fan motor trade and who remain indifferent to its opportunities. We venture to hope that this year all will fall in line. Business is quickly improving, it is true, but no chance to turn an honest penny can be neglected; and far more pennies lie waiting in fan work than would appear at first sight. In other words, just when the income would normally be falling off, on account of the longer daylight, it is increased, and that at a time of day when the generating plant is running but is underloaded. If the station does not itself place the fan motors, there are now plenty of energetic local electrical engineers and supply houses who should be encouraged. We have heard of one busy agent in New York who sold 900 fan motors during last season, and who bids fair to beat that handsome record this year.

Not long ago, the direct current fan motor was alone available, and in a limited range of voltages. Now the flexibility of the direct current motor service has been greatly increased not only by primary batteries but by the persistent and successful efforts made to accustom people to take in stored current just as they do ice and milk. But there is a distinct new field in the alternating fan motors, several good types of which claim patronage this year and should be looked into carefully by station managers.

Perhaps a word of caution may be offered in regard to installation. In many instances the fan motor line is simply plugged into a lamp socket, but often it is a special piece of work, and we have seen some careless use of flexible cord that must be condemned. We believe that people are ready and willing to pay for good, careful wiring work, and that if they get it, they will be induced to make further trial of electricity; so that electric light becomes an entering wedge for electric power, the use of motors an argument for electric heating, and all three an irresistible recommendation for unknown and unfamiliar electrical arts destined each to occupy a vast stretch of profitable territory in the near future.—*Electrical Engineer.*


# The Gospel Truth

Of the accompanying article so aptly and clearly expresses what we feel that we desire if possible to give it wider publicity.

Are you fully alive to the possibilities of a brisk Fan Motor season? Had it occurred to you that the usual decrease of revenue, incident to the long summer days, might be counteracted and more than recovered by a Fan Motor Service? Why not make a specialty of it this year? We are anxious to aid the good work in every possible way. We cannot accomplish great things without your co-operation. If you will make the effort we will supplement it by furnishing the best Fan Motor made. We carry a large stock of Lundells, already packed, ready for instant shipment. You can't make a mistake in buying these Fans; they will substantiate the most sanguine expectation of a perspiring public. Sail in.

To-day we talk of Fan Motors; to-morrow of Okonite; again of Interior Conduit, or Pharos Incandescent Lamps, or Helios Arc Lamps, or some one of the many specialties which we manufacture or control in the West. This appears to us to be the best method of advertising these particular articles, but at the same time we do not wish you to overlook the fact that we are pre-eminently **electrical supply dealers** and carry the largest stock of general electrical merchandise in this country. We do not write this in any spirit of empty braggadocio or vanity; it is simply history.

OKONITE — IT NEVER DISAPPOINTS

## Central Electric Company,

173-175 ADAMS STREET,
CHICAGO.

St. Louis:
Southern Electrical Supply Co.

Kansas City;
Gate City Electric Co.

# INCANDESCENT LAMPS.

WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

## GLOBE ELECTRIC LIGHT CO., General Offices: Carter Building, BOSTON, MASS.

AGENTS WANTED. WRITE US.

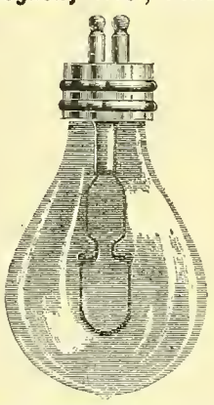
THE

## UNITED ELECTRIC IMPROVEMENT CO.

OFFICE AND WORKS:

19th St. and Allegheny Ave., PHILADELPHIA, PA.

New Discounts on Standard Series Incandescent Lamps For all Systems and for any Current, Candle-Power or Base.



TRIAL ORDER SOLICITED.

Alternating Current Generators, Transformers, Motors, Arc Lamps and Switchboard Equipment for Central Stations.

WRITE FOR DESCRIPTIVE CATALOGUE.

Multipolar and Bipolar Direct Current Dynamos and Appurtenances for Isolated Plants.
Improved Long Distance Series Incandescent Apparatus and Supplies.

CORRESPONDENCE SOLICITED. SATISFACTION GUARANTEED.

## ELECTRIC LIGHTING AND Railway Supplies.

## Western Electric Company,

NEW YORK and CHICAGO.

## THE UPTON ARC LAMP

For All Circuits.

The Cheapest to Buy, Use and Maintain.

| | |
|---|---|
| Direct current lamps, constant potential, with globe and resistance, to burn 8, 11, 14 hours, | $12.00 |
| Alternating current lamps and globe, | 14.00 |
| Series current lamps and globe, | 14.00 |

## Standard Thermometer Co.,

PEABODY, MASS.

The Original Manufacturers of the

*SIMPLEX, WARD and KNIGHT LAMPS*

CHARLES P. BRAMHALL, Selling Agent, 39 Cortlandt Street, NEW YORK.

CONTRACTORS FOR COMPLETE SUBWAY SYSTEMS FOR ELECTRIC RAILWAYS AND ELECTRIC LIGHT, TELEPHONE AND TELEGRAPH COMPANIES.

EDWARD S. PEROT, President.
C. GALLAGHER, Vice-Pres. & Gen. Mgr.
JAS. P. McQUAIDE, Sec. & Treas.

## THE NATIONAL CONDUIT MANUFACTURING CO.,

MANUFACTURERS OF WROUGHT-IRON CEMENT-LINED TUBES FOR ELECTRIC SUBWAYS.

Works, HASTINGS-ON-HUDSON. New York Office, TIMES BUILDING.

We own Patent No. 395,584, covering Wrought-Iron Cement-Lined Pipe for Subways and the method of Laying. Also, Patents Nos. 416,234 and 416,235 for Distributing Boxes. Over 9,000,000 feet of this Subway Constructed by us *now in use in the United States and Canad*

# BUCKEYE

QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

INCANDESCENT LAMPS

Monadnock Building, Chicago. THE BUCKEYE ELECTRIC CO., Cleveland, O.

The Boudreaux Dynamo Brush Co. NO GAUZE.

NAPOLEON LUNDELL

AS WELL AS

The Boudreaux Dynamo Brush Co. NO CARBON.

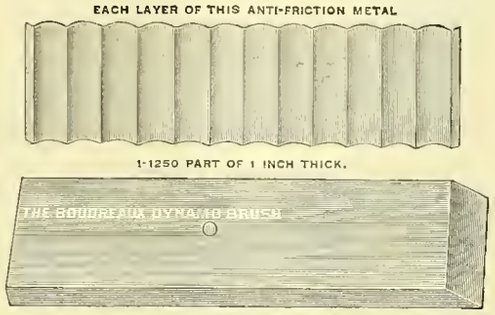
Knew that victories could only be gained by the use of the best material.

That is why all *LUNDELL MOTORS* are equipped with

# THE BOUDREAUX DYNAMO BRUSH.

NO SPARKING.

NO CUTTING.




NO TRIMMING.

NO GREASING.

**TESTIMONIAL.**

NATIONAL MILLING CO., MINNEAPOLIS, MINN.—"We have been using the Brushes since March 1, last, and they are giving us better satisfaction than any we have ever used before. You can send us another pair about the 1st of September next."

The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

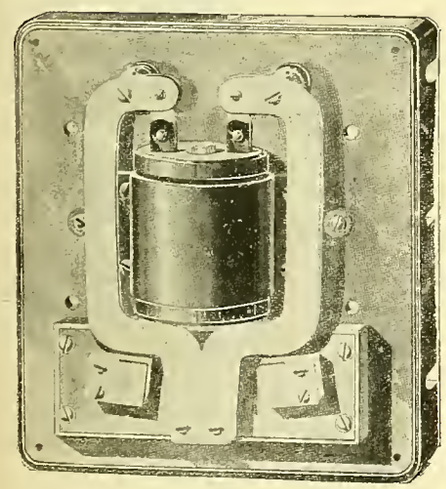
## THE BOUDREAUX DYNAMO BRUSH CO.,

**Mallers Building, CHICAGO.** **Postal Telegraph Building, NEW YORK.**

The Boudreaux Dynamo Brush Co. NO COPPER.

# SINCE MARCH 1st

# Our New (Model 1895) Electric Light and Power Controllers



HAVE BEEN ADOPTED BY CENTRAL STATIONS OPERATING

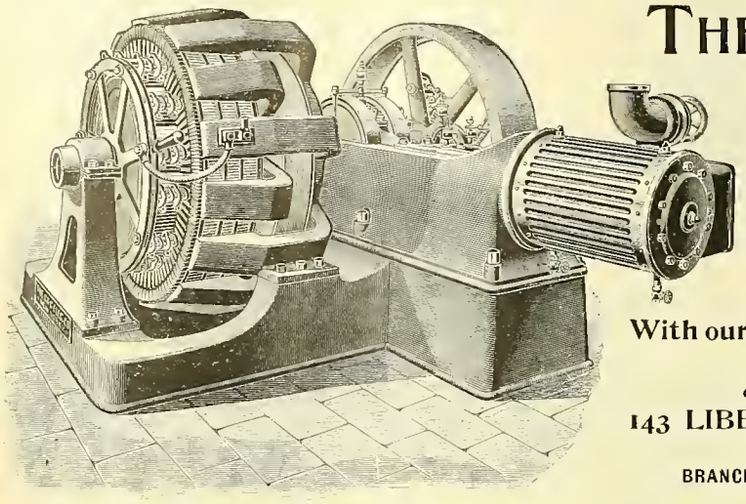
**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{\text{On}}{\text{Out}}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

OUR GENERAL WESTERN AGENTS ARE

## WALLACE ELECTRIC CO., 307 DEARBORN ST., CHICAGO.

## ELECTRIC SELECTOR & SIGNAL CO., 45 Broadway, New York.



# THE C & C ELECTRIC CO.

MANUFACTURERS OF

## Bipolar AND Multipolar Dynamos,

Automatic and Hand Controlled Motors,
Complete Plants for Power Transmission,
Isolated Lighting Plants, Central Station Apparatus.

With our Extensive Works we are prepared to fill promptly all orders for 1 H.-P. to 250 H.-P.

GENERAL OFFICES: 143 LIBERTY ST., NEW YORK.

WORKS: GARWOOD, N. J. On Central R. R. of N. J.

BRANCH OFFICES: CHICAGO, Monadnock Building. BOSTON, 63 Oliver Street. CLEVELAND, Cuyahoga Building. PHILADELPHIA, 633 Arch Street.

# HELIOS ELECTRIC COMPANY,

Factory and Offices,

**1310 Filbert Street, Philadelphia, Pa.**

*We have no Stock nor Old Style Lamps that we must get rid of at any price—no junk.*

## THE HELIOS LAMPS

Are the latest patterns and newest type. Our Lamps are much in advance of any lamp now on the market, because they are New and of Latest Designs.

Our ALTERNATING LAMPS have Reflector Plates. Our DIRECT CURRENT Lamps do not see-saw. Our Focusing Lamps, both Direct and Alternating, are especially adapted for photo-engraving and stereopticon work.

Anchor Electric Co., New England Agents, Boston, Mass.
Central Electric Co., Western Agents, Chicago.
Moore & Baylis, Agents for Western New York, Buffalo, N. Y.,
Globe Electrical Supply & Construction Co., New York City Agents, Vandam and Greenwich Streets, New York.
Mountain Electric Co., Agents for Colorado, Utah, Wyoming and New Mexico, Denver, Col.
Machinery Supply Co., Agents for Southern California and Arizona, Los Angeles, Cal.
W. T. M. Mottram, Agent for Texas, Dallas, Tex.
Canadian General Electric Co., Canadian Agents, Toronto, Canada.
California Electrical Works, San Francisco, Cal.

## CHICAGO SHORTHAND INSTITUTE, 35th St. and Wabash Ave.

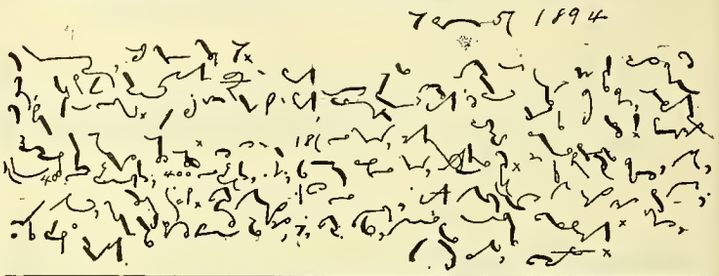
**A Central School of Shorthand and Typewriting of the most Modern and Complete Type.**

**A COMPLETE COURSE OF SHORTHAND.** We offer you shorthand instructions in abundance, and most excellent in quality. Our course is graded and arranged in logical order. We claim not a new system, but a new method of imparting the art of shorthand by which we can equip any ordinary intelligent person for the execution of any stenographic work devolving upon the expert stenographer or court reporter.

The method of instruction employed is practical and progressive. The principles are taken up and explained in an orderly manner, and the student directed how to apply them correctly in the work of forming the characters rapidly and artistically. You may have access to the quintessence of the standard systems—Pitman, Munson, Graham. We guarantee to turn you out a full-fledged stenographer capable of any kind of stenographic work. The art is made a specialty.

Tuition, $10.00 per month. Secure class seats immediately.

Evening classes, $5.00 per month. 98 per cent. of our students hold positions.



## MOULDED MICA.

TREE INSULATORS.

Wall Socket for Sign Work, etc.

## Weatherproof Sockets.

For use outdoors and in damp situations.

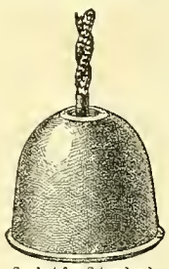
Regular Edison, Thomson-Houston & Westinghouse Base.

TROLLEY LINE INSULATORS,
VULCABESTON.

## H. W. JOHNS MFG. CO.,

240 & 242 Randolph Street,
CHICAGO.

NEW YORK, PHILADELPHIA, BOSTON.



Socket for Standard ⅛-inch Pipe Bracket Fixtures.

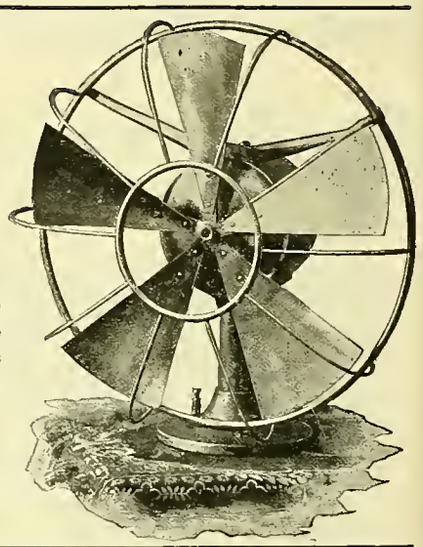
## THE BEST ELECTRIC FAN On the Market.

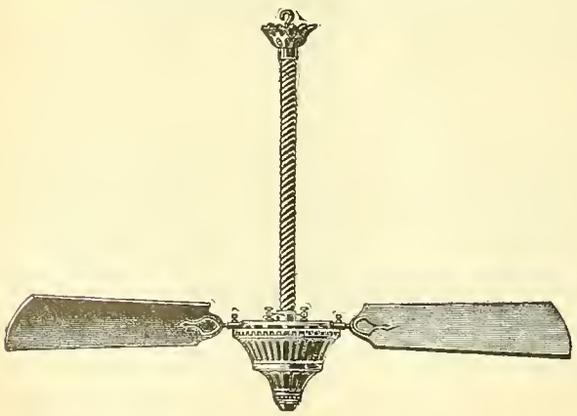
**For Alternating Current, Wound for 50 or 100 volts.**

The Fan is 14 inches in diameter.
Will always start when current is on
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

Agents Wanted in Different Localities.

For further information address
THE
**W. J. Davis Electric Co.,**
PITTSFIELD, MASS.

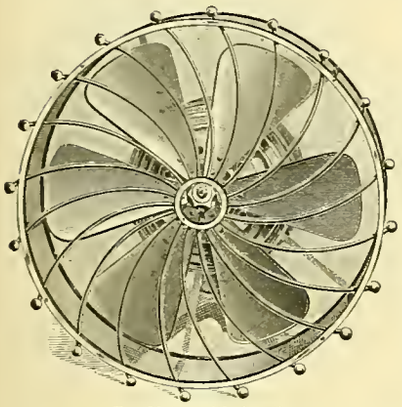




**AN EMPHATIC SUCCESS!**
**THE DIEHL ELECTRIC FANS WIRED IN A SERIES OF TWO OR MORE ON A STREET RAILWAY CURRENT.**

**DIEHL & COMPANY, 385 BROADWAY, NEW YORK.**

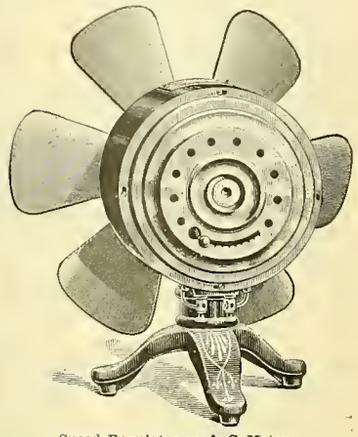
# TRANSFORMERS, — SWITCHES, — FAN MOTORS.



Fan Motor with Guard.

## OUR 1895 FAN MOTORS

Have speed regulators on both Alternating and Direct Current.
Are the most economical in operation.
Give the strongest breeze.
Are the most symmetrical in design.
Have the handsomest guard.



Speed Regulator on A. C. Motor.

## Wagner Electric Mfg. Co.,

ST. LOUIS.

BOSTON: 620 Atlantic Avenue.
PHILADELPHIA: 1000 Betz Building.
CINCINNATI: 161 West Pearl Street.
MINNEAPOLIS: 249 Second Avenue South.

**AGENCIES:**

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CHICAGO: 1564 Monadnock Block.
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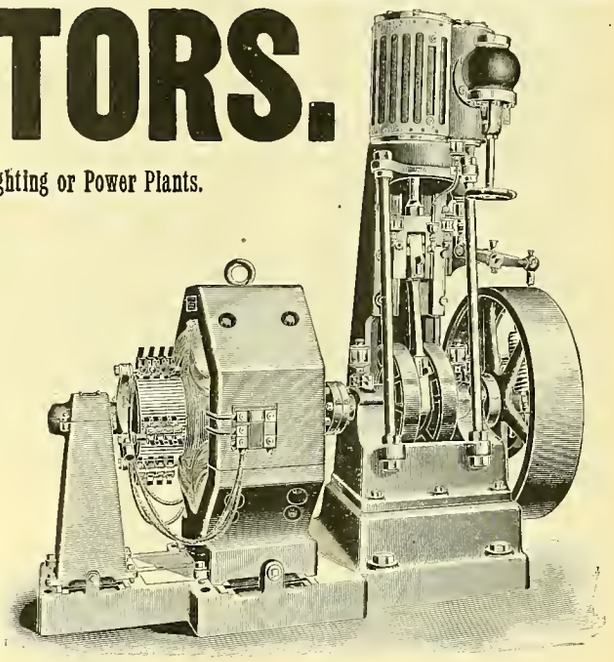
# EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*



## THE EDDY ELECTRIC MFG. CO.,

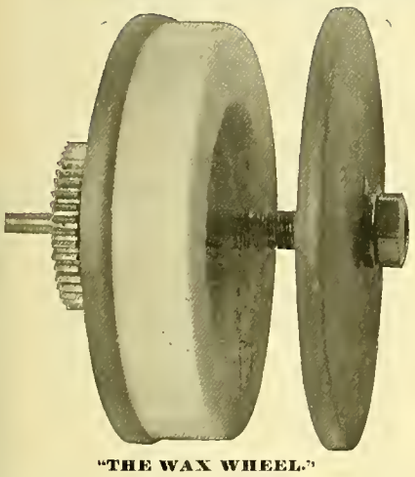
*WINDSOR, CONN.*

NEW YORK OFFICE, HAVEMEYER BLDG.

*REPRESENTED BY:*

Walter C. McIntire & Co., 506 Commerce St., Philadelphia, Pa.
Western Electrical Supply Company, St. Louis, Mo.
F. P. Little Electrical Construction & Supply Co., Buffalo, N. Y
W. T. Osborn, Kansas City, Mo.
D. P. GOSLINE, 30 Oliver St., Boston, Mass.

**All Our Apparatus Guaranteed as Represented.**



"THE WAX WHEEL."

*Built for all types of currents.*
*Only one adjustment.*

**NO** *MAGNETS. SPRINGS. DASH POTS. CLUTCHES.*

**Telephone Harrison 39.**

# The American Gas Engine Electric Co.

Hereby announces that it has acquired the manufactory of the Nutting Electric Company, and the sole rights for the United States under all of its patents.

We have increased our manufacturing facilities to such an extent that we can now quote the well known

## Wax Wheel Arc Lamp

Until further notice, as follows:—

| | |
|---|---|
| Series Arc Light Circuits, direct current, net, - - - | $10.00. |
| Constant Potential Circuits, direct current, net, - - | 10.00. |
| NOTE:—Resistance for Constant Potential Circuits will cost per lamp, extra, | $1.50. |

*CONTRACTING AND CONSULTING ENGINEERS' DEPARTMENT FOR COMPLETE GAS ENGINE ELECTRIC PLANTS.*

## THE KILMARNOCK-GRIFFIN DOUBLE ACTING GAS ENGINE

IN SIZES FROM 1 TO 1,000 HORSE POWER.

**Offices: Dexter Building, 84 Adams Street, CHICAGO.**

# The "Electra" Carbons.

ELECTRA ·TRADE MARK·

## IMPORTED
## HIGH GRADE NUERNBERG CARBONS

ELECTRA ·TRADE MARK·

**FOR DIRECT CURRENT ARC LAMPS.** **FOR ALTERNATING CURRENT ARC LAMPS.**

**Are the most economical and efficient manufactured. They produce a very brilliant and absolutely steady light, burning without any dust.**

**HUGO REISINGER,** NO. 38 BEAVER STREET, NEW YORK.
Sole Importer for the United States and Canada.

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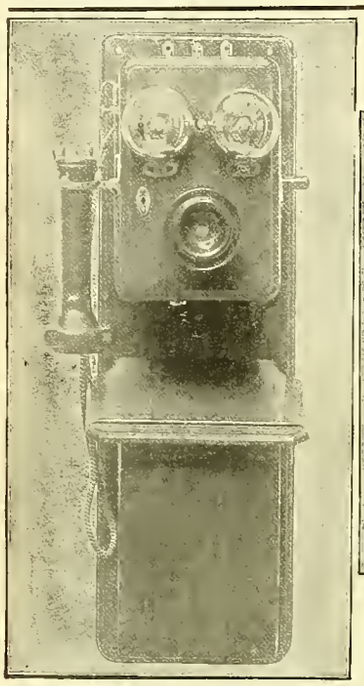
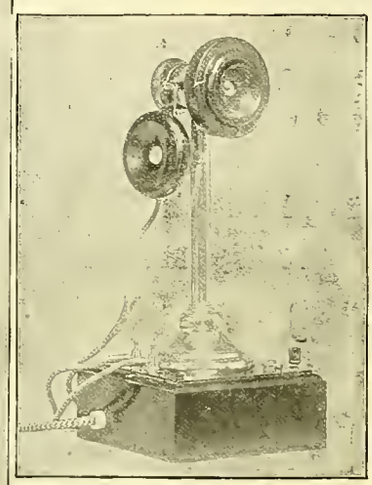


M. & B.



Desk Set.

**Complete Exchange Plants.**
**Metallic or Ground Circuit.**

**SWITCHBOARDS ABSOLUTELY GUARANTEED.**

*STATE AGENTS WANTED.*

ADDRESS

**M. & B. TELEPHONE CO.,**

**Bullitt Building, - Philadelphia.**

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NOTICE! We will sell 10,000 Kusel's LONG DISTANCE CARBON TELEPHONE

**TRANSMITTERS at $1.50 Each, Complete,**

In oak or walnut cases. This Transmitter is guaranteed the most powerful Battery Transmitter made or money refunded. Order a sample pair. Send for our Telephone catalogue.

MISSOURI TELEPHONE MFG. CO., 1230 Olive Street, - ST. LOUIS, MO.

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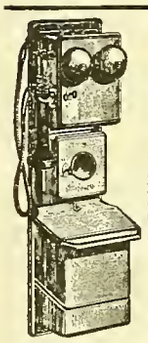
**Clark Electric Specialty Mfg. Co.,**
606 Temple Ct., Minneapolis, Minn.,
MANUFACTURERS OF
Switch Boards, Battery Boxes, Push Buttons, Rosette Mouldings, Etc.
Correspondence solicited.



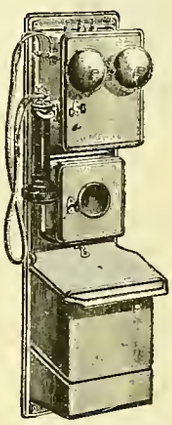
THIS TELEPHONE IS CALLED THE

**Long Distance, No. 1.**

Will speak one thousand miles on a properly constructed line. You can hear a watch tick one hundred miles. Is that satisfactory? If so, write to

**W. A. GUSTAFSON,**
JOLIET, ILL.,

For prices and information. Send business card, I sell to the trade only.



TELEPHONES, RECEIVERS, TRANSMITTERS, MAGNETO and EXTENSION BELLS, WIRE AND CORD, WOOD BRACKETS, GLASS INSULATORS.

The most Complete Stock.

**JULIUS ANDRAE & SONS CO.,**
MILWAUKEE, - WIS.

Our Instruments are absolutely

**NON-INFRINGING.**

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**$5 TO $15 TELEPHONES.**
**Supplies of Every Description.**
Transmitters (Blake Pattern); Hunning Silver Diaphragm or Magneto Receivers; Magneto Bells; Wire Cross Arms; Insulators; Induction Coils; Backboards; Switches; Batteries, etc. Wholesale Prices to Dealers.

**Farr Telephone & Const. Supply Co., Mfrs.,**
Sales Store and Office, 342 Dearborn St., Chicago.
Western Agents for DANBURY ELECTRICAL WORKS.

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**TELEPHONES!!**

This company is manufacturing **A Compound Magneto Telephone**

Which it sells outright under a guarantee both as to efficiency and as against infringement of patents.
It talks as well over one hundred miles as any other Telephone talks over one mile.
This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists.

**WESTERN TELEPHONE CONSTRUCTION CO.,**
539, 540 and 541 Monadnock Blk., Chicago, Ill.

---

**DO YOU WANT**

The best made?
To be up to time?
Quick results from a 'phone?
To save time?
The most efficient?
The most durable? Then

**Buy the "Gerson"**

These 'phones are used on private lines between Boston and Chicago.

**TELEPHONE**
**Long Distance and Interior.**

**SATISFACTION GUARANTEED.**

U. S. Government gives the "Gerson" 99 per cent. for efficiency—highest given.

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SOLE AGENTS FOR

**THE GERSON Electrical Mfg. Co.,**
INCORPORATED,
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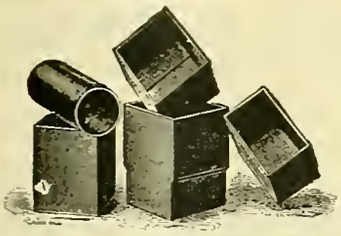
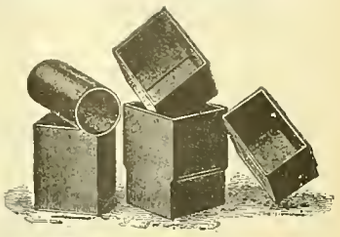


# THE FREEMAN



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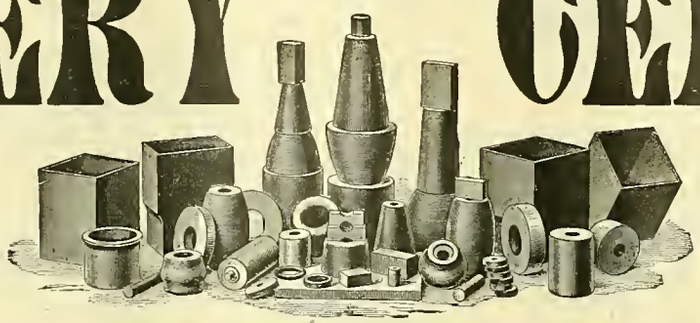

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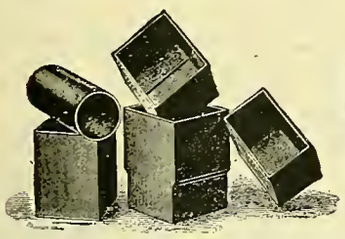

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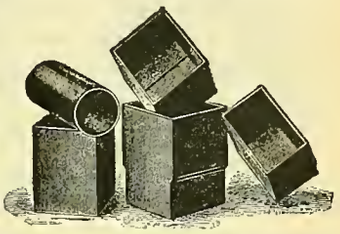

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This system does not infringe the patents of the Bell Telephone or Western Electric Co. We build exchanges complete for local companies, or will install and operate exchanges ourselves at a low monthly rental. We keep in stock Blake transmitters and all kinds of supplies.

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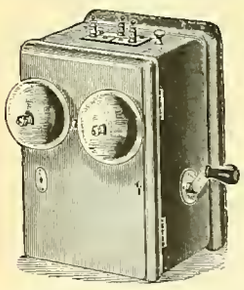

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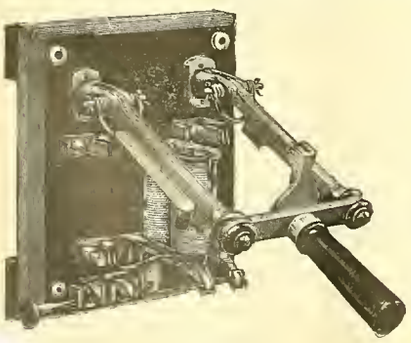

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BARE AND INSULATED ELECTRIC WIRE,

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Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

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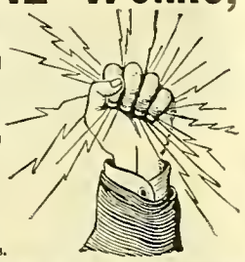

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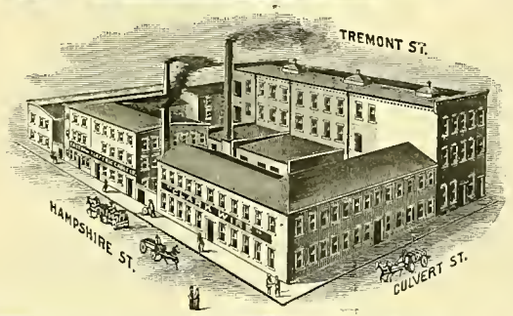


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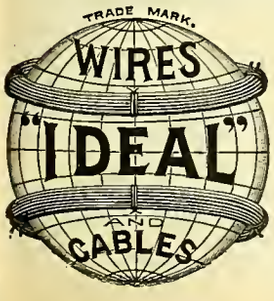


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**It will not Deteriorate by long use, nor Oxidize the Copper. Finished in the following Styles: Black Polished, White and Black Glazed Braid and White Fireproof.**

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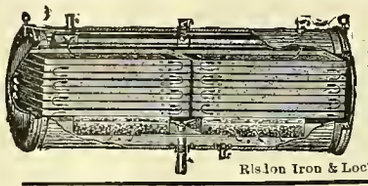

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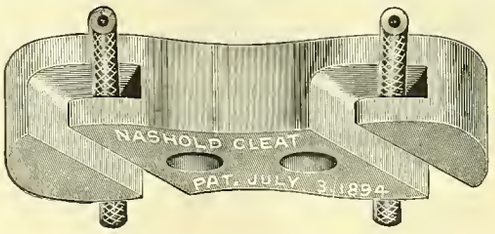
Patented in U. S., Canada, England, France, And Applied for in Germany.

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**It is made of finest glazed porcelain.**
**It is in one piece.**
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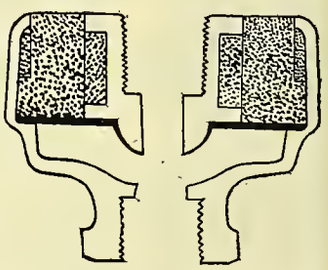

Sectional View—Patented July 10, 1894—Full Size.

**For Insulating Fixtures.**

This joint conforms to the requirements of Underwriters' rules. Write for prices and circulars.

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FOR ALL PURPOSES.
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LOWELL, MASS.

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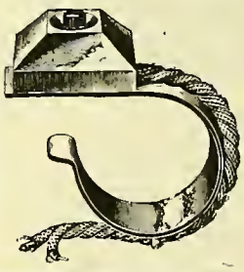

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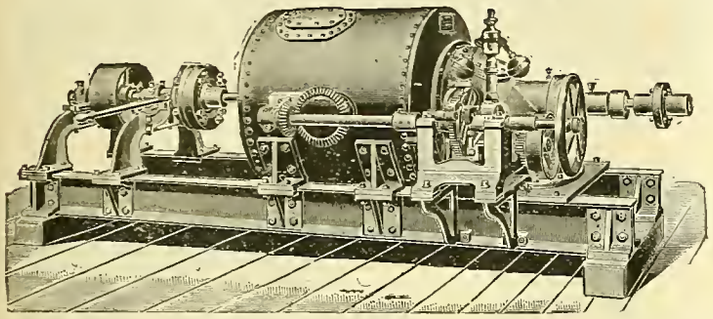

Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.

The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

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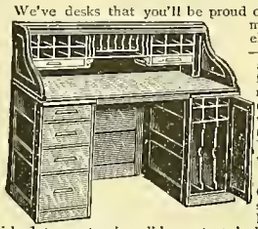

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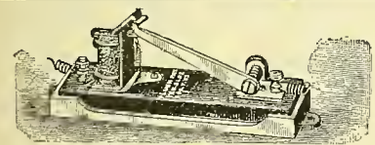

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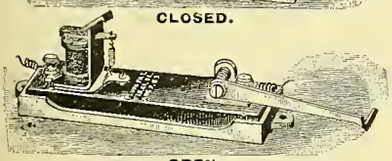

OPEN.

Regular Size, 6 inches long, 2¾ inches high, 1 to 1½ inches wide.

In a suit brought against F. Stevens by the Cutter Company, claiming an infringement on an Electric Flush Switch, it was decided in his favor by the United States Court in December last, the Court dismissing the case with costs.

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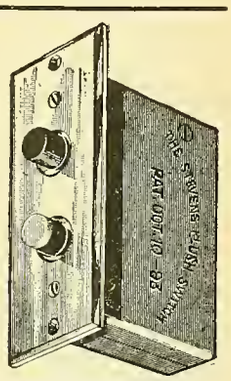


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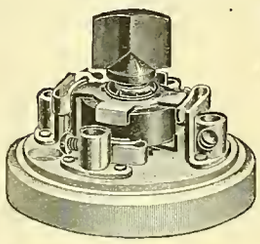

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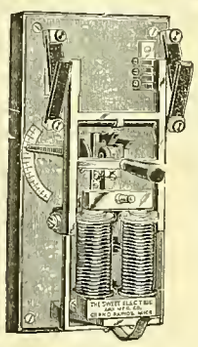

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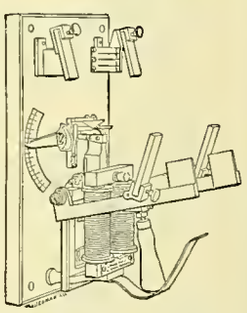

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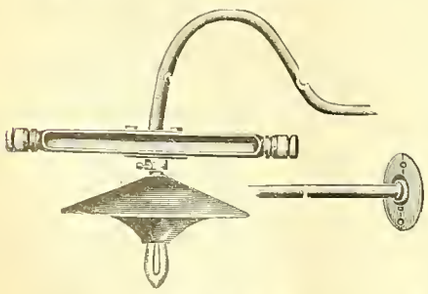

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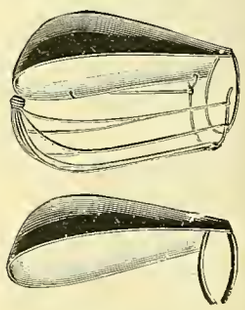

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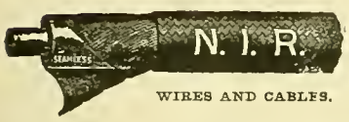

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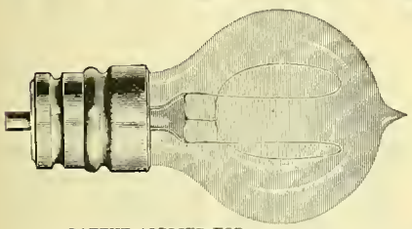
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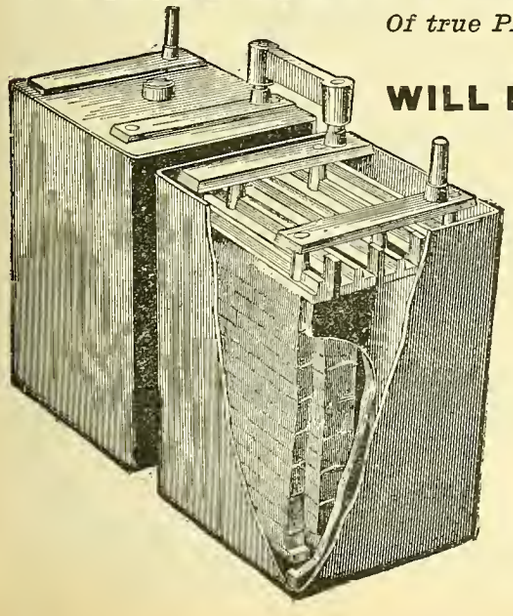

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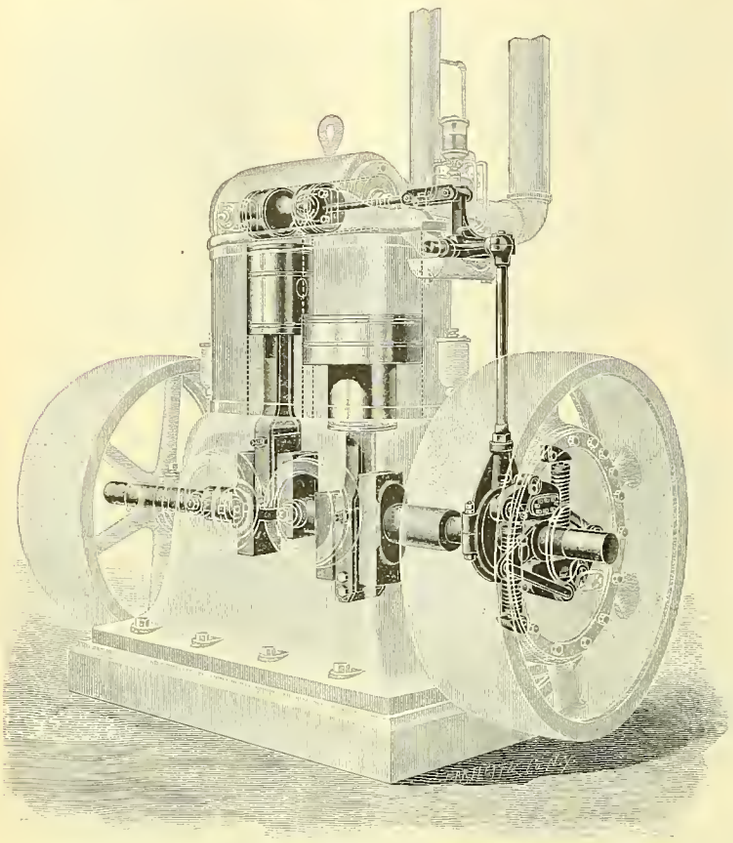

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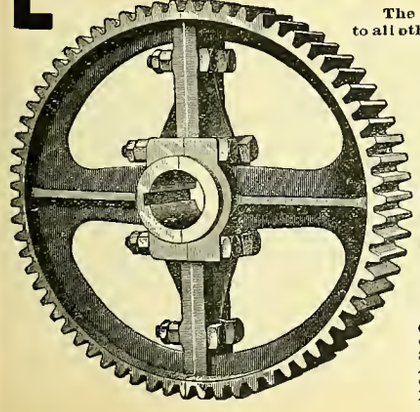

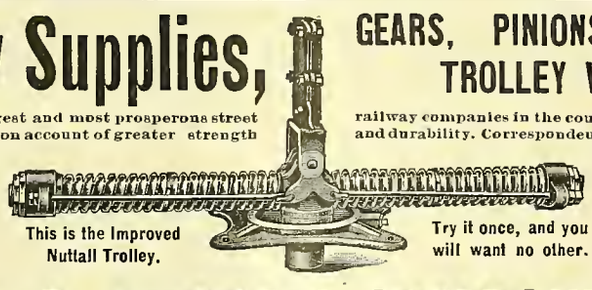

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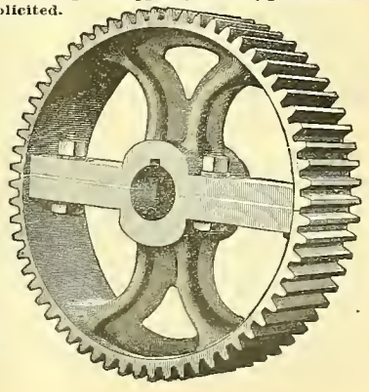

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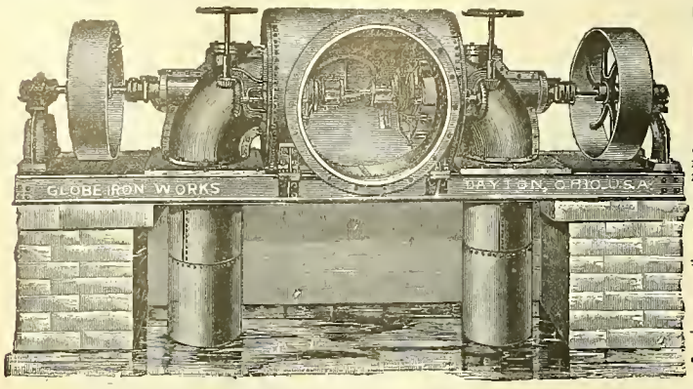


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| ⅞ " | 16.42 | 122.00 | 127.18 | 196.19 | 82.58 |
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| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
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|---|---|---|---|---|---|
| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
| Whole Gate | 16.33 | 128.00 | 134.18 | 199.56 | 80.60 |
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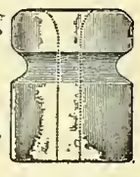

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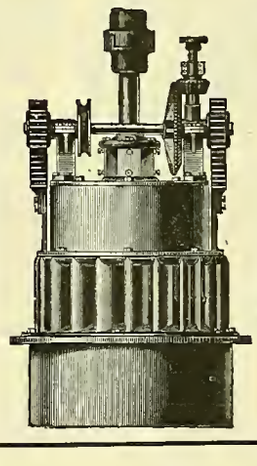

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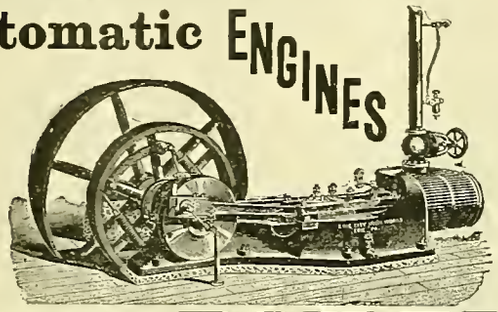

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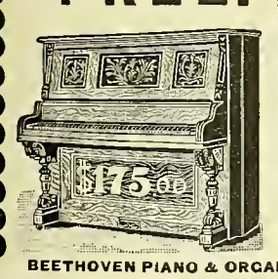

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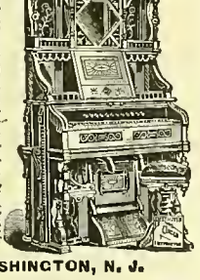

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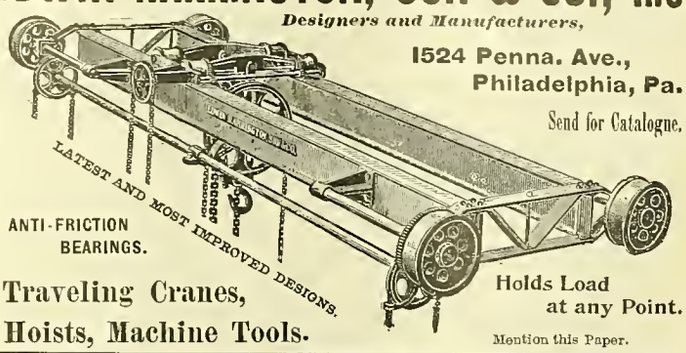


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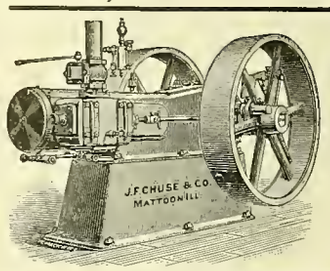


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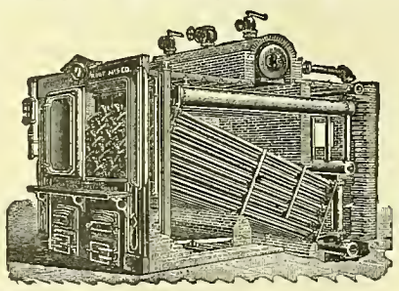

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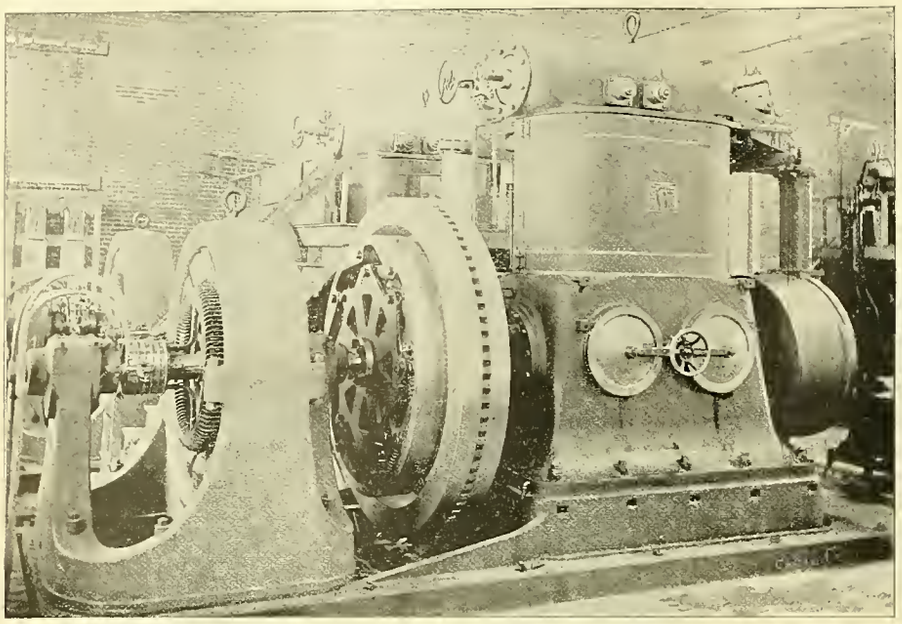

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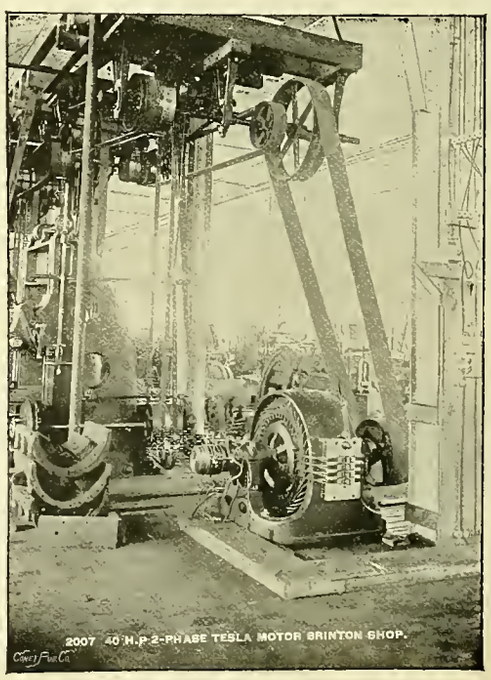


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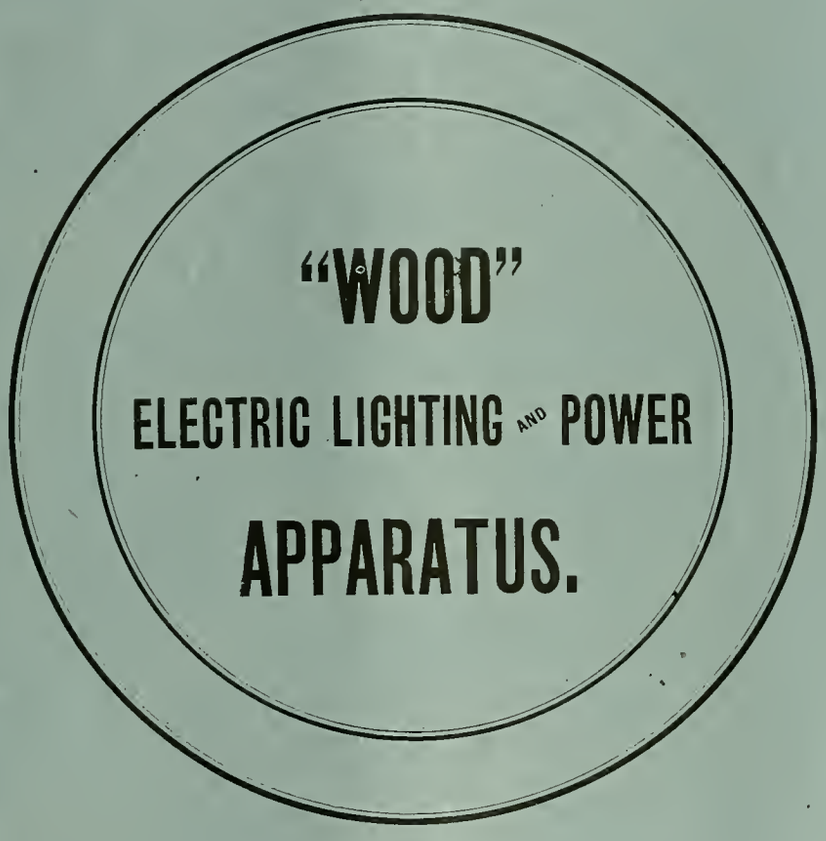


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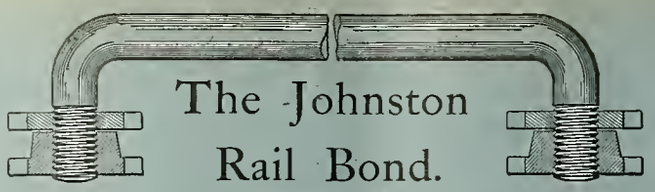

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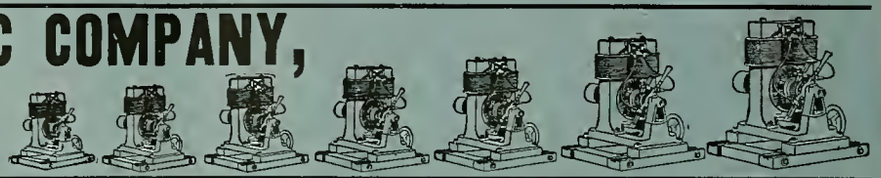

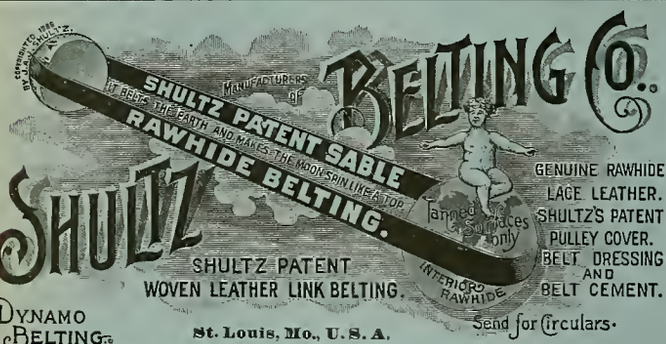


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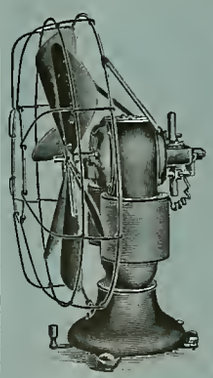

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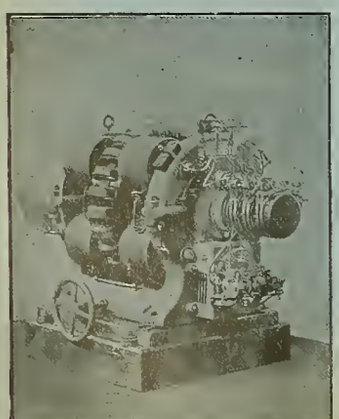

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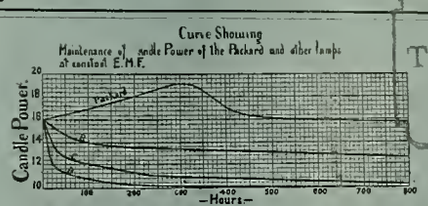


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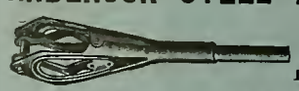

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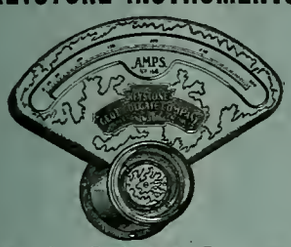


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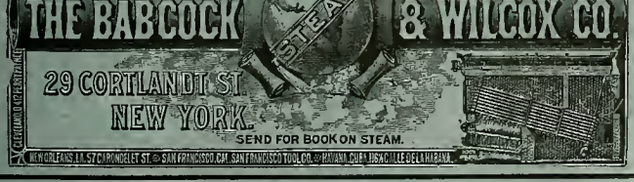


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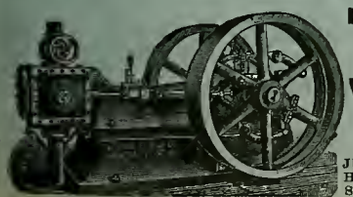

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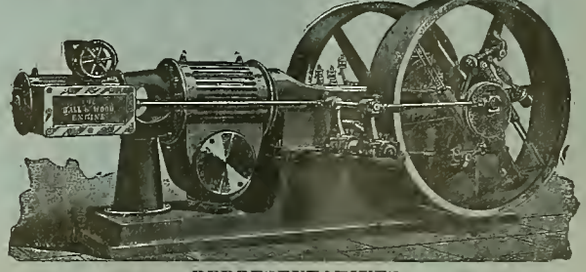


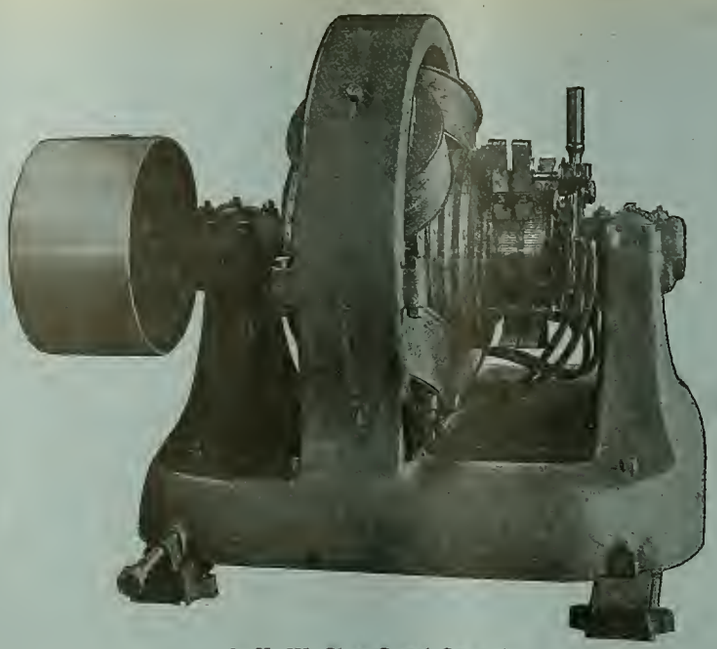
REPRESENTATIVES:

Stern & Silverman, 707 Arch St., Philadelphia, Pa. O. E. Sargent, Fort Dearborn Bldg., Chicago, Ill.
George M. Kenyon, Endicott Arcade, St. Paul, Minn. James & Company, Chattanooga, Tenn.

**STANDARD UNDERGROUND CABLE CO.,** **WIRES and CABLES,**

THE ROOKERY, CHICAGO. WESTINGHOUSE BUILDING, PITTSBURG. TIMES BUILDING, NEW YORK.

Slow Speed



Moderate Speed

60 K. W. Slow Speed Generator.

# GENERATORS AND MOTORS.

For a medium sized machine having a low speed nothing in the market to-day equals our **SLOW AND MODERATE SPEED GENERATORS AND MOTORS.** They are of superior design, high efficiency, regulate excellently, do not heat and do not spark. Most of the defects familiar in bipolar machines have been eliminated. The Frames are of cast soft steel of highest magnetic permeability, and the machine occupies a minimum floor space. The Armatures are iron-clad and thoroughly ventilated. The Insulation is practically indestructible. The Commutator and Brushes work perfectly under all conditions of load. The Bearings cannot get out of line. The Armature Windings are interchangeable and easily replaceable and are securely supported and protected by the projecting iron spider. In every detail of design and construction these machines hold the highest rank.

The Slow Speed Generators are built in capacities from 4.5 K. W. to 60 K. W. Moderate Speed Generators from 7.5 K. W. to 75 K. W. The Slow Speed Motors are built in capacities of from 1 H. P. to 70 H. P. Moderate Speed Motors from 5 H. P. to 85 H. P. The larger sizes are adapted for direct connection to the engine.

## WRITE FOR PRICES AND PARTICULARS.

# GENERAL ELECTRIC COMPANY,

MAIN OFFICE, SCHENECTADY, N. Y.

**SALES OFFICES:**

Boston, Mass., 180 Summer Street.
New York, N. Y., 44 Broad Street.
Syracuse, N. Y., Sedgwick, Andrews & Kennedy Bldg.
Buffalo, N. Y., Erie County Savings Bank Building.
Philadelphia, Pa., 509 Arch Street.
Baltimore, Md., 227 East German Street.
Pittsburg, Pa., Times Building.

Atlanta, Ga., Equitable Building.
Cincinnati, Ohio, 420 West Fourth Street.
Columbus, Ohio, 14 North High Street.
Nashville, Tenn., 308 North Summer Street.
Chicago, Ill., Monadnock Building.
Detroit, Mich., 13 Rowland Street.
Omaha, Neb., 309 South 13th Street.

Kansas City, Mo., New York Life Building.
St. Louis, Mo., Wainwright Building.
Dallas, Tex., Corner Elm and Griffin Streets.
Helena, Mont., Electric Building.
Denver, Colo., 505 16th St., Kittredge Bldg.
San Francisco, Cal., 15 First Street.
Portland, Ore., Front and Ankeny Streets.
Seattle, Washington, Bailey Building.

Foreign Dept. { Schenectady, N. Y. / New York Office, 44 Broad St.

Canada, Canadian General Electric Company, Ltd., Toronto, Ont.

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Westinghouse Machine Co. —


## CLASSIFIED LIST.


**Accumulators.**
Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.

**Arc Lamps.**
C & C Electric Co.
Central Electric Co.
Clark Electric Co.
Corey, R. B.
Crocker-Wheeler Elec. Co,
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Perkins El. Switch Mfg. Co.
Standard Thermometer Co.
Waterman, Chas. H.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Hemigray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Gillette, E. & F.
Huebel & Manger
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Electric Co.

**Belting,**
Shultz Belting Co.

**Bicycles.**
Monarch Cycle Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Brownell & Co., The.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Corey, R. B.
General Electric Co.
Partridge Carbon Co.
Reisinger, Hugo.
Waterman, Chas. H.
Wertheim, Ed.
Western Electric Co.

**Compound.**
Standard Paint Co.
Tornberg, Edw. R.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.
National Conduit Mfg. Co.

**Construction & Repairs.**
Allen-Hussey Co.
Amstutz, N. S.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El. Const. Co.

**Contractors and Electric Light Plants.**
Allen-Hussey Co.
Amstutz, N. S.
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Clark Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Siemens & Halske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Bunnell & Co, J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co, E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Brodie Electric Co.
Central Electric Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Electric Protection Co.
Elec. Selec. & Signal Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Desks.**
Montgomery Ward & Co.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Clark Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Siemens & Halske Elec. Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Allen-Hussey Co.
Amstutz, N. S.
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg, Co,
Ford, Owen.
Thayer Electric Co.

**Electrical Instruments.**
Anderson, Albert & J. M.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S.
Queen & Co. Inc.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Electrical Specialties.**
Allen, L. B.
Clark El. Specialty Mfg. Co.
Electric Protection Co.
Interstate Com. El. Const Co.
Nashold Cleat Co.
Proctor-Raymond Elec. Co.
Rockford Torch Co.

**Electroliers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. B.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.

**Engines, Steam.**
Ball & Wood Co., The.
Brownell & Co., The.
Chuse & Co., J. F.
Erie City Iron Wks.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Central Electric Co.
Davis Elec. Co., W. J.
Diehl & Co.
Dieterichs-Warwick El Co
Interior Conduit & Ins. Co.
Roth Bros. & Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Bard Rubber Co.

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Butler Mfg. Co.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Dieterichs-Warwick El. Co.
Electric Appliance Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Morris & MacCurdy;
Nashold Cleat Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Proctor-Raymond Elec. Co.
Queen & Co Inc.
Sioux City Brass Works.
Sweet Elec. & Mfg. Co.
Thayer Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Edwards, W. S. Mfg. Co.
Hemigray Glass Co.

**Graphite Specialties.**
Besly & Co., Chas. B.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Bard Rubber Co.
Fiberite Co. The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Aetna Electric Works.
Am. Electrical Mfg. Co.
Automatic Elec. Spec. Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Onio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.

**Mica.**
Johns Mfg. Co., H. W.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Andrae & Sons, J.
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Dieterichs-Warwick El. Co.
Eddy Elec, Mfg, Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Works.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.
Standard Paint Co.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd

**Pianos and Organs.**
Beethoven Piano & Organ Co.

**Platinum.**
Baker & Co.

**Poles.**
Morris, Tasker & Co.
Nuttall Co., R. D.
Valentine-Clark Co.

**Porcelain.**
Empire China Works.
General Electric Co.
Hemingray Glass Co.

**Publishers, Electrical**
Electrician Publishing Co

**Push Buttons.**
Central Electric Co.
Electric Appliance Co
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Separators**
Goubert Mfg. Co.

**Silk Braid**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Cons. Electric Storage Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones.**
Andrae & Sons, J.
Central Electric Co.
Farr Tel. & Const. Supply Co.
Gillette, E. & F.
Gustafson, W. A.
Jameson & Co., W. D.
M. & B. Telephone Co.
Mo Telephone Mfg. Co.
Partrick & Carter Co.
Public Telephone Co.
Western Electric Co.
Western Tel. Const. Co.

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Diamond Electric Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hornberger Elec. Mfg. Co.
Louisville Elec. Works.
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Chi. Shorthand Institute.
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**Wire, Bare.**
Anderson, Albert & J. M.
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Brixey, W. R.
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Nuttall Co., R. D.
Okonite Co., The.
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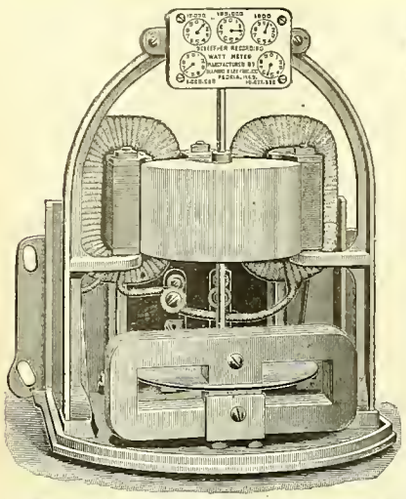
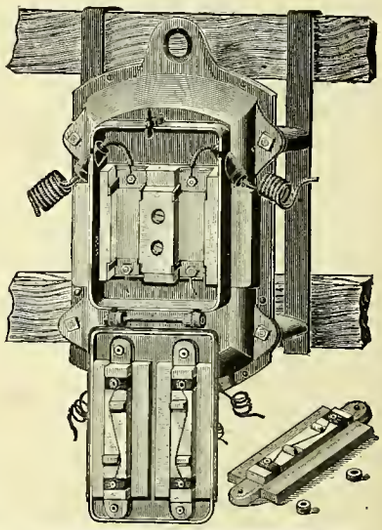


# SCHEEFFER'S RECORDING WATT-METER.

For Alternating Circuits. No Commutator. No Brushes.

Registers Direct Actual Power Consumed.

EASILY ADJUSTED. ABSOLUTELY RELIABLE.



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Simplest, Safest and Best.

FOR ANY VOLTAGE. FOR ALL SYSTEMS.

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## Alternating Current ARC LAMPS.

# The Kester '95

**IS THE LAMP YOU HAVE HOPED FOR.**

It is the only perfected Arc Lamp for the alternator, either high or low frequency.

It comprises all that is desired in an Arc Lamp.

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**For All Circuits.**

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| Direct current lamps, constant potential, with globe and resistance, to burn 8, 11, 14 hours, | $12.00 |
| Alternating current lamps and globe, | 14.00 |
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The Original Manufacturers of the

*SIMPLEX, WARD and KNIGHT LAMPS.*

CHARLES A. BRAMHALL, Selling Agent, 39 Cortlandt Street, NEW YORK.

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**The Above Lines Include ARC LAMPS for Every Service.**

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Has never ben equaled in Quality or Popularity.

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The most successful and perfect fan made.

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Carefully constructed to the smallest detail. Life and efficiency answers the most critical demands.

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The premier of insulated wires. For use anywhere for any purpose. It never disappoints.

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Branches: { Kansas City, Mo.: Gate City Electric Co.
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## Standard "Ward" Arc Lamps

**With Resistance, Clear Globes and Tested Ready for Use, 6½, 8 and 10 Amperes, at $10 Each.**

This price for lamps in pairs. Single lamps with globes and resistance tested, TWELVE dollars.
In lots of 50 or more as received from the manufacturer, without globes, resistances or testing, $7.50 each.

**ALSO LARGE STOCK OF**

Ward Alternating Lamps, Knight Alternating Lamps, Knight Direct Current Lamps, Kinsman Lamps, Focusing Lamps, Photo-Engraving and Stereopticon Lamps, and Ward and Knight High Tension Series Lamps, Twin Lamps, Railroad Lamps,

**ALL AT LOWEST PRICES.**

**ALSO LARGE LOT OF IMPORTED AND DOMESTIC CARBONS**

Of the Following Makes:

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FIDELITY, SOLAR, LANCASTER, GLOBE

At Lowest Prices Ever Offered.

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WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

**GLOBE ELECTRIC LIGHT CO.,** General Offices: Carter Building. **BOSTON, MASS.**

AGENTS WANTED. WRITE US.

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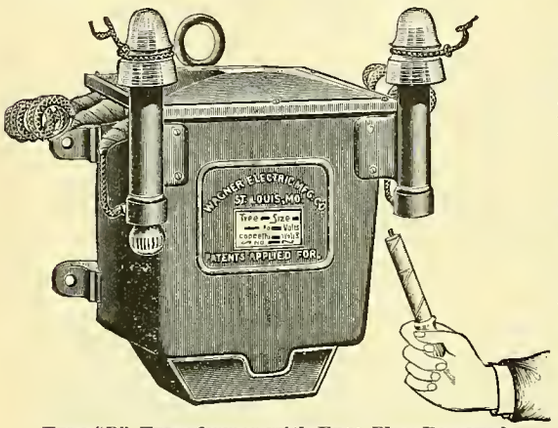


Type "D" Transformer with Fuse Plug Removed.

***A New Type*—*Transformer, Primary Cut-outs and Insulator Brackets all combined.***

**No more brackets pulling off of walls.**

**With our wall or cross-arm hooks, transformer may be *Hung* and *Connected* in *Five minutes.***

**Our new fuse plugs will not hold an arc with 5,000 volts.**

***Our Transformers* are acknowledged by all experts to be the *Highest* in *Efficiency* ever made.**

**Adopted by the largest stations in the country.**

***We Challenge Competition* in any form of test, in laboratory or practical use.**

**Made in all sizes, 5 lights to 3,000 lights.**

JOHN MUSTARD, Betz Building, Philadelphia, Pa.
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**Wagner Electric Mfg. Co.,** ST. LOUIS, MO.

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# "A GOOD THING"
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ORDER A COPY OF
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Price $1.00, Postage Prepaid.

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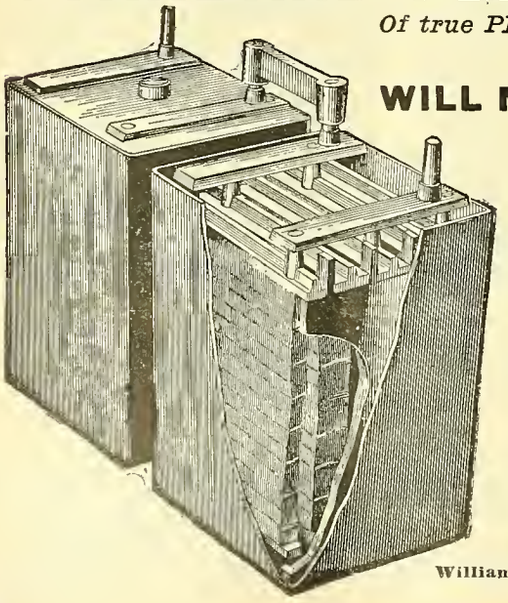
# STANDARD PLANTE STORAGE BATTERIES



*Of true PLANTE Type and CRYSTALLINE FORMATION.*

Will give or receive without injury, currents that would destroy other batteries.

**WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.**

Contain no asbestos or other separating material to increase their internal resistance.

**ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.**

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

**Highest efficiency, largest delivery, lowest internal resistance.**

For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

**Cannot be damaged by excessive charge or discharge currents.**

A 400 ampere current has been taken from a 120 ampere hour cell.

**CHALLENGE:** We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

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William Hood, Western Selling Agent,
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The Boudreaux Dynamo Brush Co. NO GAUZE.

The Boudreaux Dynamo Brush Co. NO CARBON.

ALL

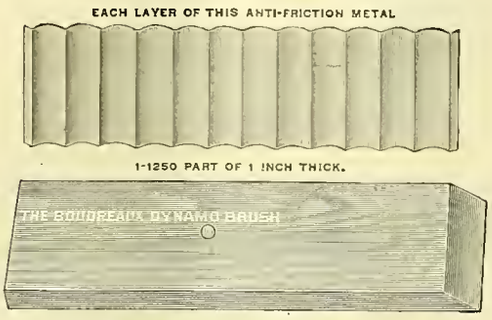
# LUNDELL MOTORS

ARE EQUIPPED WITH

## THE BOUDREAUX DYNAMO BRUSH.

NO SPARKING.

NO CUTTING.




NO TRIMMING.

NO GREASING.

**TESTIMONIAL.**

THE DECATUR BREWING CO., DECATUR, ILL.—The brushes you sent us some time ago, have been put in use since, and we are quite satisfied with their performance.

The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

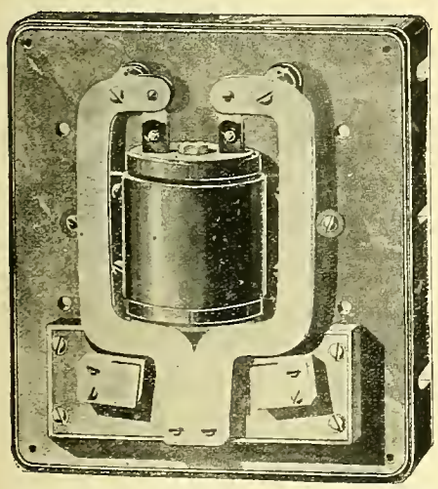
The Boudreaux Dynamo Brush Co. NO COPPER.

# THE BOUDREAUX DYNAMO BRUSH CO.,

**Mallers Building, CHICAGO.** **Postal Telegraph Building, NEW YORK.**

# SINCE MARCH 1st

# Our New (Model 1895) Electric Light and Power Controllers



HAVE BEEN ADOPTED BY CENTRAL STATIONS OPERATING

**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{On}{Out}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

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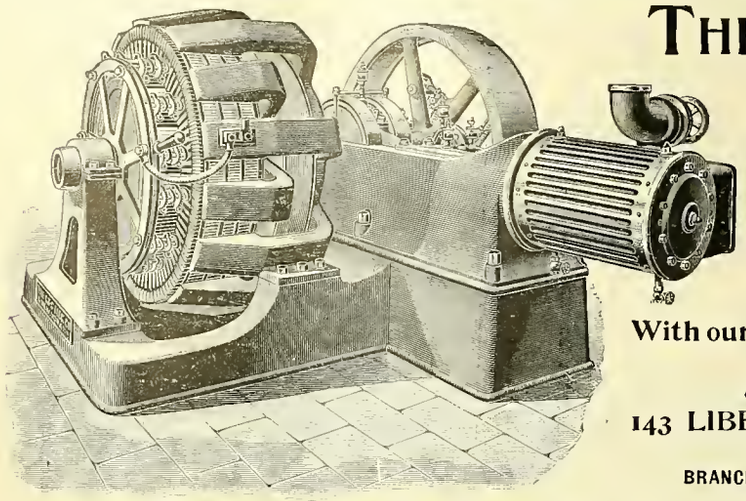

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MANUFACTURERS OF

## Bipolar AND Multipolar Dynamos,

Automatic and Hand Controlled Motors,
Complete Plants for Power Transmission,
Isolated Lighting Plants, Central Station Apparatus.

With our Extensive Works we are prepared to fill promptly all orders for 1 H.-P. to 250 H.-P.

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Factory and Offices,

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*We have no Stock nor Old Style Lamps that we must get rid of at any price—no junk.*

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Are the latest patterns and newest type. Our Lamps are much in advance of any lamp now on the market, because they are New and of Latest Designs.

Our ALTERNATING LAMPS have Reflector Plates. Our DIRECT CURRENT Lamps do not see-saw. Our Focusing Lamps, both Direct and Alternating, are especially adapted for photo-engraving and stereopticon work.

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Mountain Electric Co., Agents for Colorado, Utah, Wyoming and New Mexico, Denver, Col.
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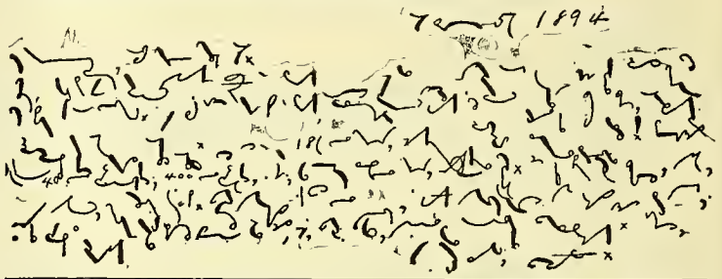

# "Monarch" Insulating Material.

A hard, black composition, which is not liable to crack or break during service, or alter its form under ordinary changes of temperature. It is moulded to exact shape, and is suitable for switch-blocks, sockets, bushings, telephone bases, and other parts requiring accuracy of dimension and finish.

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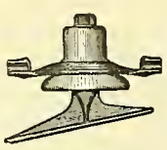

Insulated with Moulded Mica, and designed with special reference to their strength, durability and high insulating qualities.

**VULCABESTON** Heat Proof Insulation.

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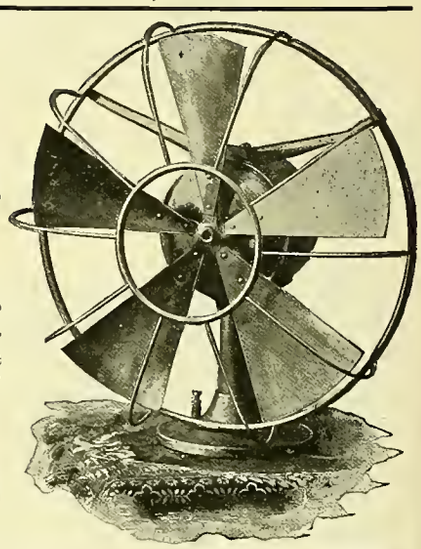
# THE BEST ELECTRIC FAN On the Market.



**For Alternating Current, Wound for 50 or 100 volts.**

The Fan is 14 inches in diameter.
Will always start when current is on.
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

Agents Wanted in Different Localities.

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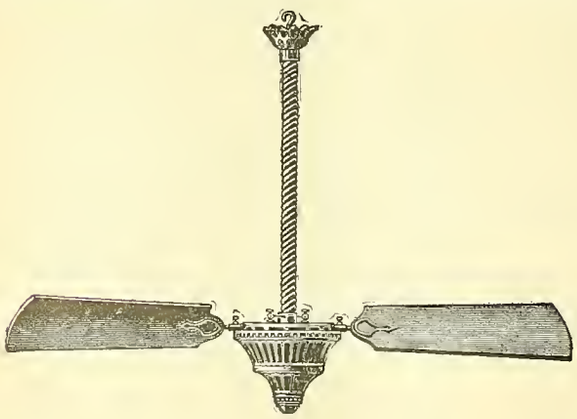

**AN EMPHATIC SUCCESS!**
**THE DIEHL ELECTRIC FANS WIRED IN A SERIES OF TWO OR MORE ON A STREET RAILWAY CURRENT.**

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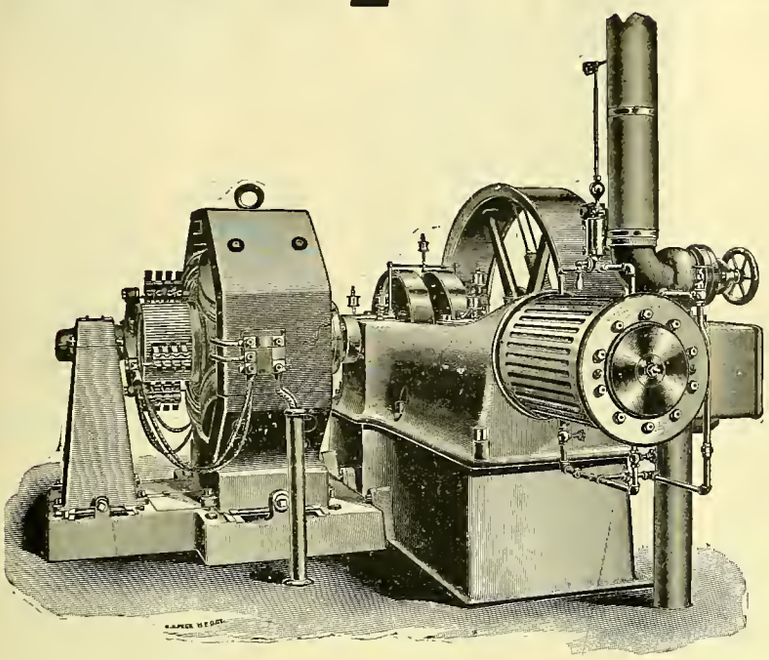

DIRECT CONNECTED OR BELTED
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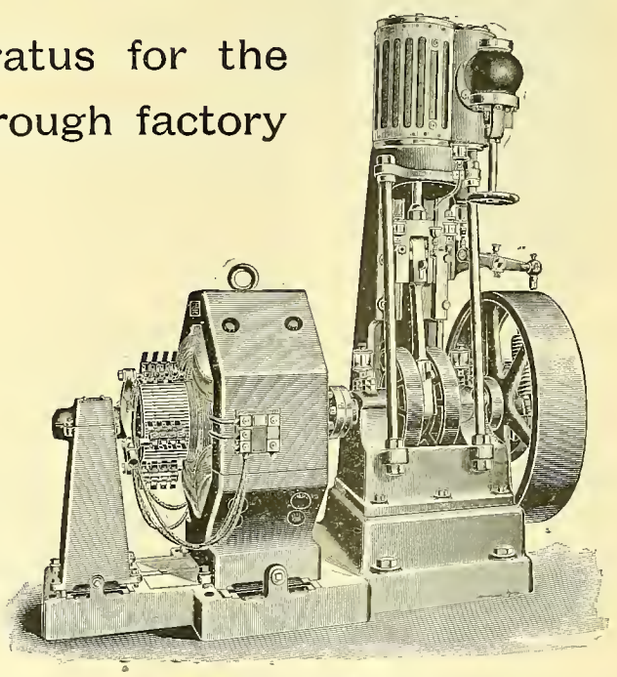
## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.



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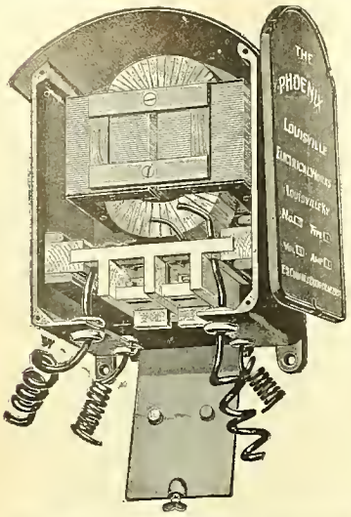

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*Embodies every poin' essential to A PERFECT Transformer.*

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THE HIGHEST EFFICIENCY AND CLOSEST REGULATION
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To try one is to adopt it for your FUTURE STANDARD.

**Louisville Electrical Works,**
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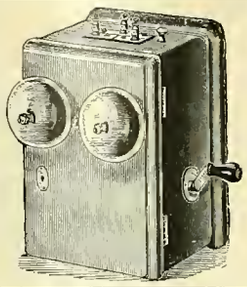

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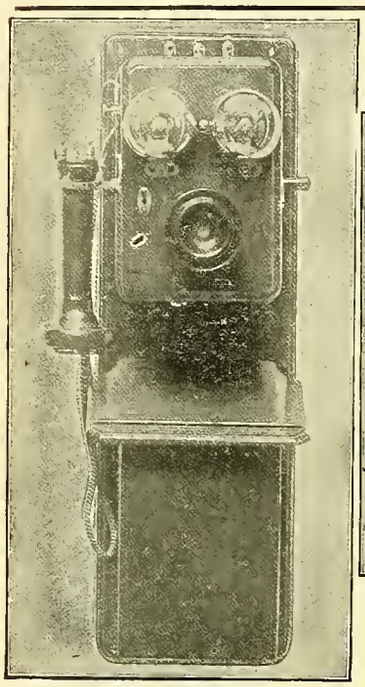
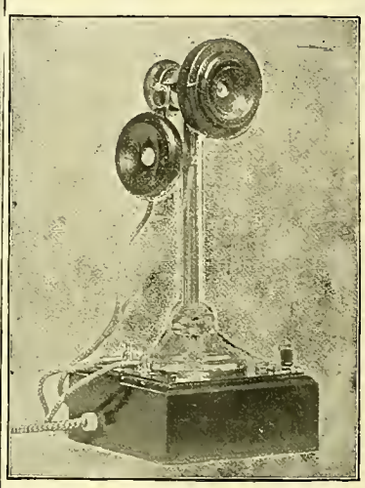


# M. & B.



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**Complete Exchange Plants.**
**Metallic or Ground Circuit.**

SWITCHBOARDS ABSOLUTELY GUARANTEED.

*STATE AGENTS WANTED.*

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Will speak one thousand miles on a properly constructed line. You can hear a watch tick one hundred miles. Is that satisfactory? If so, write to

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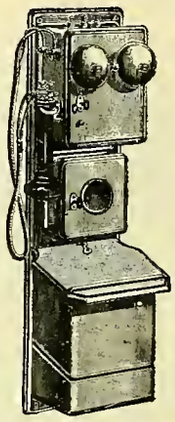
For prices and information. Send business card, I sell to the trade only.



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MAGNETO and
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WIRE AND CORD,
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The most Complete Stock.

**JULIUS ANDRAE & SONS CO.,**
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Our Instruments are absolutely

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**Supplies of Every Description.**

Transmitters (Blake Pattern); Hunning Silver Diaphragm or Magneto Receivers; Magneto Bells; Wire Cross Arms; Insulators; Induction Coils; Backboards; Switches; Batteries, etc. Wholesale Prices to Dealers.

**Farr Telephone & Const. Supply Co., Mfrs.,**
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Western Agents for DANBURY ELECTRICAL WORKS.

## TELEPHONES!!

This company is manufacturing **A Compound Magneto Telephone**
Which it sells outright under a guarantee both as to efficiency and as against infringement of patents.
It talks as well over one hundred miles as any other Telephone talks over one mile.
This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists.

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Brass, 12-inch, $15.00.

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*Ship at once 10 more Warwick Fan Motors C.O.D. They keep me cool, and dont burn out. Satan 1st Rex.*

Nickeled, Three Speed, $17.50.

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**THE DIETERICHS-WARWICK ELECTRIC COMPANY, CLEVELAND, OHIO.**

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WIRES AND CABLES

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WIRES AND CABLES

We have largely increased our factory facilities for the manufacture of our Paranite high grade rubber covered wire, and are now enabled, without in any way lowering the grade of our compound, to quote lower prices than ever before on this staple product.

We carry in Chicago a large and complete stock of

**Paranite Wires and Cables,**
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We are making a specialty of all kinds of Paranite rubber covered wire for telephone work, and are prepared to fill promptly all orders for cables from five conductors to five hundred.

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Our two conductor twisted telephone wire has become standard with telephone companies all over the country.

WIRES AND CABLES

WIRES AND CABLES

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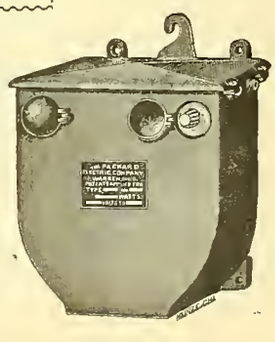

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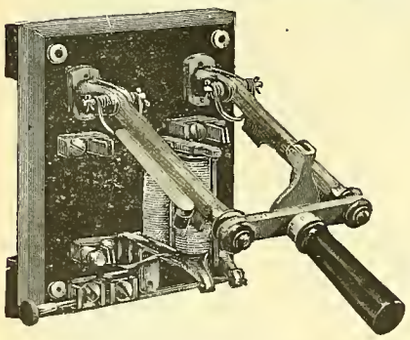

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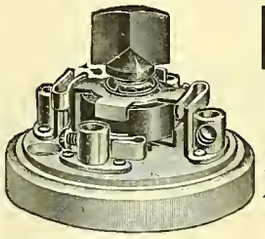

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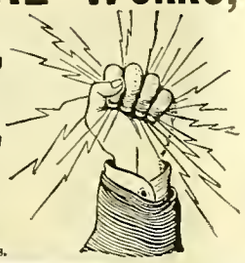

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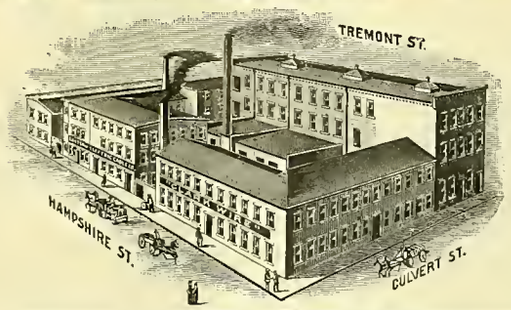


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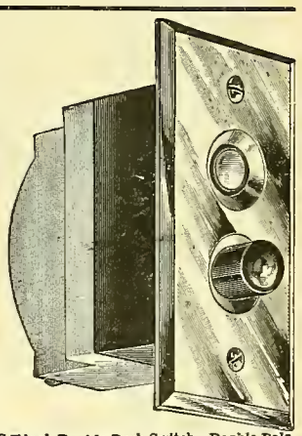

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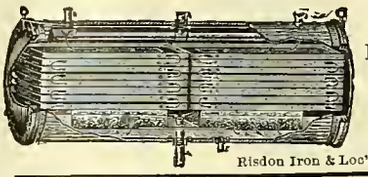

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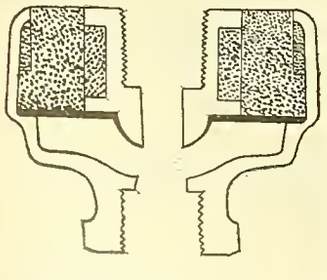

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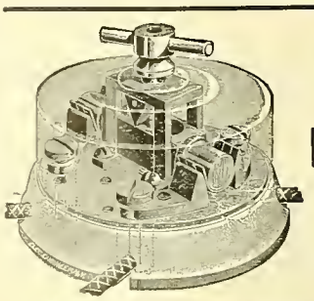

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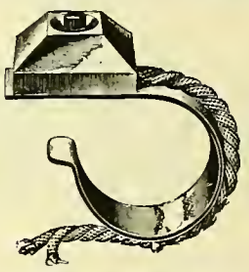

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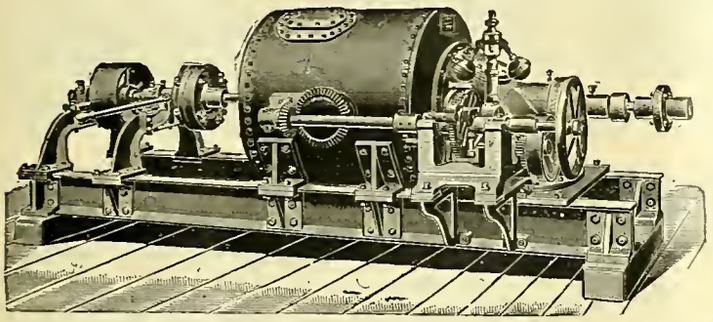

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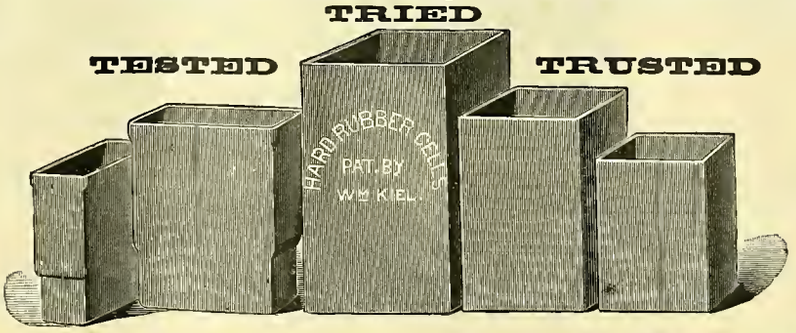


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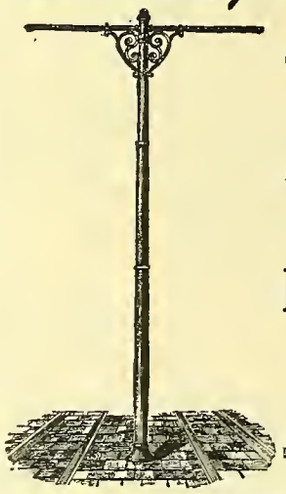

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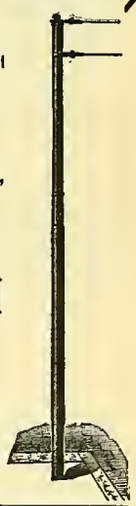

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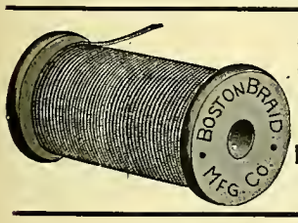


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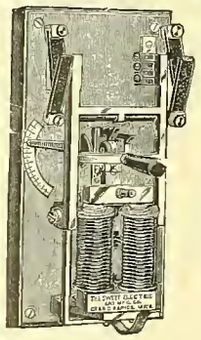

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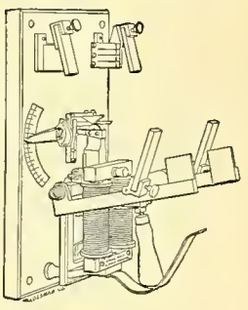

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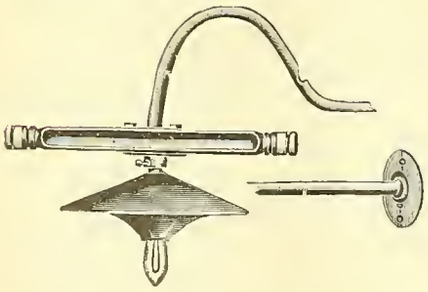

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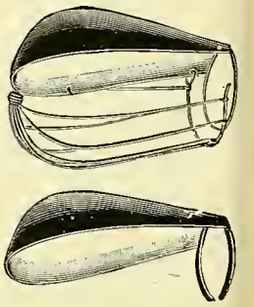

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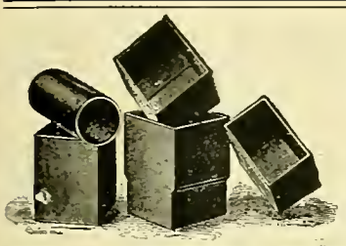

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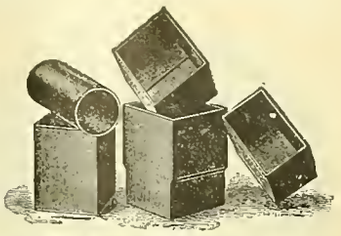

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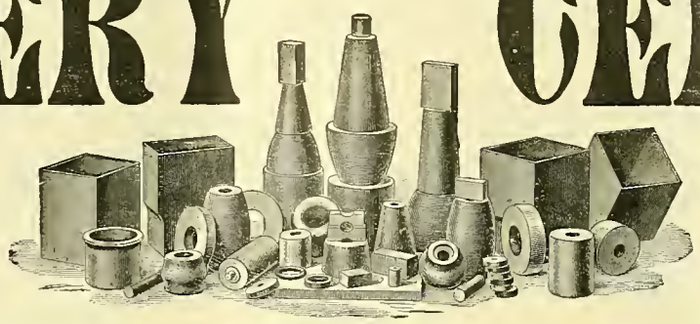

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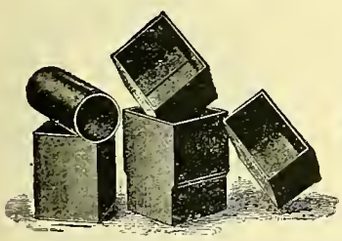

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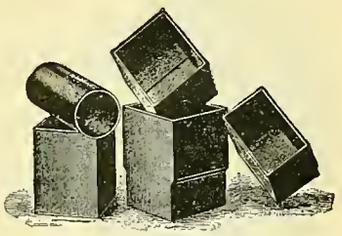

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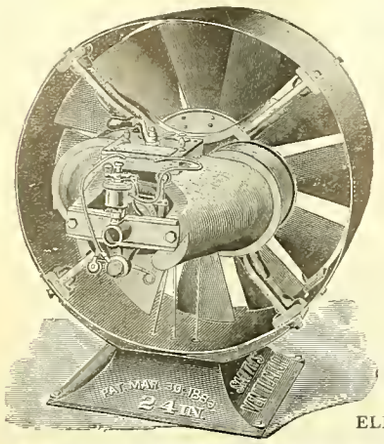


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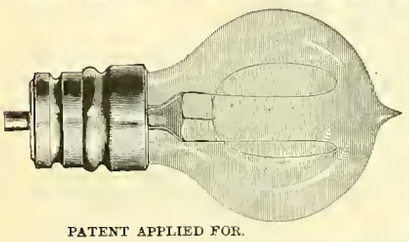

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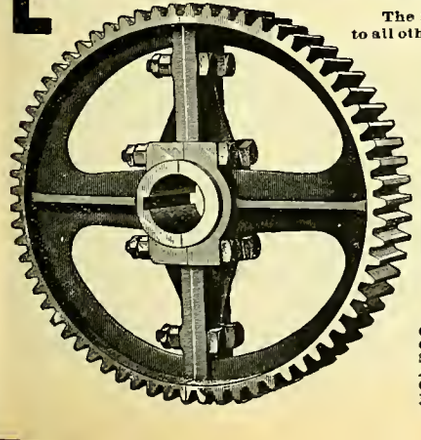

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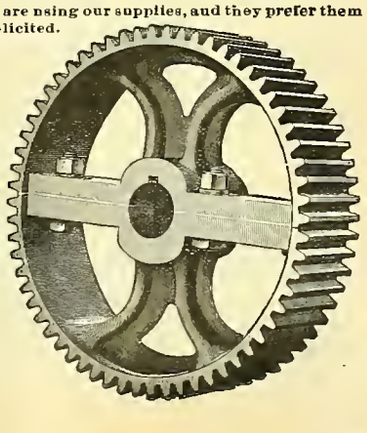

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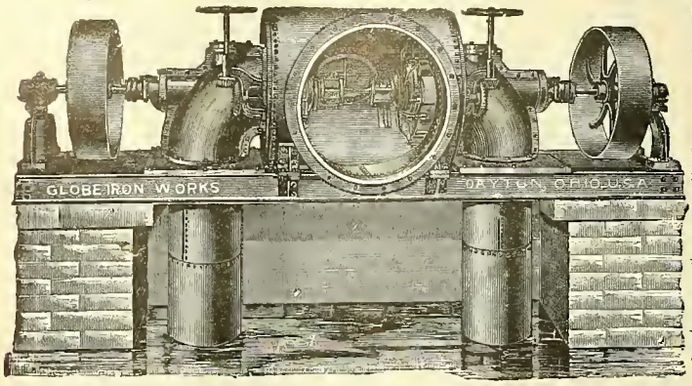


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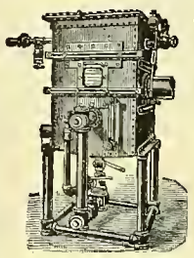

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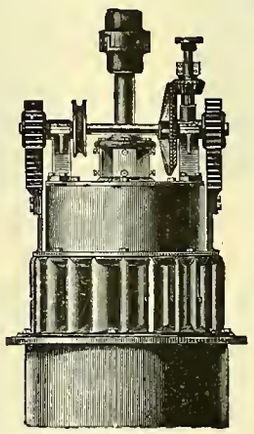

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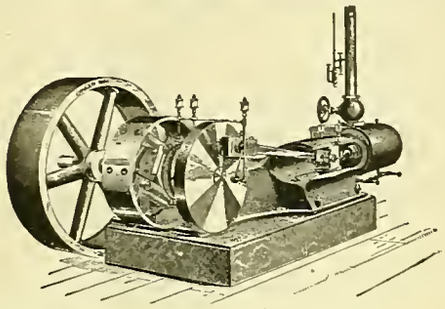

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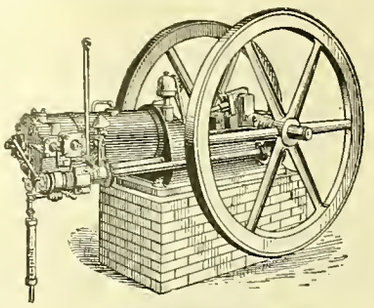

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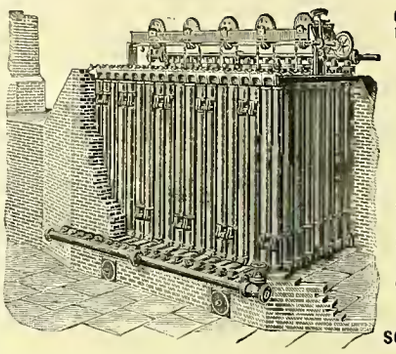

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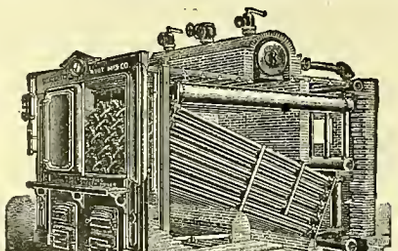

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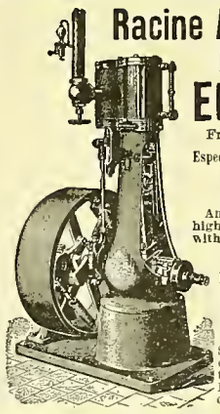

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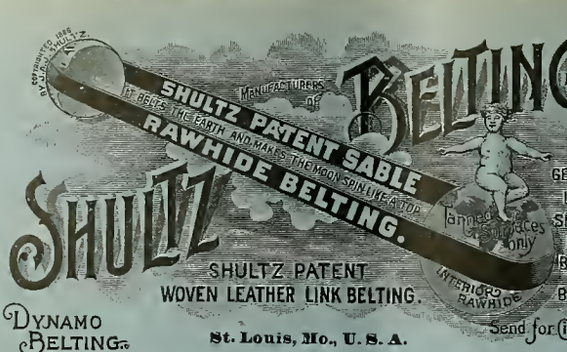


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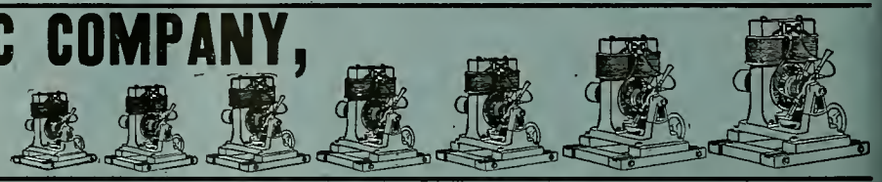

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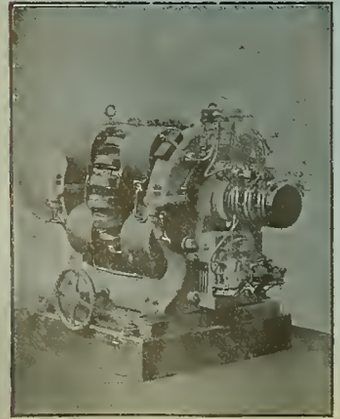

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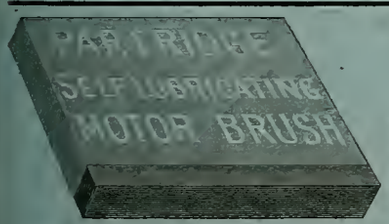


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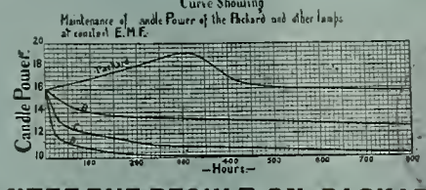


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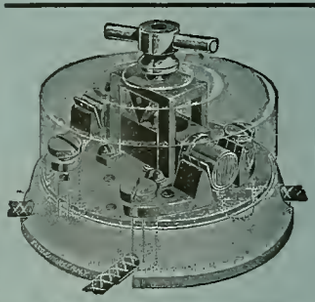

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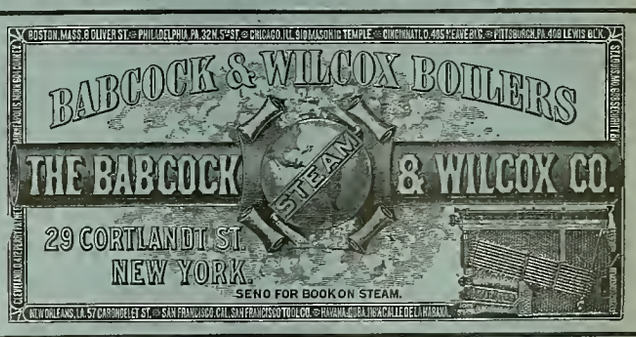


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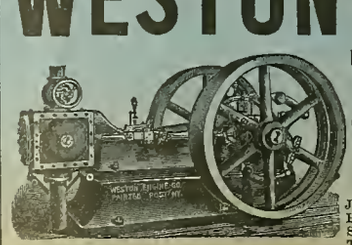

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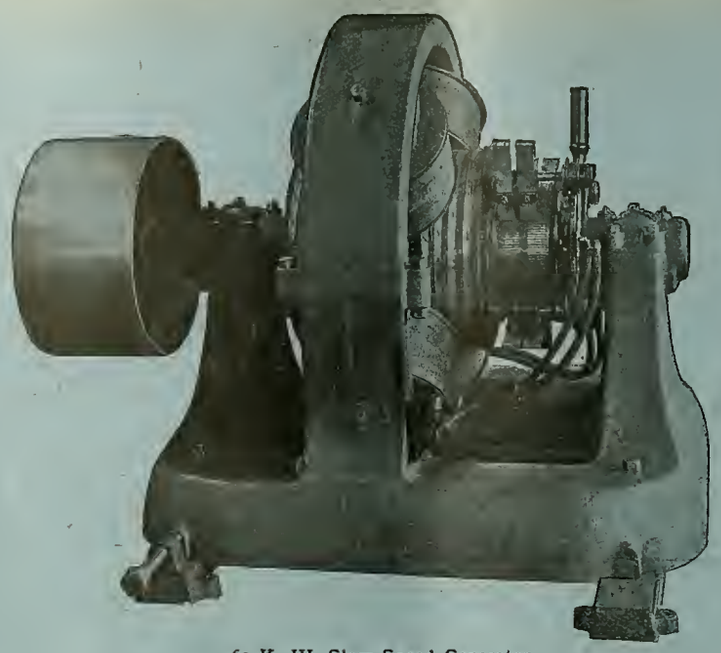

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Atlanta, Ga., Equitable Building.
Cincinnati, Ohio, 420 West Fourth Street.
Columbus, Ohio, 14 North High Street.
Nashville, Tenn., 308 North Summer Street.
Chicago, Ill., Monadnock Building.
Detroit, Mich., 13 Rowland Street.
Omaha, Neb., 309 South 13th Street.

Kansas City, Mo., New York Life Building.
St. Louis, Mo., Wainwright Building.
Dallas, Tex., Corner Elm and Griffin Streets.
Helena, Mont., Electric Building.
Denver, Colo., 505 16th St., Kittredge Bldg.
San Francisco, Cal., 15 First Street.
Portland, Ore., Front and Ankeny Streets.
Seattle, Washington, Bailey Building.

Foreign Dept. { Schenectady, N. Y. / New York Office, 44 Broad St.

Canada, Canadian General Electric Company, Ltd., Toronto, Ont.

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## CLASSIFIED LIST.


**Accumulators.**
Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co,
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.

**Arc Lamps.**
C & C Electric Co.
Central Electric Co.
Corey, R. H.
Crocker-Wheeler Elec. Co,
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Perkins El. Switch Mfg. Co.
Standard Thermometer Co.
Waterman, Chas. H.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Hemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Bicycles.**
Monarch Cycle Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Brownell & Co., The.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** .(See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Corey, R. B.
General Electric Co.
Partridge Carbon Co.
Reisinger, Hugo.
Waterman, Chas. H.
Wertheim, Ed.
Western Electric Co.

**Compound.**
Standard Paint Co.
Tornberg, Edw. R.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.
National Conduit Mfg. Co.

**Construction & Repairs.**
Allen-Hussey Co.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El. Const. Co.

**Contractors and Electric Light Plants.**
Allen-Hussey Co.
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Siemens & Halske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Dearborn Electric Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Brodie Electric Co.
Central Electric Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec, Mfg, Co.
Electric Appliance Co.
Electric Protection Co.
Elec. Selec. & Signal Co.
Farr Tel. & Const. Supply Co,
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Desks.**
Montgomery Ward & Co.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Siemens & Halske Elec. Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Allen-Hussey Co.
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg, Co,
Ford, Owen.
Thayer Electric Co.

**Electrical Instruments.**
Anderson, Albert & J. M.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Colgate Co., Geo. L.
Dearborn Elect c Co.
Diamond Electi Co.
Electric Appliat eCo.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Queen & Co. Inc.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Electrical Specialties.**
Allen, L. B.
Clark El. Specialty Mfg, Co.
Electric Protection Co.
Interstate Com. El. Const Co.
Nashold Cleat Co.
Proctor-Raymond Elec. Co.
Rockford Torch Co.
S. K. C. Specialty Co.

**Electrollers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.

**Engines, Steam.**
Ball & Wood Co., The.
Brownell & Co., The.
Chuse & Co., J. F.
Erie City Iron Wks.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Central Electric Co.
Davis Elec. Co., W. J.
Diehl & Co.
Dieterichs-Warwick El Co
Interior Conduit & Ins. Co.
Roth Bros. & Co.

**Feed Water Heaters.**
Gouberi Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Partrick & Carter Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Butler Mfg. Co.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Dieterichs-Warwick El. Co.
Electric Appliance Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Morris & MacCurdy;
Nashold Cleat Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Proctor-Raymond Elec. Co.
Queen & Co Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Sweet Elec. & Mfg. Co.
Thayer Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Edwards, W. S. Mfg. Co.
Hemingray Glass Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co.. Eugene.
Nashold Cleat Co.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okoulte Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Aetna Electric Works.
Am. Electrical Mfg. Co.
Automatic Elec. Spec. Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co, Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.

**Mica.**
Johns Mfg. Co., H. W.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Andrae & Sons, J.
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Dieterichs-Warwick El. Co.
Eddy Elec, Mfg, Co.
Elliott-Lincoln Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Works.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.
Standard Paint Co.

**Patents.**
Goocb, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd

**Pianos and Organs.**
Beethoven Piano & Organ Co.

**Platinum.**
Baker & Co.

**Poles.**
Morris, Tasker & Co.
Nuttall Co., R. D.
Valentine-Clark Co.

**Porcelain.**
Empire China Works.
General Electric Co.
Hemingray Glass Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Separators.**
Gouberi Mfg. Co.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones.**
Andrae & Sons, J.
Central Electric Co.
Farr Tel. & Const. Supply Co.
Gillette, E. & F.
Gustafson, W. A.
Jameson & Co., W. D.
M. & B. Telephone Co.
Mo Telephone Mfg. Co.
Partrick & Carter Co.
Phila. Telephone Co.
Public Telephone Co.
Western Electric Co.
Western Tel. Const. Co.

**Transformers.**
Central Electric Co.
Diamond Electric Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hornberger Elec. Mfg. Co.
Louisville Elec. Works.
Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Trolley Cord.**
Samson Cordage Wks.

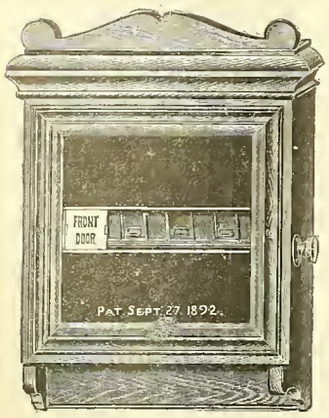
**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Chi. Shorthand Institute.
Int. Corr. Schools.
Rose Poly. Institute.
Scientific Machinist Co.

**Water Wheels.**
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okoulte Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.

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Made in Sizes from 4 to 20 Drops.

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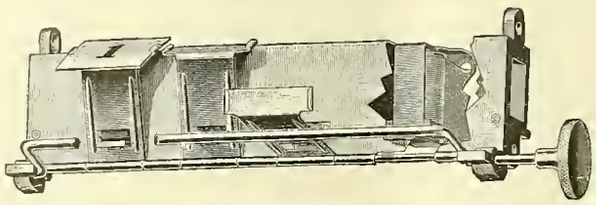

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No Springs. No Screws. Nothing to get out of adjustment. Simplicity itself.

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**ECLIPSE** Iron-box Bells,
**SPARK** Coils,
**WOOD** Push Buttons,
Floor Pushes,
Door Connections, etc., etc.

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ELECTRA
TRADE MARK.

ELECTRA
TRADE MARK.

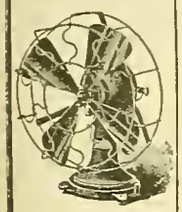
## FOR DIRECT CURRENT ARC LAMPS.

## FOR ALTERNATING CURRENT ARC LAMPS.

**Are the most economical and efficient manufactured. They produce a very brilliant and absolutely steady light, burning without any dust.**

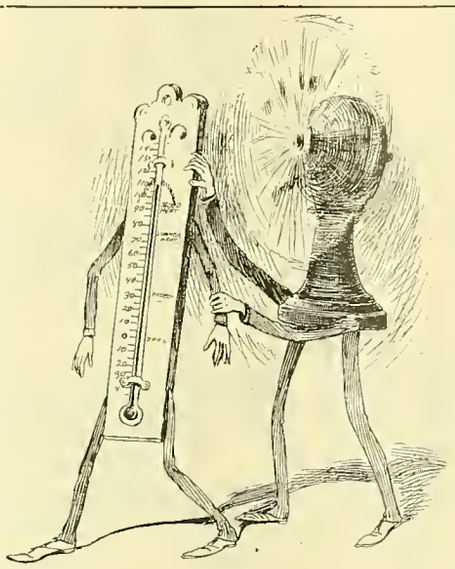
## HUGO REISINGER,

**NO. 38 BEAVER STREET, NEW YORK.**
Sole Importer for the United States and Canada.



Scheeffer Recording Watt Meters.

# Suppressed News.



Think of a police officer modest enough to suppress for a full fortnight information of an important arrest! But it's so. The delayed report comes from Inspector Moore's district, Auditorium Tower Station. Two weeks ago our popular but eccentric citizen, Mr. Theo. Mometer, who is known to possess a decidedly mercurial temperament, indulged in a real old fashioned "tear" (pronounced *tare*). About the time he began to feel "comfortable" his neighbors experienced a distressingly uncomfortable feeling. The ever watchful Officer Lundell happened along just then and promptly took the hilarious citizen in tow and landed him in the cooler, where he has since had ample opportunity to sober down and reflect upon the mutability of human affairs. It is rumored that a prominent ice man with a strong pull will bail him out. However this may be, the community has naught to fear so long as Capt. Lundell is on duty. The handsome captain will be remembered as the officer who rendered such efficient service during the hot times last year. Although his name appears but **once** on the pay roll (a distinction in these days of O'Malleys and Sullivans), he is ever alert to his duty. He is one of the finest. —*Tribune.*

Diamond Transformers.

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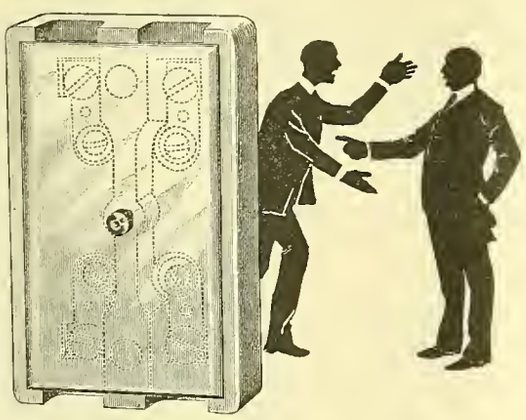


Main Cut-Out.

Interior Conduit Supplies.

**We are paying** careful attention to the miscellaneous small supplies used by **Central Stations** and **Railways**. We particularly solicit "hurry-up" mail orders. With very few exceptions we ship the goods same day that order is received, in any event promptly advising customers just what to expect.

Pharos Incandescent Lamps.

---

GENERAL WESTERN AGENTS

Okonite Wire and Products. Interior Conduit Supplies. Helios Incandescent Arc Lamps, Direct or Alternating. Lundell Fans and Motors. Carpenter Enamel Rheostats.

---

# Central Electric Company,

## 173-175 Adams St.,

## CHICAGO.

Saint Louis,
Southern Electrical Supply Co.

Kansas City,
Gate City Electric Co.

# INCANDESCENT LAMPS.

WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

## GLOBE ELECTRIC LIGHT CO., General Offices: Carter Building, BOSTON, MASS.

AGENTS WANTED. WRITE US.

---

# BUCKEYE

QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

INCANDESCENT LAMPS

Monadnock Building, Chicago. THE BUCKEYE ELECTRIC CO., Cleveland, O.

---

# PATENT DECISIONS

Have never yet affected the user of apparatus made by the

## Western Telephone Construction Company.

The recent "Berliner Decision" cannot interfere with its use, although it is claimed that the Berliner patent covers all forms of microphones made by all other Companies.

Do business at fair prices with a Company that is proven RELIABLE and RESPONSIBLE, and avoid trouble and loss.

---

THE FOLLOWING EXCHANGES IN SUCCESSFUL OPERATION (SOME OVER A YEAR) USE "WESTERN" APPARATUS, ACKNOWLEDGED BY THE BEST POSTED TELEPHONE PEOPLE (AND CLAIMED BY US ABSOLUTELY) **NOT TO INFRINCE** ANY PATENT OWNED BY THE BELL COMPANY:—

Cambridge, Ohio, 200 telephone capacity, (formerly had 60 Bell "Microphone"), Bell people offered free service in vain.

Van Wert, Ohio, 150 telephone capacity, (formerly had 65 Bell "Microphone"), Bell exchange system abandoned entirely.

Webster City, Iowa, 150 telephone capacity, (formerly Bell, "Blake," "National" of Boston, and others, now equipped with ***Western.***

Washington, Iowa, 100 telephone capacity, (Bell system would not pay at $48.00 and $36.00, Western system a complete success, earning 20 per cent. at $24 00, and $18 00 per annum.

Decatur, Ind., 100 telephone capacity, (could not afford a Bell system), "Western System" earning good profit at low rates.

Petaluma, Cal., 150 telephone capacity, (operating expense with "Western System" thirty-one cents (31) per telephone per month).

Santa Fe, N. M., 100 telephone capacity, (Bell system "gave up the ghost" after the ***"Western"*** started).

Palatka, Fla., 100 telephone capacity. (What became of the Bell there?)

Palestine, Tex., 150 telephone capacity, (Bell system behind the times—***"Western"*** successful).

Greensboro, N. C., 100 telephone capacity. (***Western*** successful against Bell.)

Salisbury, N. C., 100 telephone capacity, (Bell system "not in it" with ***"Western"*** there).

---

But why again enumerate? Buy apparatus that the Bell people have failed to defeat commercially or with patents—from the

# Western Telephone Construction Company,

OFFICES AND FACTORY:

250, 252 and 254 South Clinton Street, Chicago, Ill.

NOTE:—Largest manufacturers of telephone apparatus, exclusively, in the world.

The Boudreaux Dynamo Brush Co. NO GAUZE.

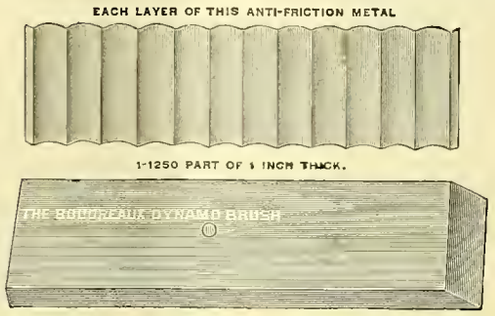
# WILL YOU BE IN IT? YES!

The Boudreaux Dynamo Brush Co. NO CARBON.

**USE**

## THE BOUDREAUX DYNAMO BRUSH.

NO SPARKING.
NO CUTTING.




NO TRIMMING.
NO GREASING.

The Boudreaux Dynamo Brush Co. has given the sole agency for the Dominion of Canada to R. E. T. Pringle, Montreal, Que. There is no doubt that the brush will meet with the same favor it has encountered in the United States.

The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

## THE BOUDREAUX DYNAMO BRUSH CO.,

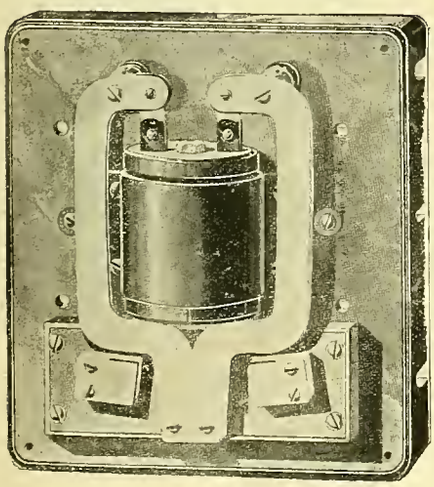
**Mallers Building, CHICAGO.** **Postal Telegraph Building, NEW YORK.**

Sole Agent for Canada, R. E. T. PRINGLE, Montreal, Que.

The Boudreaux Dynamo Brush Co. NO COPPER.

# SINCE MARCH 1st

# Our New (Model 1895) Electric Light and Power Controllers



HAVE BEEN ADOPTED BY CENTRAL STATIONS OPERATING

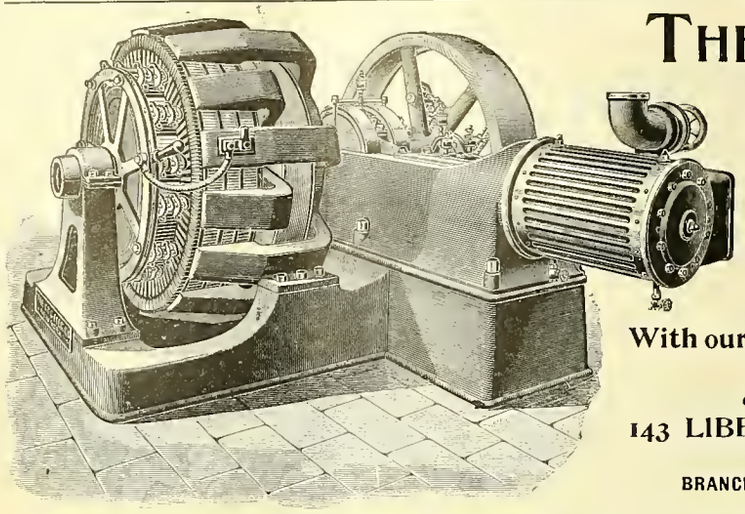
**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{On}{Out}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

OUR GENERAL WESTERN AGENTS ARE

## WALLACE ELECTRIC CO., 307 DEARBORN ST., CHICAGO.

## ELECTRIC SELECTOR & SIGNAL CO., 45 Broadway, New York.



# THE C & C ELECTRIC CO.

MANUFACTURERS OF

## Bipolar AND Multipolar Dynamos,

Automatic and Hand Controlled Motors,
Complete Plants for Power Transmission,
Isolated Lighting Plants, Central Station Apparatus.

With our Extensive Works we are prepared to fill promptly all orders for 1 H.-P. to 250 H.-P.

GENERAL OFFICES: 143 LIBERTY ST., NEW YORK.

WORKS: GARWOOD, N. J. On Central R. R. of N. J.

BRANCH OFFICES: CHICAGO, Monadnock Building. BOSTON, 63 Oliver Street. CLEVELAND, Cuyahoga Building. PHILADELPHIA, 633 Arch Street.

# HELIOS ELECTRIC COMPANY,

Factory and Offices,

**1310 Filbert Street, Philadelphia, Pa.**

*We have no Stock nor Old Style Lamps that we must get rid of at any price—no junk.*

## THE HELIOS LAMPS

Are the latest patterns and newest type. Our Lamps are much in advance of any lamp now on the market, because they are New and of Latest Designs.

Our ALTERNATING LAMPS have Reflector Plates. Our DIRECT CURRENT Lamps do not see-saw. Our Focusing Lamps, both Direct and Alternating, are especially adapted for photo-engraving and stereopticon work.

Anchor Electric Co., New England Agents, Boston, Mass.
Central Electric Co., Western Agents, Chicago.
Moore & Baylis, Agents for Western New York, Buffalo, N. Y.,
Globe Electrical Supply & Construction Co., New York City Agents, Vandam and Greenwich Streets, New York.
Mountain Electric Co., Agents for Colorado, Utah, Wyoming and New Mexico, Denver, Col.
Machinery Supply Co., Agents for Southern California and Arizona, Los Angeles, Cal.
W. T. M. Mottram, Agent for Texas, Dallas, Tex.
Canadian General Electric Co., Canadian Agents, Toronto, Canada.
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## CHICAGO SHORTHAND INSTITUTE, 35th St. and Wabash Ave.

**A Central School of Shorthand and Typewriting of the most Modern and Complete Type.**

**A COMPLETE COURSE OF SHORTHAND.** We offer you shorthand instructions in abundance, and most excellent in quality. Our course is graded and arranged in logical order. We claim not a new system, but a new method of imparting the art of shorthand by which we can equip any ordinary intelligent person for the execution of any stenographic work devolving upon the expert steongrapher or court reporter.

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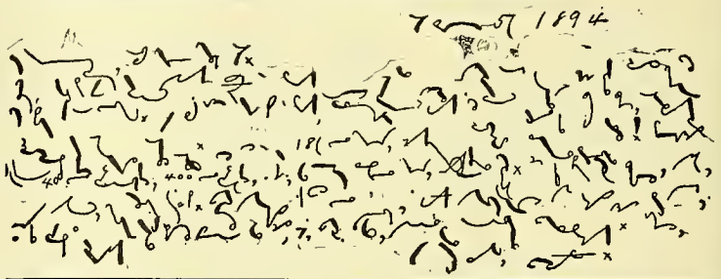
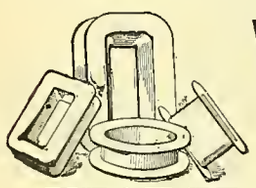
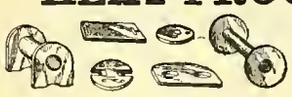




# VULCABESTON

Field Magnet and Arc Lamp Regulator Spools, Bushings, Washers, Controller Parts, Commutator Rings, etc., for use in connections requiring a tough and strong

## HEAT-PROOF INSULATION.



Send for Price List.

## MOULDED MICA Trolley Line Insulators.

They are not always the cheapest at first, but they are always the best in the end.

H. W. JOHNS MFG. CO.,

NEW YORK, PHILADELPHIA, BOSTON. 240-242 Randolph St., CHICAGO

# THE BEST ELECTRIC FAN On the Market.

**For Alternating Current, Wound for 50 or 100 volts.**

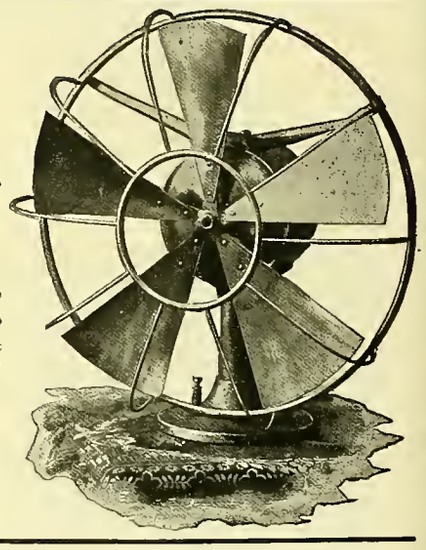
The Fan is 14 inches in diameter.
Will always start when current is on.
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

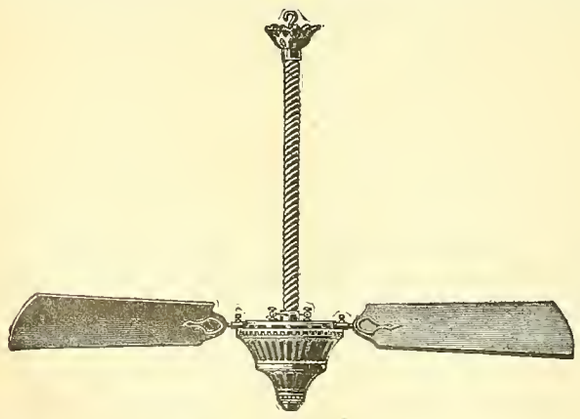
Agents Wanted in Different Localities.

For further information address THE

**W. J. Davis Electric Co.,**

PITTSFIELD, MASS.

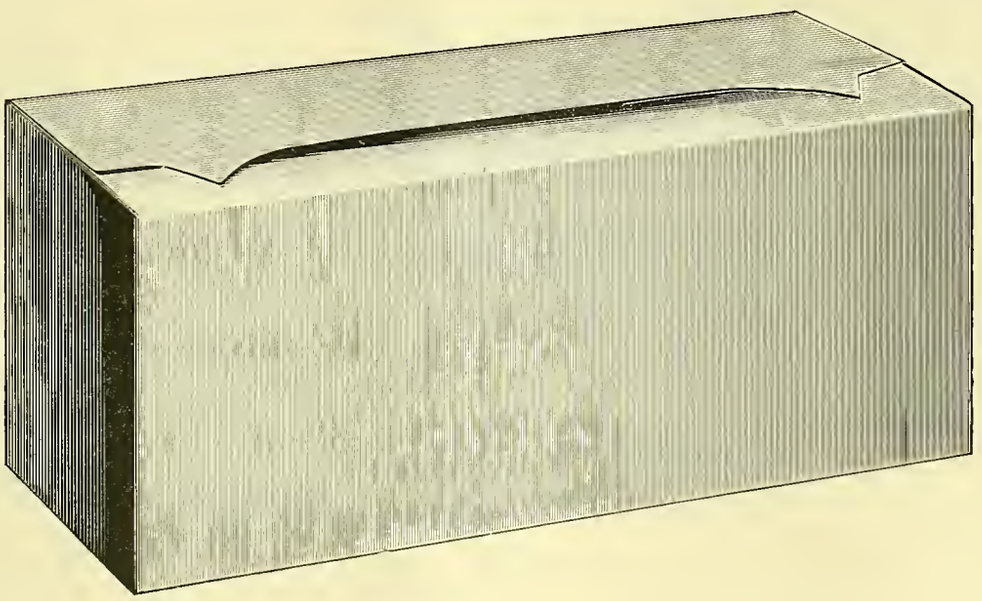




**AN EMPHATIC SUCCESS!**
**THE DIEHL ELECTRIC FANS WIRED IN A SERIES OF TWO OR MORE ON A STREET RAILWAY CURRENT.**

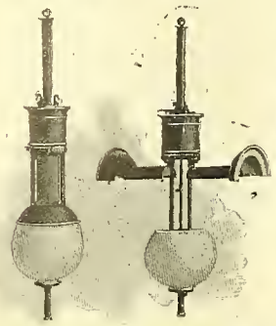
DIEHL & COMPANY, 385 BROADWAY, NEW YORK.

# This Box Will Be Opened



## NEXT WEEK.

# The S. K. C. Spark Arrester,



## STORM AND BUG PROTECTOR.

*Cheap, Durable, Effective,*
*Ornamental,*
*Readily Applied,*
*Operates Perfectly.*

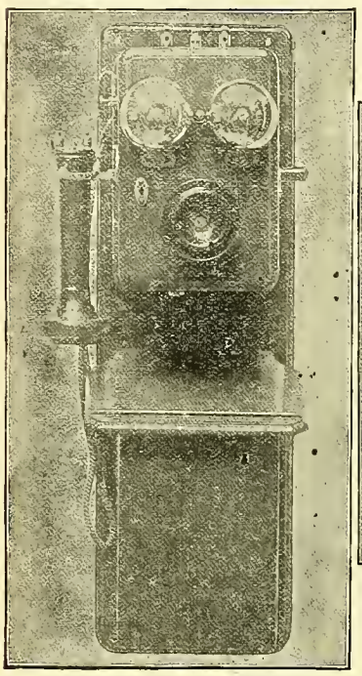
Manufactured by the

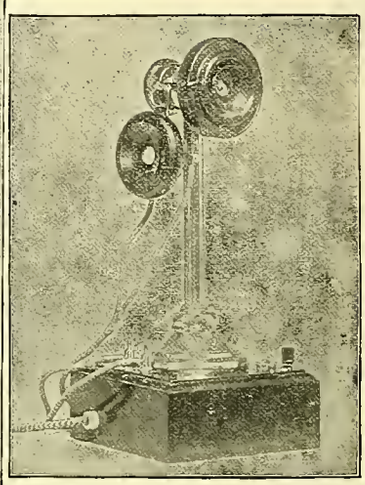
**S. K. C. SPECIALTY COMPANY,**

Western Agents: Wallace Electric Co., 307 Dearborn St., Chicago.
New England Agent: Fred. P. Barnes, Equitable Bldg., Boston, Mass.

PITTSFIELD, MASS.

# M. & B.





## Desk Set.

**Complete Exchange Plants.**
**Metallic or Ground Circuit.**

**SWITCHBOARDS ABSOLUTELY GUARANTEED.**

*STATE AGENTS WANTED.*

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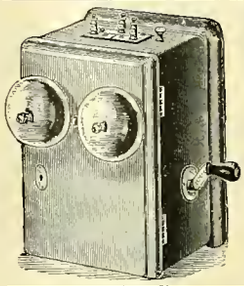
FOR ALL PURPOSES, AT THE LOWEST PRICES.
SEND FOR CATALOGUE.

MISSOURI TELEPHONE MFG. CO., 1230 Olive Street, ST. LOUIS, MO.



## MAGNETO BELLS

AND

Standard Goods. No Infringements. **TELEPHONES.** Get Our Prices Before Purchasing Elsewhere.

**E. & F. GILLETTE,**
BAYPORT, CONN.

## BLAKE TRANSMITTERS.

**COMPLETE, $2.00 EACH.**

In Walnut and Oak Cases.
Blake Transmitter Castings, $1.00.

**Philadelphia Telephone Co.,**
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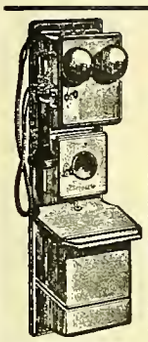

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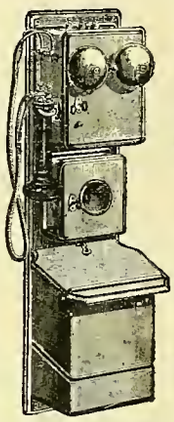
IS CALLED THE

## Long Distance,
**No. 1.**

Will speak one thousand miles on a properly constructed line. You can hear a watch tick one hundred miles. Is that satisfactory? If so, write to

**W. A. GUSTAFSON,**
JOLIET, ILL.,

For prices and information. Send business card, I sell to the trade only.



TELEPHONES,
RECEIVERS,
TRANSMITTERS,
MAGNETO and
EXTENSION BELLS,
WIRE AND CORD,
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GLASS INSULATORS.

The most Complete Stock.

**JULIUS ANDRAE & SONS CO.,**
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Our Instruments are absolutely

**NON-INFRINGING.**

## $5 TO $15 TELEPHONES.

**Supplies of Every Description.**

Transmitters (Blake Pattern); Hunning Silver Diaphragm or Magneto Receivers; Magneto Bells; Wire Cross Arms; Insulators; Induction Coils; Backboards; Switches; Batteries, etc. Wholesale Prices to Dealers.

**Farr Telephone & Const. Supply Co., Mfrs.,**
**Sales Store and Office, 342 Dearborn St., Chicago.**
Western Agents for DANBURY ELECTRICAL WORKS.

## TELEPHONES!!

This company is manufacturing **A Compound Magneto Telephone** Which it sells outright under a guarantee both as to efficiency and as against infringement of patents.

It talks as well over one hundred miles as any other Telephone talks over one mile.

This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists.

**WESTERN TELEPHONE CONSTRUCTION CO.,**
**539, 540 and 541 Monadnock Blk., Chicago, Ill.**

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Which is now ready, contains 100 pages and will be found of unusual interest. Anyone wishing to obtain a complete list of all the electrical books published to date, together with descriptions of the most important, can do so by writing us.

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**DO YOU WANT**

The best made?

To be up to time?

Quick results from a 'phone?

To save time?

The most efficient?

The most durable? Then

**Buy the "Gerson"**

These 'phones are used on private lines between Boston and Chicago.

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**Long Distance and Interior.**

**SATISFACTION GUARANTEED.**

U. S. Government gives the "Gerson" 99 per cent. for efficiency—highest given.

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**150 Broadway, New York,**

SOLE AGENTS FOR

## THE GERSON Electrical Mfg. Co.,

INCORPORATED,

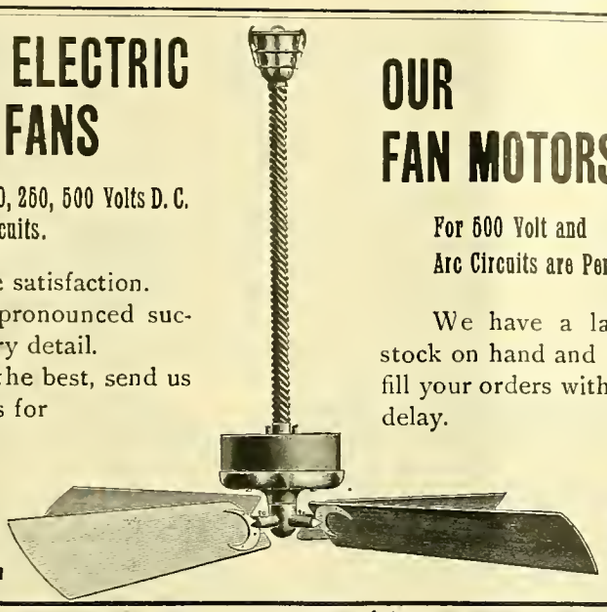
of Philadelphia, Pa.

# DAYTON ELECTRIC CEILING FANS

For 110, 220, 250, 500 Volts D. C. and Arc Circuits.

Give absolute satisfaction.
They are a pronounced success in every detail.
If you want the best, send us your orders for

# THE DAYTON.



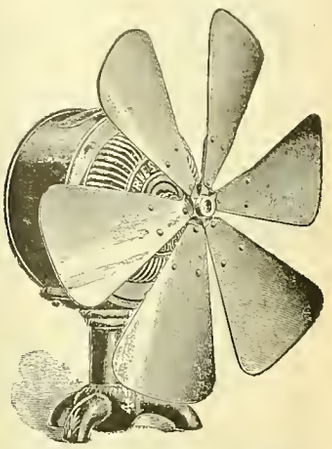
# OUR FAN MOTORS

For 500 Volt and Arc Circuits are Perfect.

We have a large stock on hand and can fill your orders without delay.

# ALTERNATING FAN MOTORS.

We have a limited stock of the Ries and Scott Fan Motors on hand. As we are making an exceptionally low price on them, they are going fast. If you are looking for a bargain in this line, we can accommodate you. Send us your orders at once if you wish to take advantage of low price.



# METROPOLITAN ELECTRIC COMPANY,

186-188 Fifth Avenue, Chicago, Ill.

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# STANDARD "WARD" ARC LAMPS,

**$10.00** EACH,

***Including Resistance, Clear Globes, and Tested Ready for Use.***

This price for 6½, 8 and 10 ampere lamps sold in pairs; single lamp with large resistance, globe, etc., $12.00.
In lots of 50 or more, as received from the manufacturer, without globes, resistance or testing,

**$7.50** EACH.

Knight Direct Current Lamps furnished complete with clear globes, resistance and testing,

**$9.00** EACH.

Knight Alternating Current Lamps, complete,

**$10.00** EACH.

Also Ward and Knight High Tension Lamps for Series Circuit; Railway Lamps; Twin Lamps; Focusing, Photo-Engraving and Stereopticon Lamps at Lowest Prices.

**CARBONS**—Lacombe, Hardtmuth, Siemens & Halske, National, Fidelity, Solar, Lancaster, Globe, at Lowest Prices.

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ESTABLISHED 1873.
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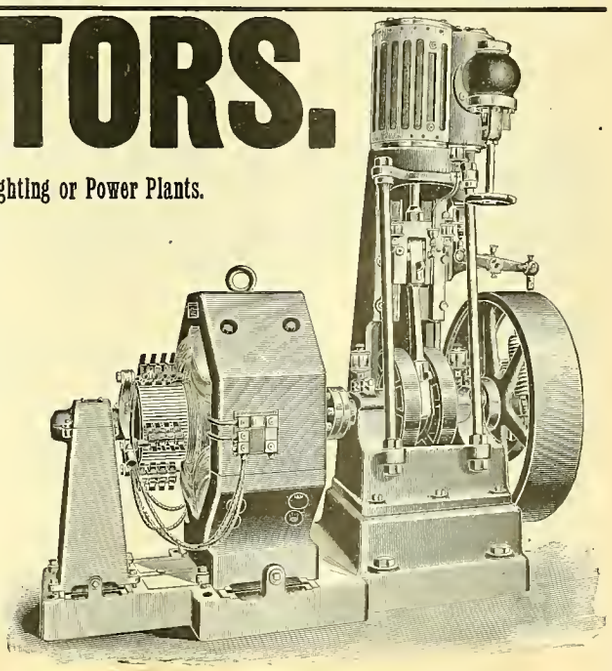
# EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*



# THE EDDY ELECTRIC MFG. CO.,

*WINDSOR, CONN.*

NEW YORK OFFICE, HAVEMEYER BLDG.

*REPRESENTED BY:*

Walter C. McIntire & Co., 506 Commerce St., Philadelphia, Pa.
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**All Our Apparatus Guaranteed as Represented.**

We are this summer prepared to fill the

# "LONG FELT WANT"

For an alternating current ceiling fan. When we state that this device is being manufactured by the Emerson Company, the well-known manufacturers of the celebrated Meston motors, and will be known as the

# MESTON CEILING FAN,

We know the trade will be assured that the demand is to be satisfactorily supplied.

As the Meston Fan Motor was the first successful alternating current fan motor of any kind on the market, so the Meston Ceiling Fan is destined to be the first (and up to date the only) satisfactory alternating current

## CEILING FAN.

Write us for particulars and prices.

**Electric Appliance Company,**

ELECTRICAL SUPPLIES. 242 MADISON STREET, CHICAGO.

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**USE THE BEST!**

**Eureka Commutator Compound.**

A perfect Compound for Dynamos and Motors. Works on any Commutator with Copper or Carbon Brushes. Send for sample; price 50c per stick.

**Edw. R. Tornberg,**
SIOUX FALLS, S. D.

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**The Brady Mast Arms.**

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This system does not infringe the patents of the Bell Telephone or Western Electric Co. We build exchanges complete for local companies, or will install and operate exchanges ourselves at a low monthly rental. We keep in stock Blake transmitters and all kinds of supplies.

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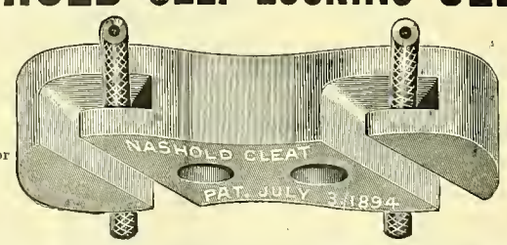
Patented in U. S., Canada, England, France, And Applied for In Germany.

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**It is the most practical Cleat made.**
**It is made of finest glazed porcelain.**
**It is in one piece.**
**It has the strength.**
**It will lock the wire firmly.**
**It will NOT break in putting up.**
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The wire can easily be put in place or removed without loosening the Cleat. It is a great saver in Time and Labor over any other Cleat in use for putting up Electric Light or other Wires.

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Guaranteed 98/99% and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by

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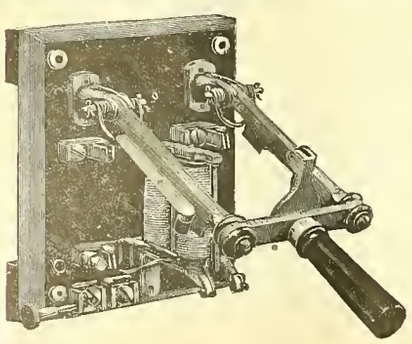

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INCANDESCENT AND FLEXIBLE CORDS,

Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

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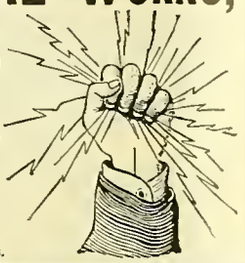

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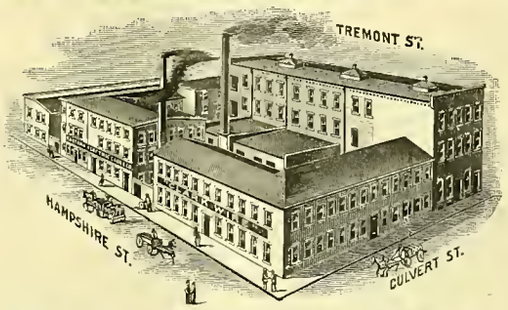


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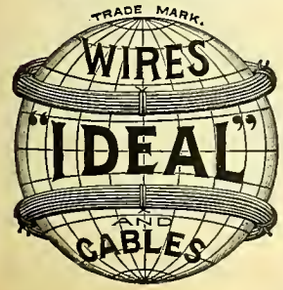


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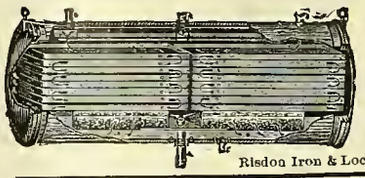

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*To Steam Users, and others interested in the manufacture, purchase, or use of, and sale, of Steam Boilers.*

Having been granted Letters Patent on a "Safety Water Tube Boiler," of the "type" and "class" in which the Steam and Water drums are arranged and located transversely to the flow of products of combustion in their travel from the furnace to out-take to stack, of which the "Stirling" and "Pierepoint" are examples. My patents covering, in a fundamental degree, devices and arrangements, for the maintenance of contiouous circulation throughout the entire boiler system, and, it having become known to me that certain parties are offering for sale boilers of this class, for which boilers they claim such continuous circulation, it is, therefore, necessary for me to notify manufacturers, users, buyers and sellers, and those who may be acting as agents for the sale of such boilers, that the same are a direct infringement of my patents, which it is my purpose to protect to the utmost extent, at the same time to guarantee to all purchasers of my Boilers the fullest protection against claims or litigation on the part of any and all patentees of Water Tube Boilers.

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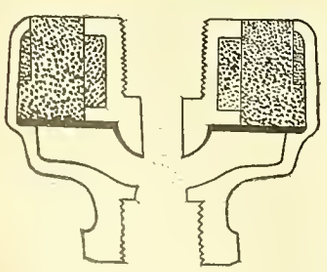

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**For Insulating Fixtures.**

This joint conforms to the requirements of Underwriters' rules. Write for prices and circulars.

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½ H. P. and upward.
25 to 800 Lights.

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Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the Inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.

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We are the only firm manufacturing his latest battery. All batteries are made under Mr. Burnley's personal supervision. We are the pioneers in the making of successful dry batteries and have had more experience in this line than any other concern in the country.

When you buy the Imperial you have the satisfaction of knowing that they are made by the original dry battery manufacturers and guaranteed to be the best on the market.

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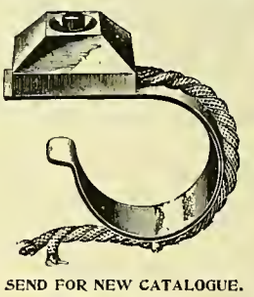

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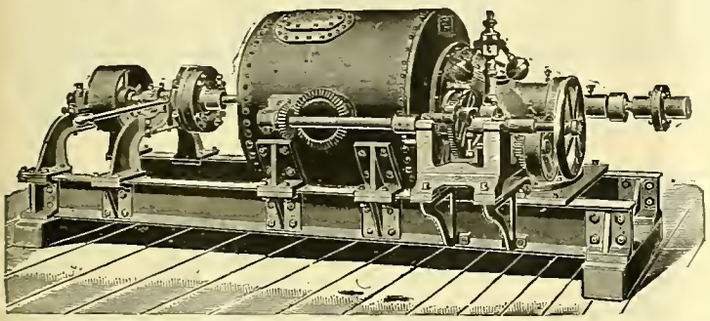

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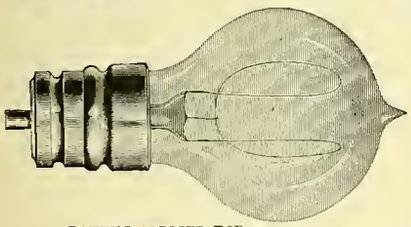

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*A good lamp at a fair price. Ordinary lamps at ordinary prices.*

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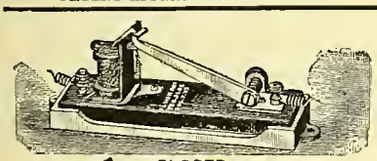

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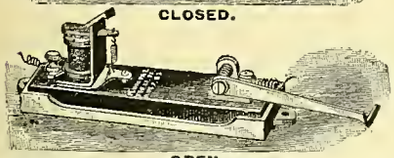

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**Regular Size, 6 inches long, 2¾ inches high, 1 to 1½ inches wide.**

In a suit brought against F. Stevens by the Cutter Company, claiming an infringement on an Electric Flush Switch, it was decided in his favor by the United States Court in December last, the Court dismissing the case with costs.

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Special attention given to the construction of models and inventors' experimental work.

**WE CLAIM**

**For the Plush Protectors,** simplicity, sure action, ready adjustment, and interchange of parts.

**For the Stevens Flush Switch,** fire and damp proof. Mechanism is simplicity itself. Nothing to get out of order. Make and break so wide that no arc can form. Wired without removing casing. Buttons made of mother of pearl. Base made of vulcabeston with porcelain cases.

Impossible for them to get out of order.

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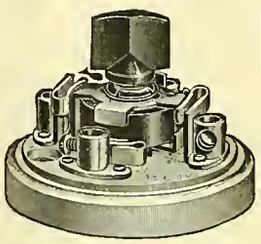
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



## FLUSH SWITCHES

Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

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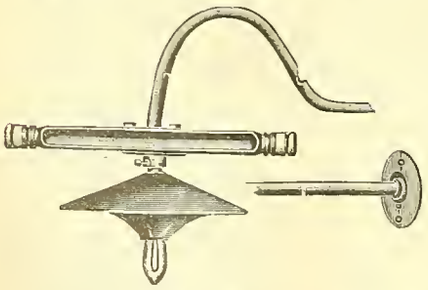

## WHAT ARE THEY?

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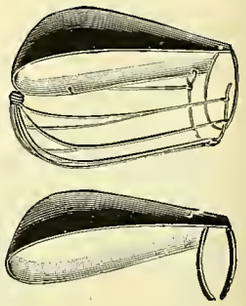
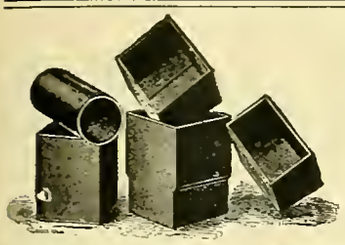
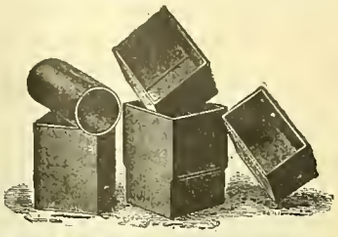


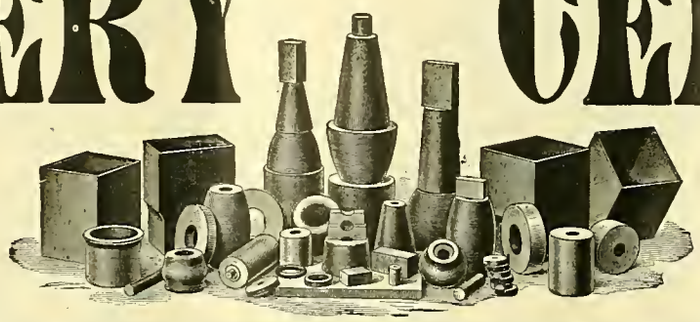
## BUTLER MANUFACTURING CO., 46 S. Clinton Street, CHICAGO.



# THE FREEMAN



# BATTERY CELLS.



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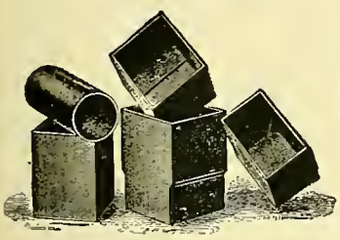

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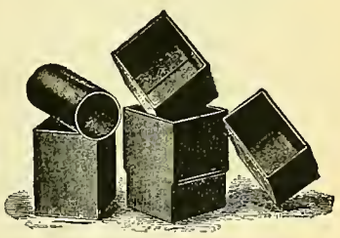

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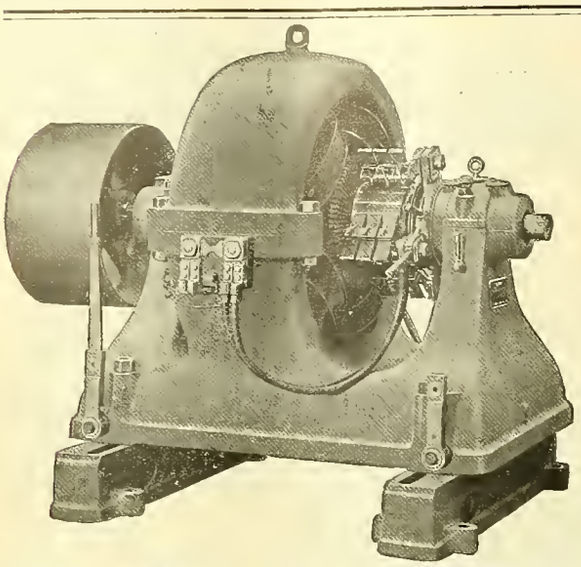

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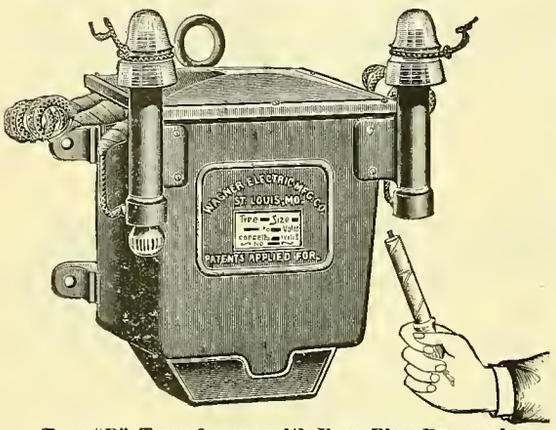


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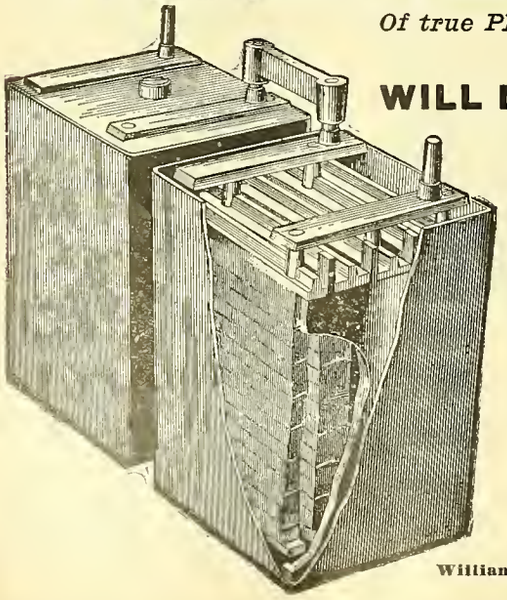

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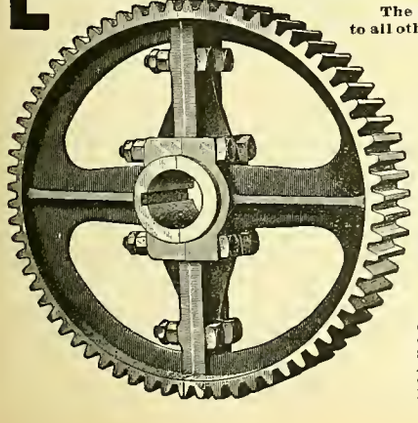

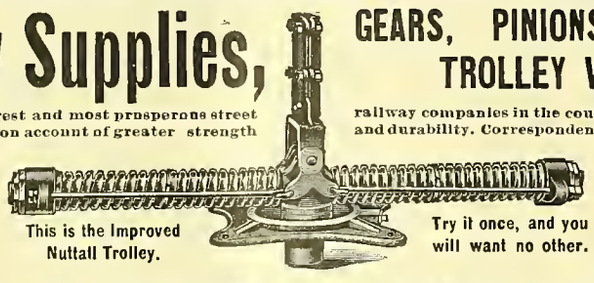

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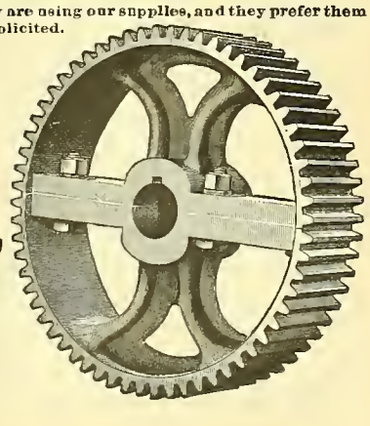

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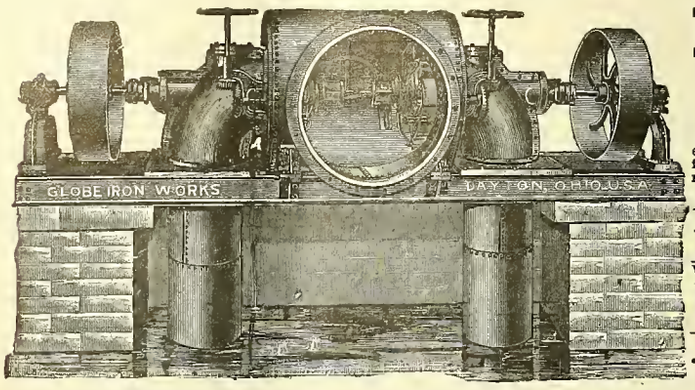


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|---|---|---|---|---|---|
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| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.68 |
| ¾ " | 16.78 | 117.33 | 112.60 | 176.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118.40 | 75.62 |

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|---|---|---|---|---|---|
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| ⅞ " | 16.56 | 134.80 | 120.85 | 188.14 | 83.09 |
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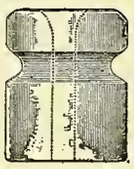

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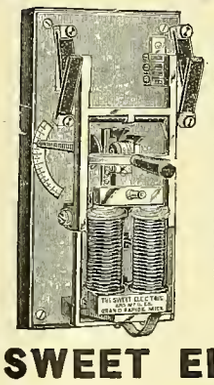

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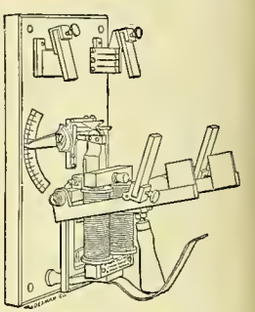

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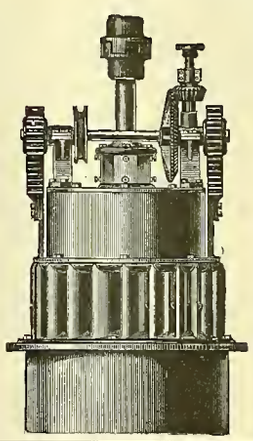

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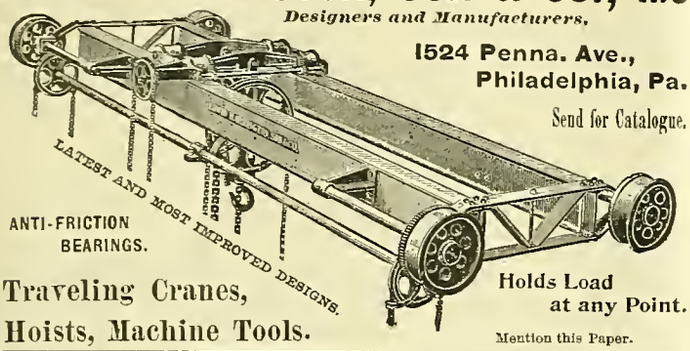


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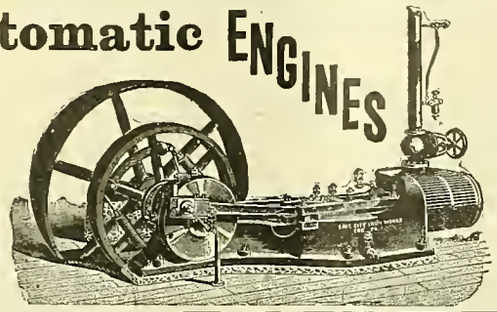

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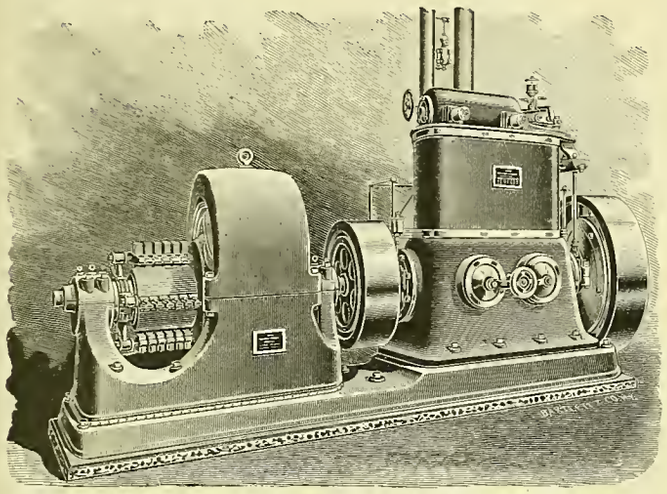

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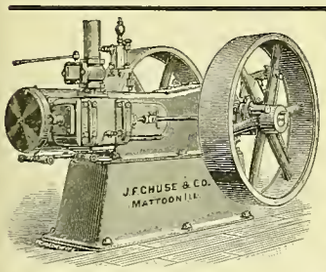


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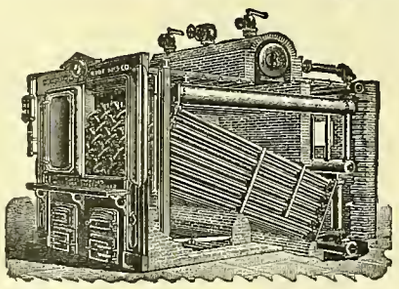

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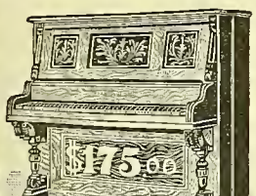

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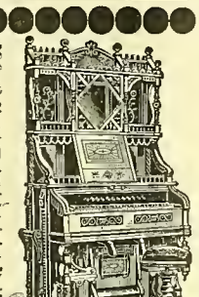

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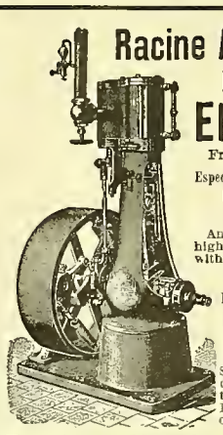

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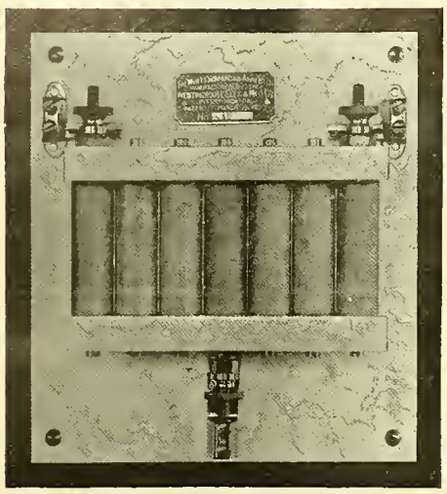

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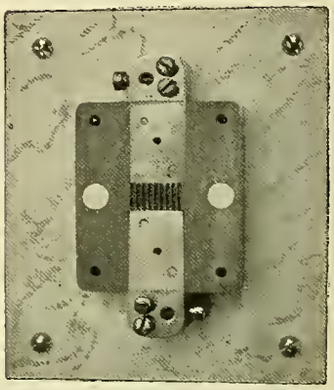

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**NO ARCING AND NO REPAIRS.**

### Extract from report of The Franklin Institute on Wurtz Lightning Arresters.

The various arresters produced by Mr. Wurtz are intended for the protection of electric lighting and power circuits from direct and indirect damage from lightning discharges, and Mr. Wurtz has, apparently, studied this question in a scientific and very exhaustive manner.

With but few exceptions all lightning arresters commonly used, up to the inventions of Mr. Wurtz, have been based upon the fact that static discharges generally tend to "ground" by the shortest distance even when obliged, in order to do this, to jump a considerable "air-gap," in preference to taking a longer path over a much lower resistance. Such arresters, therefore, have been essentially nothing more than two points or sets of points; one being "grounded" and the other connected to one or both legs of the circuit to be protected.

An arrester of this kind, while often affording a release from the static charge, would also allow the dynamo current to follow upon the arc so produced, thus producing either short circuit or a dangerous "ground," and in both cases causing an interruption of the main working circuit. Hence, the more improved arresters of this type were so constructed as to break the dynamo arc as soon as possible. This is easily seen to be a remedy rather than a preventive.

Mr. Wurtz perceived this fact and set himself to the problem of constructing an arrester in which the dynamo arc could not start, rather than one which would break the arc when started. As far as can be judged from recorded data he has succeeded in solving the problem in a very efficient manner, both for alternating and direct current.

The operative features of these arresters conform more closely to recognized laws than those of the devices previously known and used for the purpose. The instruments are cheaper to manufacture, and, as far as the Institute has been able to ascertain, are very effective in preventing damage, and they protect without causing cessation of operations.

In these respects the Institute believes these inventions to be important improvements, and therefore recommends the award of the John Scott Legacy Premium and Medal to their originator, Alexander Jay Wurtz, of Pittsburg, Pa.

Adopted at the stated meeting of the Committee on Science and the Arts, held Wednesday, May 2, 1894. JOSEPH M. WILSON, President.

Countersigned by WM. H. WAHL, Secretary.

ARTHUR BEARDSLEY, Chairman of the Committee of Science and the Arts.

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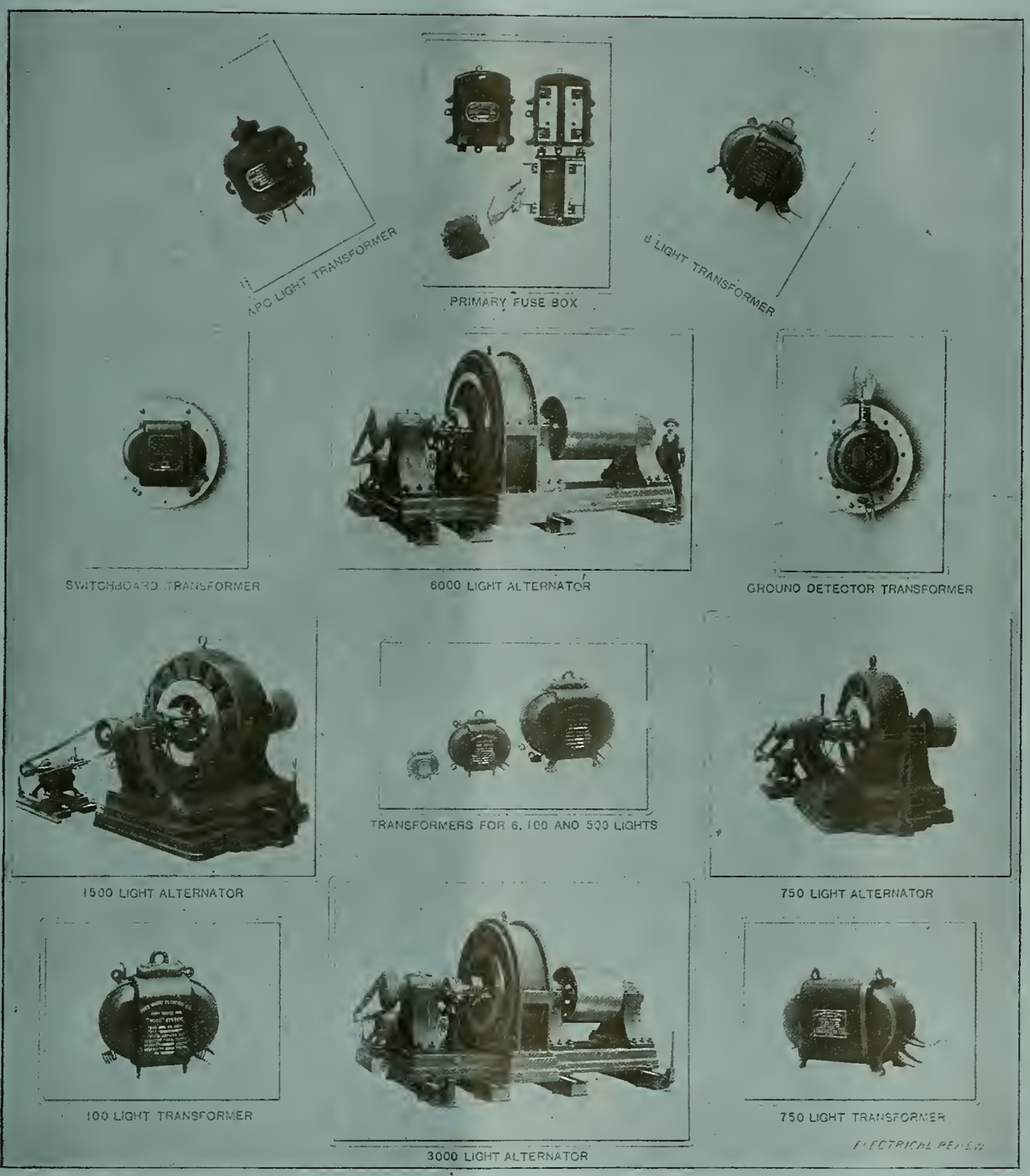


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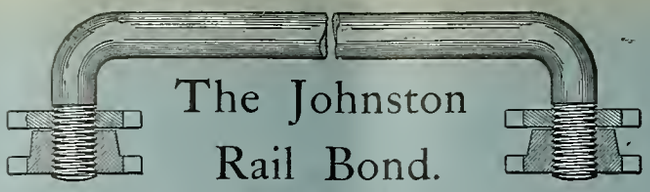

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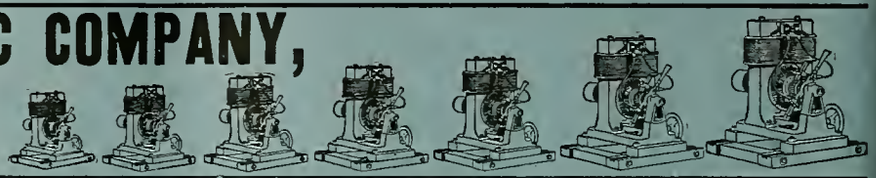

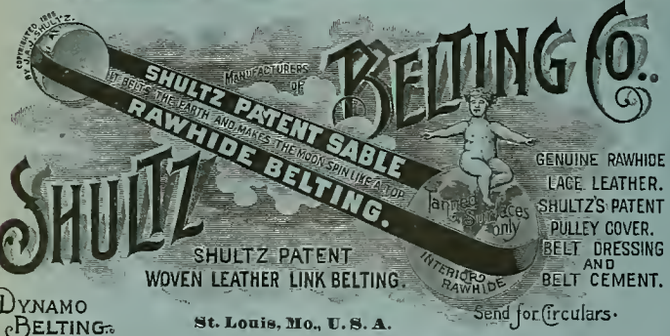


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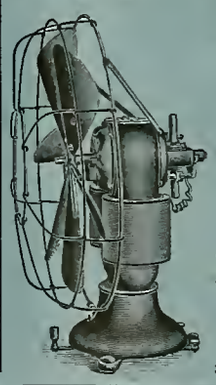

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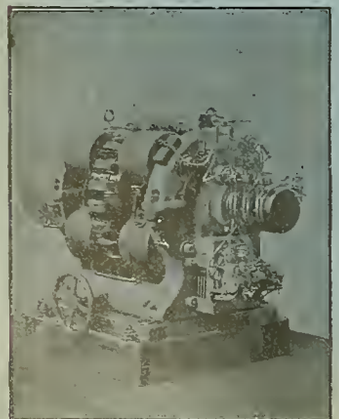

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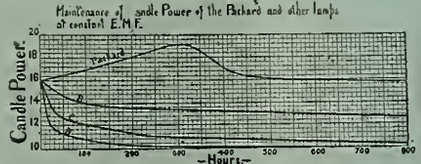


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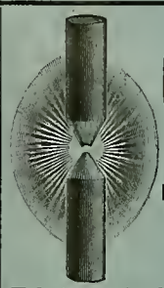

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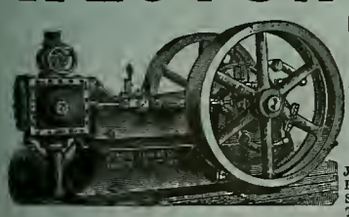

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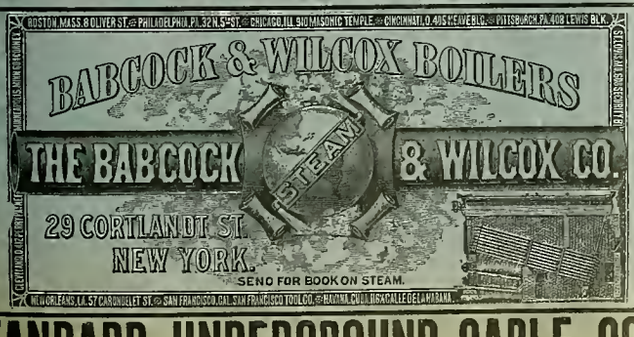


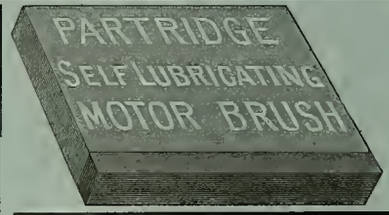


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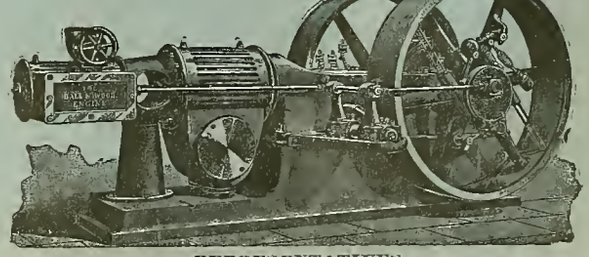

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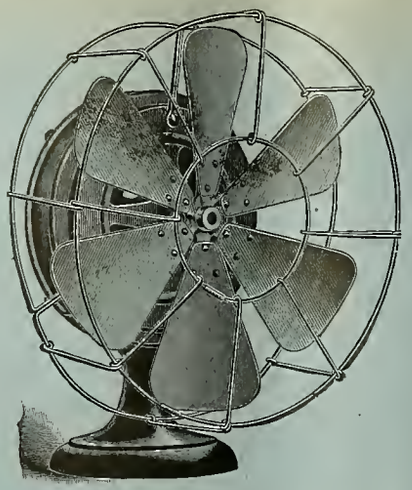

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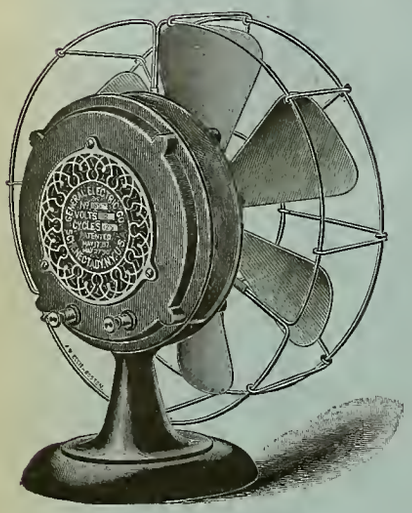

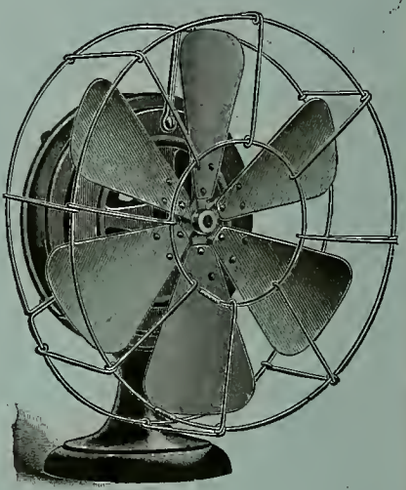

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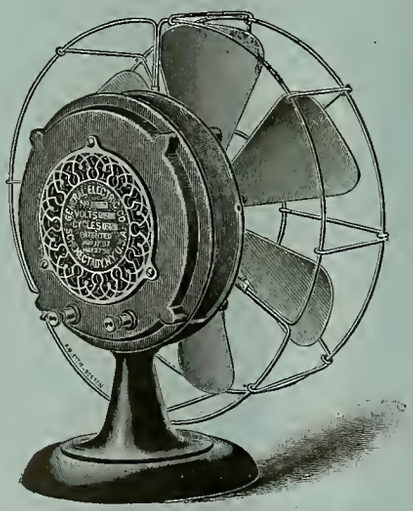

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**Accumulators.**
Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co,
Ostrander &Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.

**Arc Lamps.**
C & C Electric Co.
Central Electric Co.
Corey, R. B.
Crocker-Wheeler Elec. Co,
Ft. Wayne Elec. Corporation.
General Electric Co.
Bellos Electric Co.
Little, F. P. Elec. C. & S. Co.
Parker & Grover, Receivers.
Perkins El. Switch Mfg. Co.
Standard Thermometer Co.
Waterman, Chas. H.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boswell & Co., D. E.
Boynton Multivolt Batt'y Co.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Bemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Gillette, E. & F.
Huebel & Manger.
Ostrander & Co., W. R.
Partrick & Carter Co.
Proctor-Raymond Elec. Co.
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Bicycles.**
Monarch Cycle Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co.,Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Corey, R. B.
General Electric Co.
Partridge Carbon Co.
Reisinger, Hugo.
Waterman, Chas. H.
Wertheim, Ed.
Western Electric Co.

**Compound.**
Standard Paint Co.
Tornberg, Edw. R.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins Co.
National Conduit Mfg. Co.

**Construction & Repairs.**
Allen-Bussey Co.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El. Const. Co.

**Contractors and Electric Light Plants.**
Allen-Bussey Co.
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
**Bryan, Wm. H.**
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Siemens & Halske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Dearborn Electric Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Brodie Electric Co.
Central Electric Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec, Mfg, Co.
Electric Appliance Co.
Electric Protection Co.
Elec. Selec. & Signal Co.
Farr Tel. & Const. Supply Co,
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Bert & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Desks.**
Montgomery Ward & Co.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Siemens & Halske Elec. Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. &Mfg.Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Allen-Hussey Co.
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg, Co,
Ford, Owen.
Thayer Electric Co.

**Electrical Instruments.**
Anderson, Albert & J. M.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Colgate Co., Geo. L.
Dearborn Elect c Co.
Diamond Electri : Co.
Electric Applian eCo.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Queen & Co. Inc.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Electrical Specialties.**
Allen, L. B.
Clark El. Specialty Mfg. Co.
Electric Protection Co.
Interstate Com. El. Const Co.
Nashold Cleat Co.
Proctor-Raymond Elec. Co.
Rockford Torch Co.
S. K. C. Specialty Co.

**Electrollers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.

**Engines, Steam.**
Ball & Wood Co., The.
Chuse & Co., J. F.
Erie City Iron Wks.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Central Electric Co.
Davis Elec. Co., W. J.
Diehl & Co.
Dieterichs-Warwick El Co
Interior Conduit & Ins. Co.
Roth Bros. & Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Partrick & Carter Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Dieterichs-Warwick El. Co.
Electric Appliance Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Morris & MacCurdy;
Nashold Cleat Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Proctor-Raymond Elec. Co.
Queen & Co. Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Sweet Elec. & Mfg. Co.
Thayer Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Edwards, W. S. Mfg. Co.
Hemingray Glass Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Begeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Louisville Elec. Works
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Aetna Electric Works.
Am. Electrical Mfg. Co.
Automatic Elec. Spec. Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. &Mfg Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.

**Mica.**
Johns Mfg Co. H. W.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg Co.

**Motors.**
Andrae & Sons, J.
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Dieterichs-Warwick El. Co.
Eddy Elec, Mfg, Co.
Elliott-Lincoln Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Works.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.
Standard Paint Co.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm.Co. Ltd

**Pianos and Organs.**
Beethoven Piano & Organ Co.

**Platinum.**
Baker & Co.

**Poles.**
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Nuttall Co., R. D.
Valentine-Clark Co.

**Porcelain.**
Empire China Works.
General Electric Co.
Hemingray Glass Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Separators.**
Goubert Mfg. Co.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones.**
Andrae & Sons, J.
Central Electric Co.
Farr Tel. & Const. Supply Co.
Gillette, E. & F.
Gustafson, W. A.
Mo Telephone Mfg. Co.
Partrick & Carter Co.
Phila. Telephone Co.
Public Telephone Co.
U. S. Tel. Const. Co.
Universal Telephone Co.
Western Electric Co.
Western Tel. Const. Co.

**Transformers.**
Central Electric Co.
Diamond Electric Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hornberger Elec. Mfg. Co.
Louisville Elec. Works.
Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Trolley Cord.**
Samson Cordage Wks.

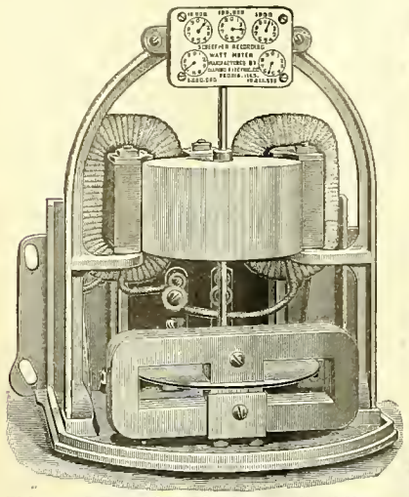
**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Chi. Shorthand Institute.
Int. Corr. Schools.
Rose Poly. Institute.
Scientific Machinist Co.

**Water Wheels.**
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J.



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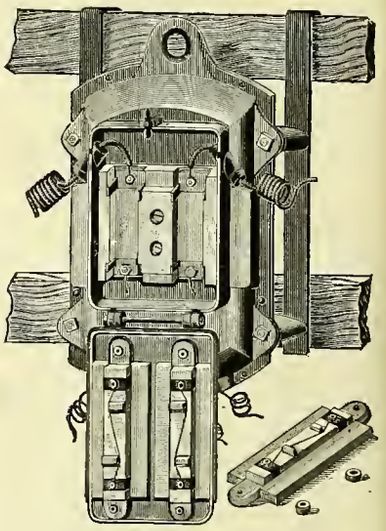

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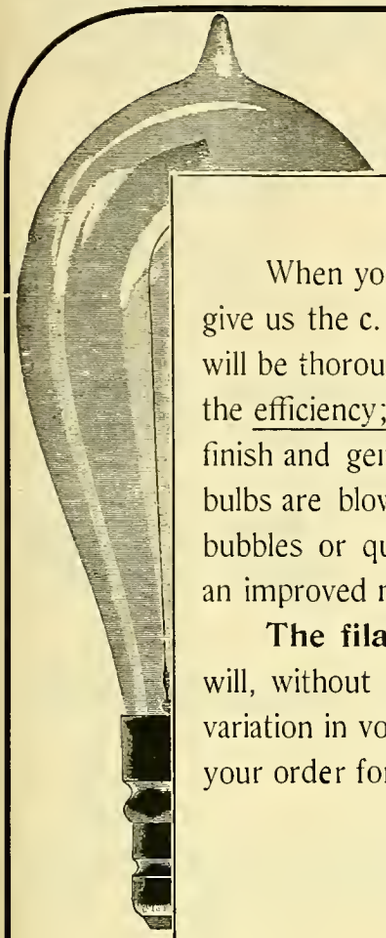

When you order **Pharos Lamps** give us the c. p., voltage and base wanted. You will be thoroughly satisfied with the quality; with the efficiency; with the average life and with the finish and general appearance of the lamp. The bulbs are blown from first quality clear glass, no bubbles or quirls. The bases are attached in an improved manner, lamps will not become loose.

**The filaments** are substantially made and will, without injury, stand an unusual amount of variation in voltage. We will be pleased to have your order for 100 as a trial lot.

## Railway Supplies.

Our line of Railway material includes the best specialties that have been put on the market. We are the general western agents for the Billings and Spencer drop-forged trolley equipments, and carry a complete stock in our Chicago warerooms.

GENERAL WESTERN AGENTS

Okonite Wire. Interior Conduit. Lundell Fan Motors. Helios Arc Lamps, Direct or Alternating.

## Central Electric Company,

**173-175 Adams St.,**

**CHICAGO.**

Garton Lightning Arresters.

Diamond Transformers.

Lundell Fan Motors.

**An Episode of the Chicago Road Race**

Which perhaps explains that wonderful burst of speed.

Interior Conduit Supplies.

BRANCHES: Southern Electrical Supply Co., St. Louis. Gate City Electric Co., Kansas City.

# INCANDESCENT LAMPS.

WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

## GLOBE ELECTRIC LIGHT CO., 6 Clifton St., ROXBURY, MASS.

AGENTS WANTED. WRITE US.

OKONITE TRADE MARK.

OKONITE WIRE.
OKONITE TAPE.
MANSON TAPE

FULL STOCK . . .
BOTTOM PRICES.

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CHICAGO. NEW YORK.

## THE UPTON ARC LAMP

For All Circuits.

The Cheapest to Buy, Use and Maintain.

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| Direct current lamps, constant potential, with globe and resistance, to burn 8, 11, 14 hours. | $12.00 |
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## Standard Thermometer Co.,

PEABODY, MASS.

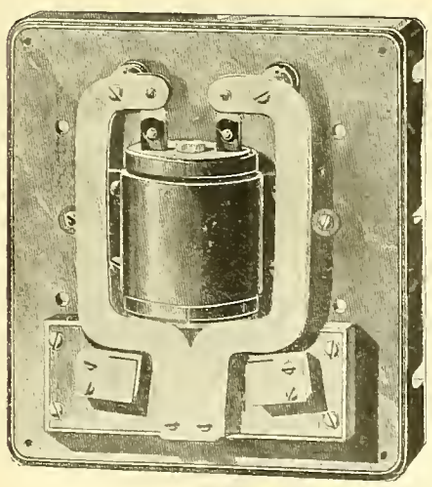
The Original Manufacturers of the

*SIMPLEX, WARD and KNIGHT LAMPS.*

CHARLES A. BRAMHALL, Selling Agent, 39 Cortlandt Street, NEW YORK.

# SINCE MARCH 1st

# Our New (Model 1895) Electric Light and Power Controllers



HAVE BEEN ADOPTED BY CENTRAL STATIONS OPERATING

**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{On}{Out}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

OUR GENERAL WESTERN AGENTS ARE

## WALLACE ELECTRIC CO., 307 DEARBORN ST., CHICAGO.

## ELECTRIC SELECTOR & SIGNAL CO., 45 Broadway, New York.

The Boudreaux Dynamo Brush Co. NO GAUZE.

The Boudreaux Dynamo Brush Co. NO CARBON.

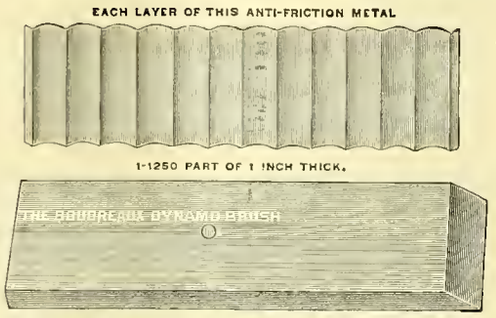
# WILL YOU BE IN IT? YES!

**USE**

## THE BOUDREAUX DYNAMO BRUSH.

NO SPARKING.

NO CUTTING.




NO TRIMMING.

NO GREASING.

The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

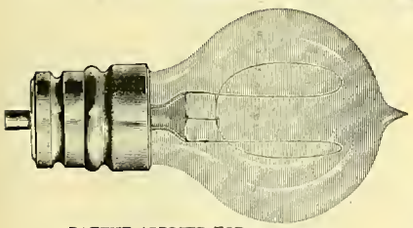
The Boudreaux Dynamo Brush Co. NO COPPER.

## THE BOUDREAUX DYNAMO BRUSH CO.,

**Mallers Building, CHICAGO.** **Postal Telegraph Building, NEW YORK.**

Sole Agent for Canada, R. E. T. PRINGLE, Montreal, Que.

# THE NEW ÆTNA LAMP.



PATENT APPLIED FOR.

**YOU DON'T SEE THE TWIST IN THE FILAMENT.**

*THIS LAMP is specially adapted to street and general railway and steamboat use, because it is absolutely non-vibratable, and we guarantee for it 50 per cent. longer life and better service than any other lamp now on the market. The filament will not droop or get out of shape while in use, no matter at what angle it is burned.*

*A good lamp at a fair price. Ordinary lamps at ordinary prices.*

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**WRITE US.** **Ætna Electric Works, Hartford, Conn.**

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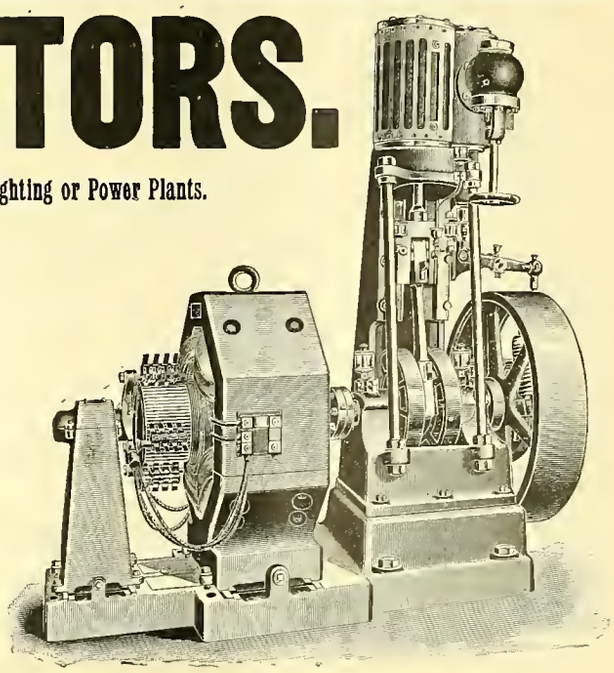
Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*



## THE EDDY ELECTRIC MFG. CO.,

*WINDSOR, CONN.*

**NEW YORK OFFICE, HAVEMEYER BLDG.**

*REPRESENTED BY:*

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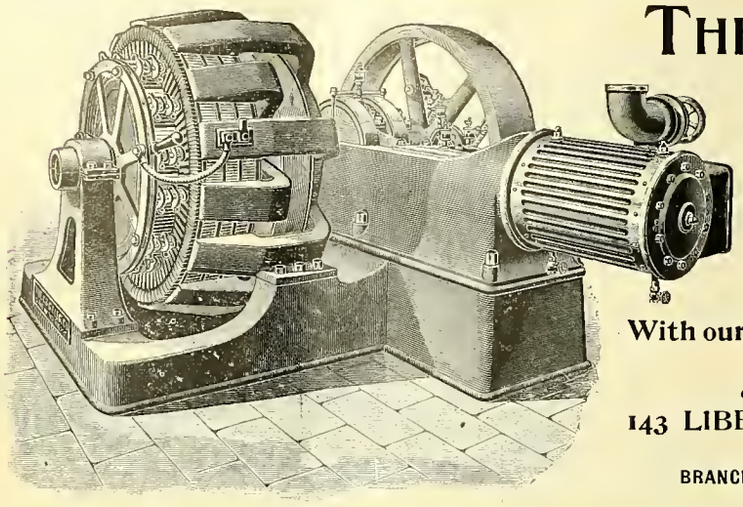
Western Electrical Supply Company, St. Louis, Mo.
F. P. Little Electrical Construction & Supply Co., Buffalo, N. Y.
W. T. Osborn, Kansas City, Mo.
D. P. GOSLINE, 30 Oliver St., Boston, Mass.

**All Our Apparatus Guaranteed as Represented.**



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MANUFACTURERS OF

## Bipolar AND Multipolar Dynamos,

Automatic and Hand Controlled Motors,
Complete Plants for Power Transmission,
Isolated Lighting Plants, Central Station Apparatus.

With our Extensive Works we are prepared to fill promptly all orders for 1 H.-P. to 250 H.-P.

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# HELIOS ELECTRIC COMPANY,

Factory and Offices,

**1310 Filbert Street, Philadelphia, Pa.**

*We have no Stock nor Old Style Lamps that we must get rid of at any price—no junk.*

## THE HELIOS LAMPS

Are the latest patterns and newest type. Our Lamps are much in advance of any lamp now on the market, because they are New and of Latest Designs.

Our ALTERNATING LAMPS have Reflector Plates. Our DIRECT CURRENT Lamps do not see-saw. Our Focusing Lamps, both Direct and Alternating, are especially adapted for photo-engraving and stereopticon work.

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Mountain Electric Co., Agents for Colorado, Utah, Wyoming and New Mexico, Denver, Col.
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W. T. M. Mottram, Agent for Texas, Dallas, Tex.
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By authority of the Supreme Court, stock of Electric Construction & Supply Co., consisting of "Ward" and "Knight" lamps and parts of same; carbons, domestic and imported; search lamps, iron, with parabolic reflectors. For list of fittings and material address

CHAUNCEY G. PARKER, THAD. T. GROVER, } Receivers.

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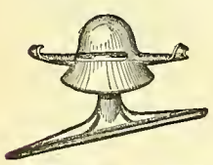
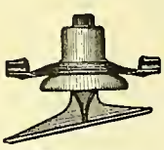
*Sale closes two months from date.*



# MOULDED MICA TROLLEY LINE INSULATORS.



*Hangers, Pull-Overs, Bracket Arm Insulators, Guard Wire, Feed Wire, Giant Strain and Section Insulators, Frogs, Crossings, Rail Bonds, Etc., Etc.*

**VULCABESTON** Heat-proof Insulation for Magnet Spools, Bushings, Controller Parts, Etc.

**ASBESTOS** for Fire-Proofing and Electrical Purposes.

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# THE BEST ELECTRIC FAN On the Market.

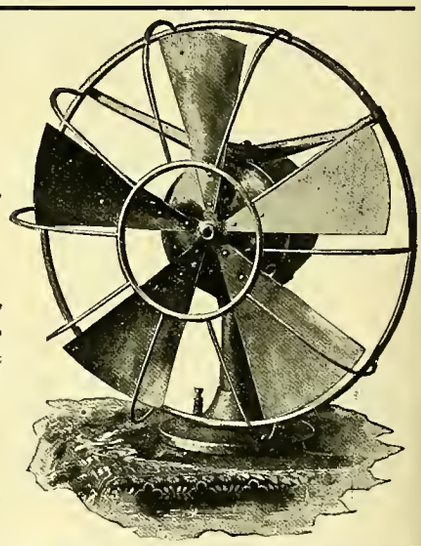
**For Alternating Current, Wound for 50 or 100 volts.**

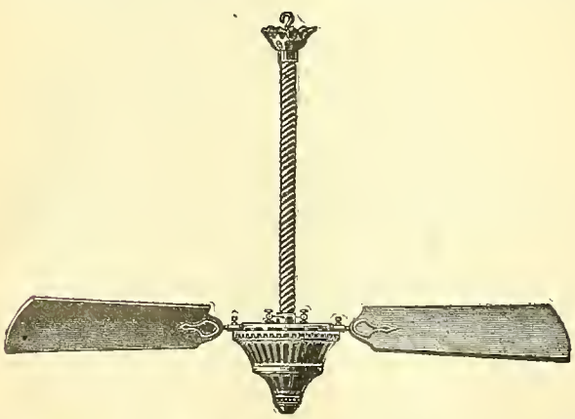
The Fan is 14 inches in diameter.
Will always start when current is on.
Positively self-lubricating, will run a whole season without looking after.
It is so constructed as to make it next to impossible to get out of line.
It is carefully made in every detail, almost noiseless, and does not throw sparks.

Agents Wanted in Different Localities.

For further information address

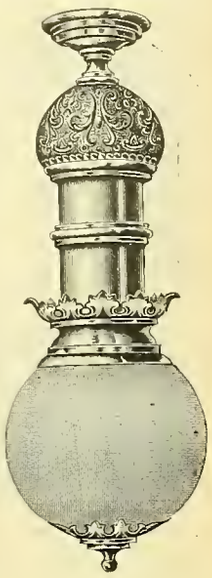
THE
**W. J. Davis Electric Co.,**
**PITTSFIELD, MASS.**





**AN EMPHATIC SUCCESS!**
**THE DIEHL ELECTRIC FANS WIRED IN A SERIES OF TWO OR MORE ON A STREET RAILWAY CURRENT.**

**DIEHL & COMPANY, 385 BROADWAY, NEW YORK.**



"When the pie was opened
The birds began to sing."

**LET EVERYBODY PASS UP HIS PLATE FOR A SLICE.**

# The Perkins Electric Switch Mfg. Co.,

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Philadelphia,
806 Walnut St.,
O. D. Pierce, Mgr.

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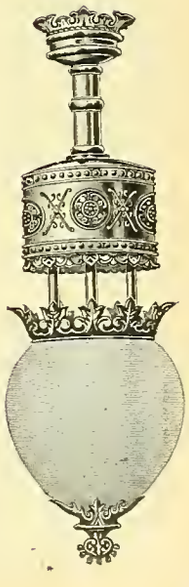

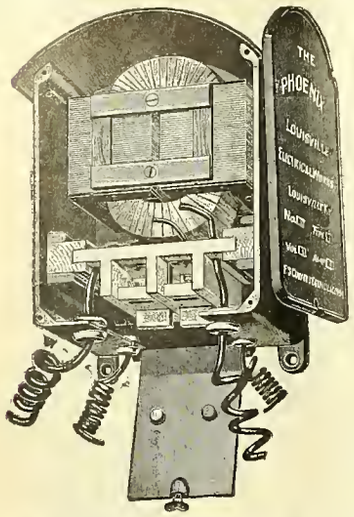

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THE

# PHOENIX

## TRANSFORMER.

*Embodies every point essential to A PERFECT Transformer.*

**WE GUARANTEE**
THE HIGHEST EFFICIENCY
AND CLOSEST REGULATION
**EVER ATTAINED.**

**Its Mechanical Construction makes it the SIMPLEST Transformer made.**

To try one is to adopt it for your
FUTURE STANDARD.

**Louisville Electrical Works,**
LOUISVILLE, KY.

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# The M. & B. Telephone Co.

Own letters patent No. 361,124, issued Aug. 12, 1887, which covers all possible forms of Battery Transmitters in which the Electrodes are *not* in *constant contact*, and they are not affected in any way by the Berliner Transmitter Patent. Send in your orders.

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GENERAL AGENTS,
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# C-S SPECIALTIES.

**C-S Flush Double Push Switch.**
Single Pole—Double Pole—Commutation; 3 Wire, 4 Wire.

**C-S Flush Key Switch.**
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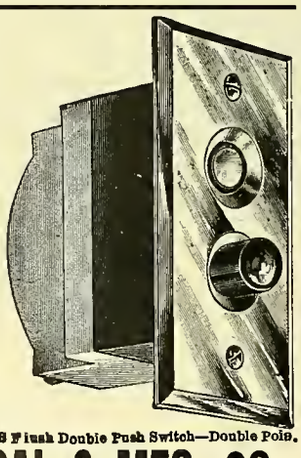
**C-S Flush Automatic Switch.**
Single Pole.

ELECTRICALLY
MECHANICALLY
ARTISTICALLY **PEERLESS.**



C-S Flush Double Push Switch—Double Pole.

**THE CUTTER ELECTRICAL & MFG. CO.,**
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# $5 TO $15 TELEPHONES.

**Supplies of Every Description.**

Transmitters (Blake Pattern); Hunning Silver Diaphragm or Magneto Receivers; Magneto Bells; Wire Cross Arms; Insulators; Induction Coils; Backboards; Switches; Batteries, etc. Wholesale Prices to Dealers.

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Western Agents for DANBURY ELECTRICAL WORKS.

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This company is manufacturing **A Compound Magneto Telephone**
Which it sells outright under a guarantee both as to efficiency and as against infringement of patents.
It talks as well over one hundred miles as any other Telephone talks over one mile.
This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists.

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# BLAKE TRANSMITTERS.

**COMPLETE, $2.00 EACH.**

In Walnut and Oak Cases.
Blake Transmitter Castings, $1.00.

Philadelphia Telephone Co.,
Box 707, Philadelphia.

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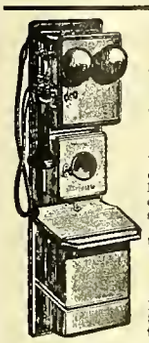

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## Long Distance,

**No. 1.**

Will speak one thousand miles on a properly constructed line. You can hear a watch tick one hundred miles. Is that satisfactory? If so, write to

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For prices and information. Send business card, I sell to the trade only.

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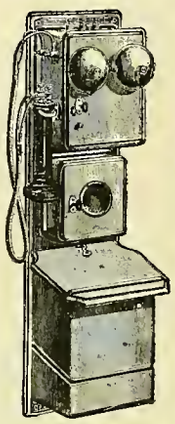

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FOR ALL PURPOSES, AT THE LOWEST PRICES.
SEND FOR CATALOGUE.

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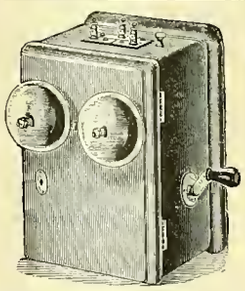

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POWER & FAN MOTORS 1/8 TO 20 H.P.

DYNAMOS, 5 TO 500 LIGHT.

We repair the bad work of others. & do it good.

Brass, 12-inch, $15.00.

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DISPATCH FROM HADES.

Nickeled, Three Speed, $17.50.

*Ship at once 10 more Warwick Fan Motors C.O.D. They keep me cool, and dont burn out.*
*Satan 1st Rex.*

TRADE ONLY

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# THE WISE WIREMAN

WIRES AND CABLES

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WIRES AND CABLES

**Of the wiring gang he was the boss,**
**And with him you couldn't play "hoss;"**
**He told the head buyer,**
**"I want Paranite wire,**
**Or my circuits will cross and recross."**

We carry in stock in Chicago for immediate shipment all sizes of Paranite Wire in large amounts, having one of the largest stocks of high grade rubber covered wire in the country.

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ELECTRICAL SUPPLIES,

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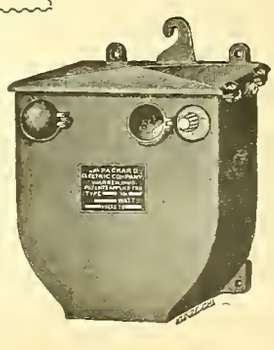
MANUFACTURERS OF THE PACKARD LAMP;

PACKARD ELECTRIC COMPANY, Warren, Ohio,

MANUFACTURERS OF THE PACKARD TRANSFORMER.



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For Arc Light and Trolley Cord.

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Procured. **30 Years' Practice.** **GRANT INSURED.** Pamphlet, references and advice **free.**

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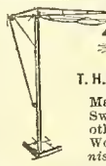

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Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work. — *Catalogues and Prices furnished on application.*

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A perfect Compound for Dynamos and Motors. Works on any Commutator with Copper or Carbon Brushes. Send for sample; price 50c per stick.

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**Boswell Storage Battery.**

For Traction Work, Electric Lighting, Electric Launch, Telegraph, Phonograph, Surgical, and for all purposes where Light and Power are required.

**Prices on Application.**

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Is just what you want for your line or exchange. Will operate up to 500 miles. Handsomely mounted in every respect, with polished oak case, it will be found an ornamental as well as a useful instrument. **OUR PRICES** on them will be found satisfactory to you and all that you would ask for.

**WE GUARANTEE**

Them in every respect, and if you need any telephones, order a pair from us and give them a thorough test. If not satisfactory we will take them back.

**AGENTS WANTED EVERYWHERE.**

**DO NOT FORGET**

That we carry a full line of Wire and Electrical Supplies. ***Prices the Lowest.***

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This system does not infringe the patents of the Bell Telephone or Western Electric Co. We build exchanges complete for local companies, or will install and operate exchanges ourselves at a low monthly rental. We keep in stock Blake transmitters and all kinds of supplies.

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**We are the sole manufacturers of the P. & B. products which have been the STANDARD for ten years.**

**Send for samples and price lists.**

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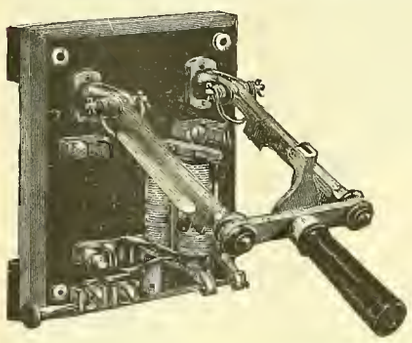
**MOTOR ARMATURES COST MONEY**



You can prevent them from burning out by using

**THE BRODIE AUTOMATIC MOTOR-SWITCH.**

It combines in one piece of apparatus a double-pole switch, adjustable limit-switch and automatic cut-out, and instantly disconnects the motor whenever it is overloaded and whenever the circuit fails from any cause.

Agents wanted in all sections of the country.

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**THE BRODIE ELECTRIC CO., - Manchester, N. H.**

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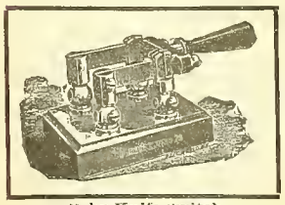

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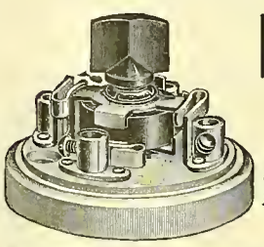

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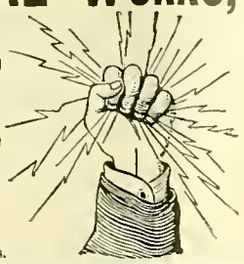

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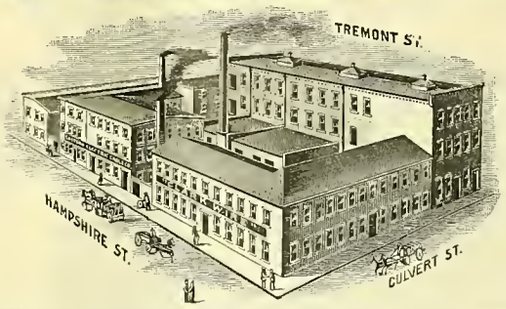


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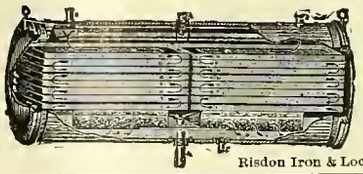

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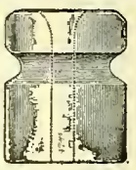

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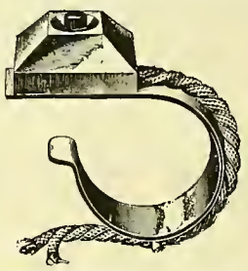

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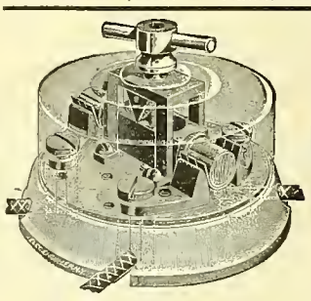

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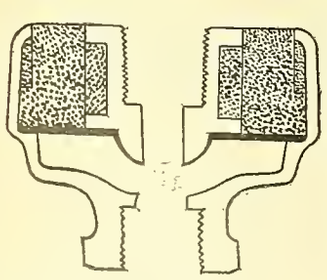

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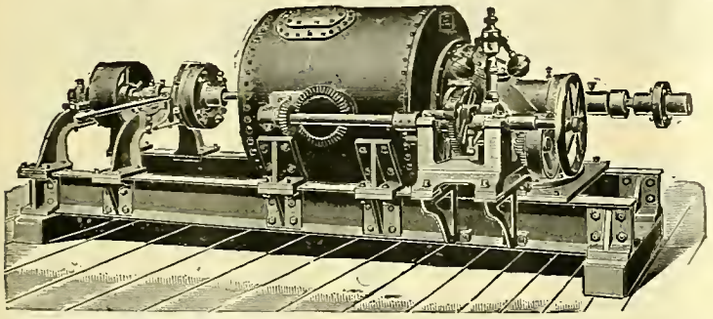

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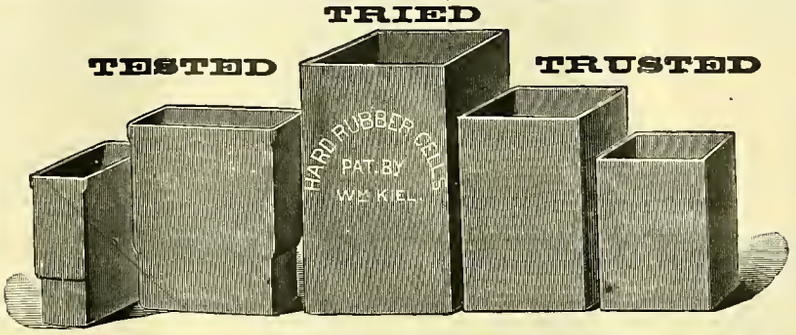


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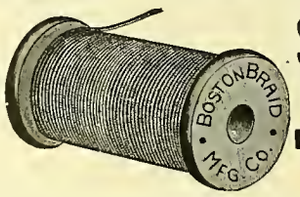


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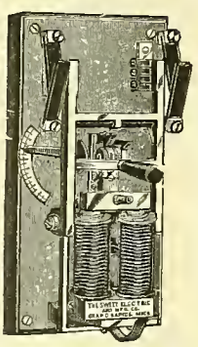

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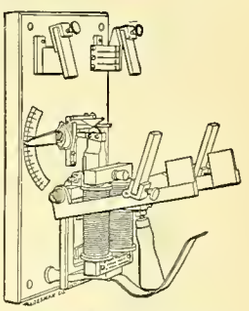

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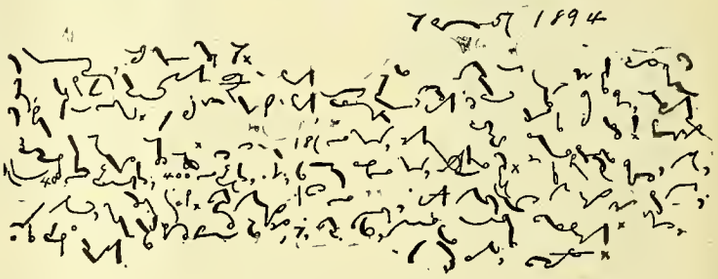


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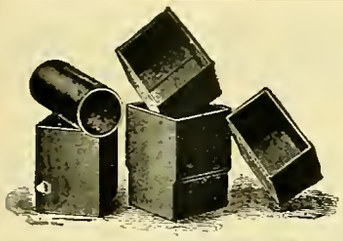

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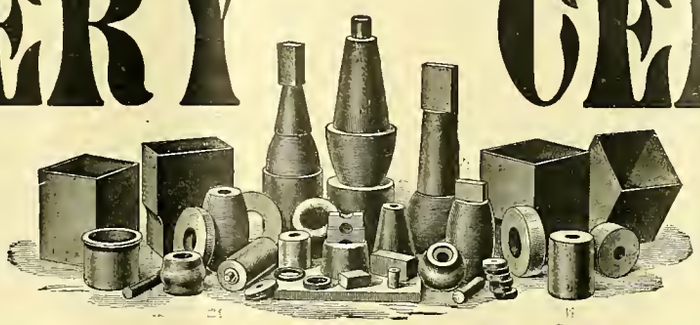

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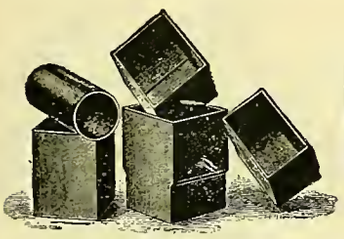

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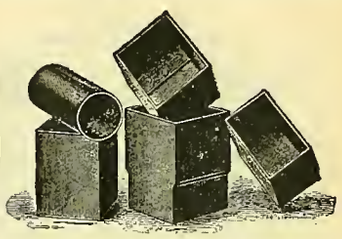

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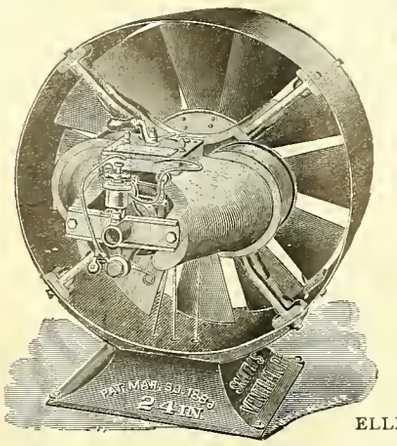

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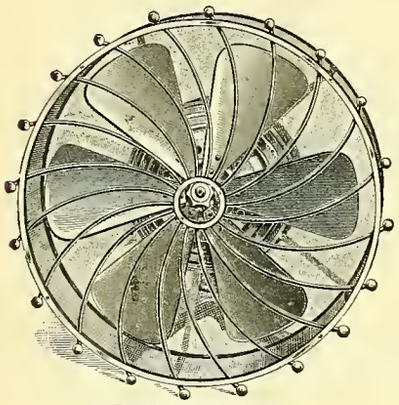

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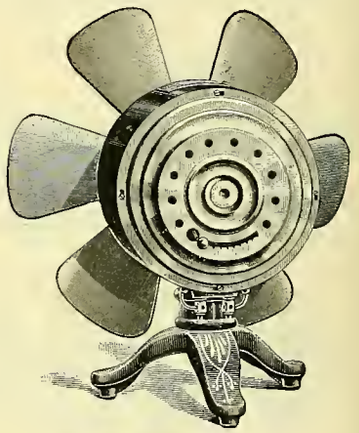

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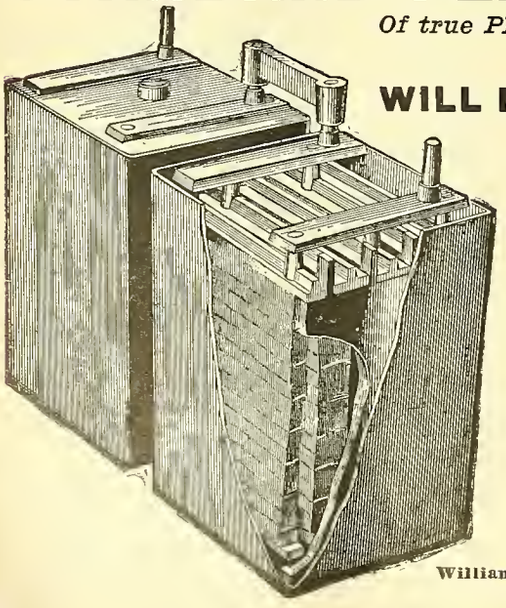

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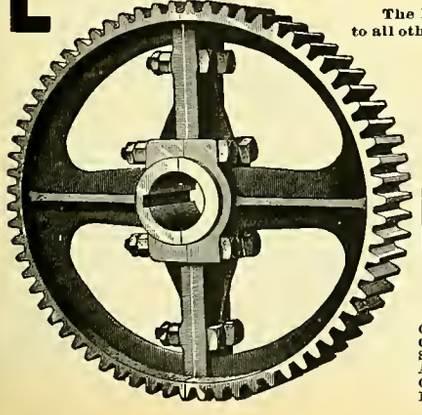

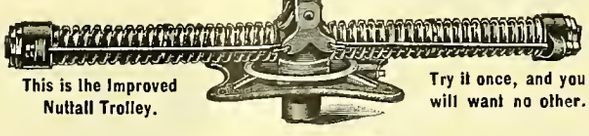

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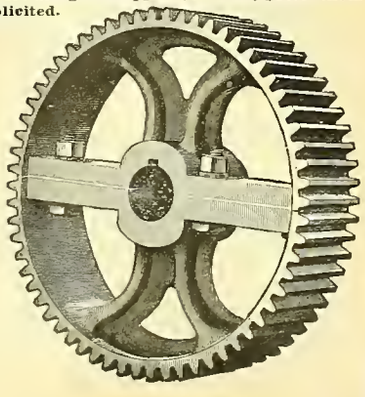

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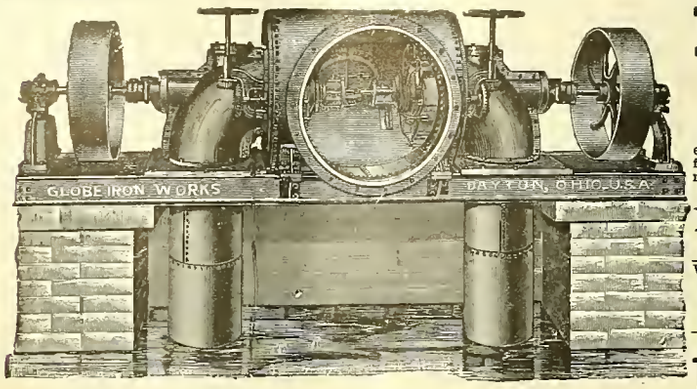


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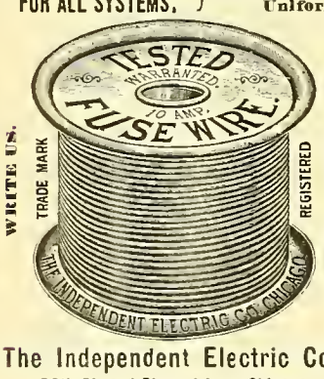


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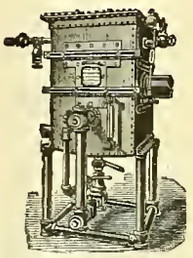

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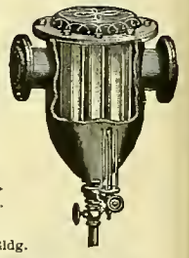

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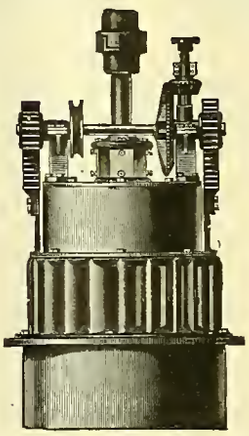

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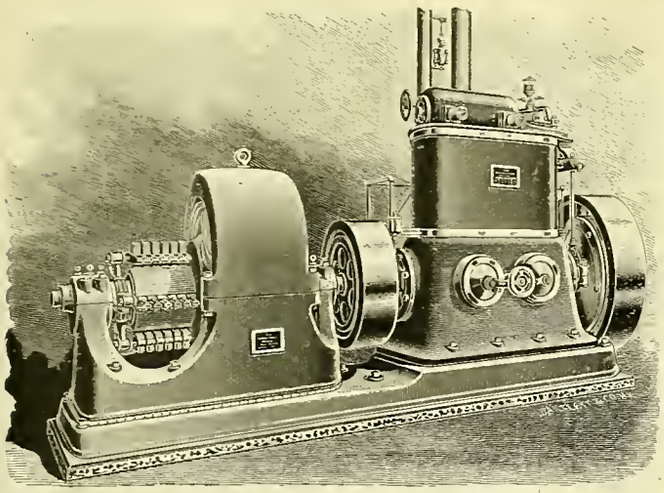

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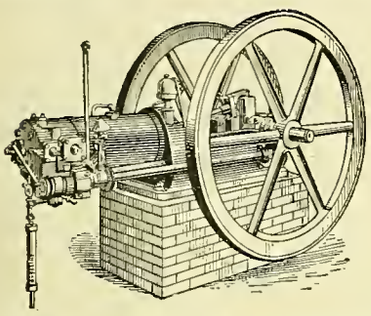

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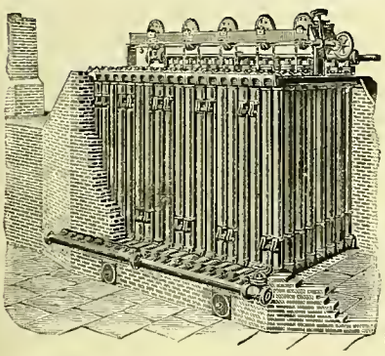

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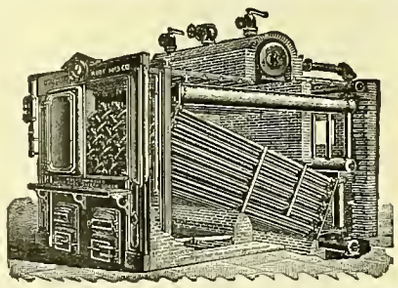

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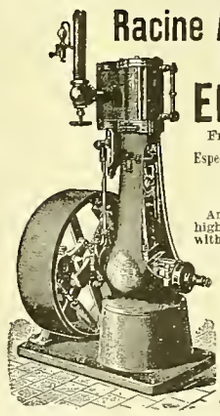

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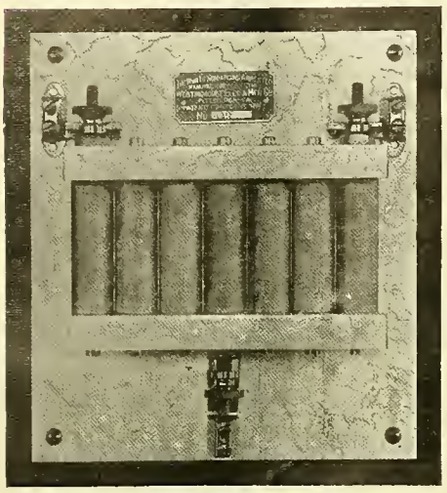

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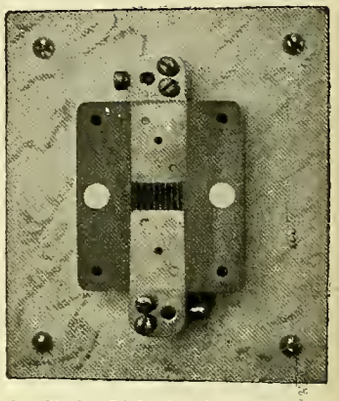

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### Extract from report of The Franklin Institute on Wurts Lightning Arresters.

The various arresters produced by Mr. Wurts are intended for the protection of electric lighting and power circuits from direct and indirect damage from lightning discharges, and Mr. Wurts has, apparently, studied this question in a scientific and very exhaustive manner.

With but few exceptions all lightning arresters commonly used, up to the inventions of Mr. Wurts, have been based upon the fact that static discharges generally tend to "ground" by the shortest distance even when obliged, in order to do this, to jump a considerable "air-gap," in preference to taking a longer path over a much lower resistance. Such arresters, therefore, have been essentially nothing more than two points or sets of points; one being "grounded" and the other connected to one or both legs of the circuit to be protected.

An arrester of this kind, while often affording a release from the static charge, would also allow the dynamo current to follow upon the arc so produced, thus producing either short circuit or a dangerous "ground," and in both cases causing an interruption of the main working circuit. Hence, the more improved arresters of this type were so constructed as to break the dynamo arc as soon as possible. This is easily seen to be a remedy rather than a preventive.

Mr. Wurts perceived this fact and set himself to the problem of constructing an arrester in which the dynamo arc could not start, rather than one which would break the arc when started. As far as can be judged from recorded data he has succeeded in solving the problem in a very efficient manner, both for alternating and direct current.

The operative features of these arresters conform more closely to recognized laws than those of the devices previously known and used for the purpose. The instruments are cheaper to manufacture, and, as far as the Institute has been able to ascertain, are very effective in preventing damage, and they protect without causing cessation of operations.

In these respects the Institute believes these inventions to be important improvements, and therefore recommends the award of the John Scott Legacy Premium and Medal to their originator, Alexander Jay Wurts, of Pittsburg, Pa.

Adopted at the stated meeting of the Committee on Science and the Arts, held Wednesday, May 2, 1894. JOSEPH M. WILSON, President.

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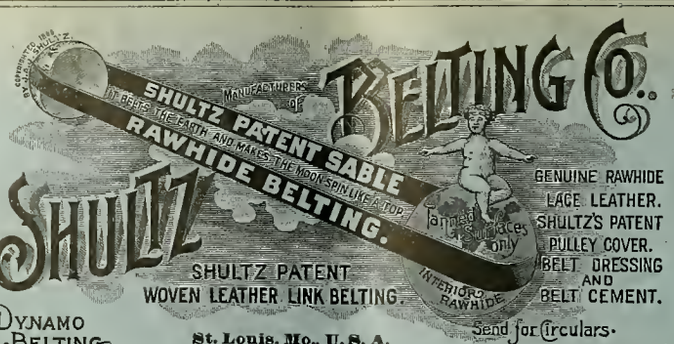


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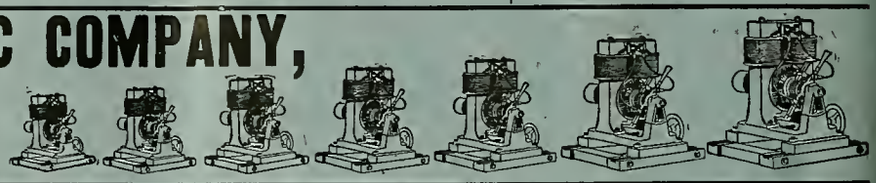

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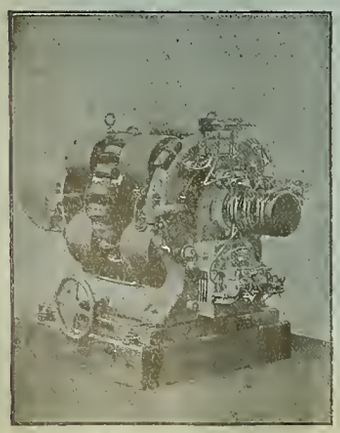

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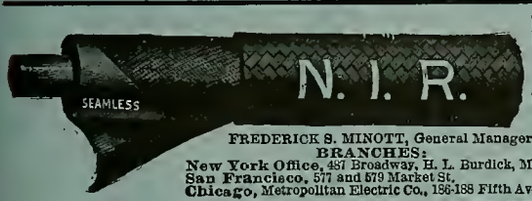


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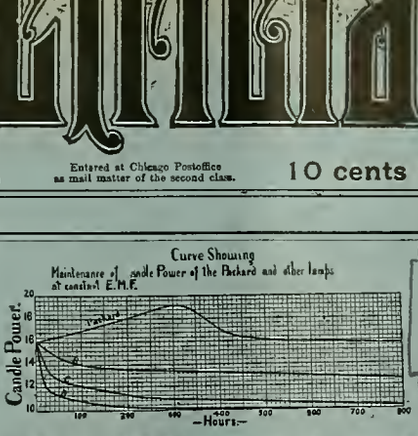


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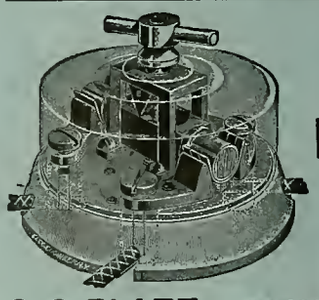

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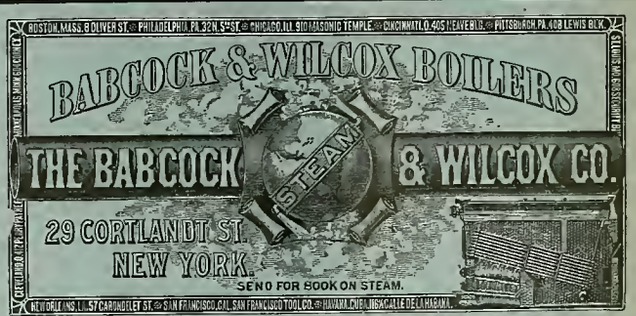


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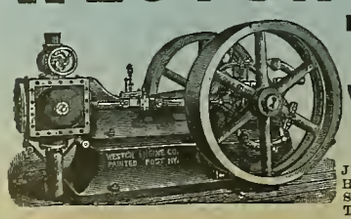

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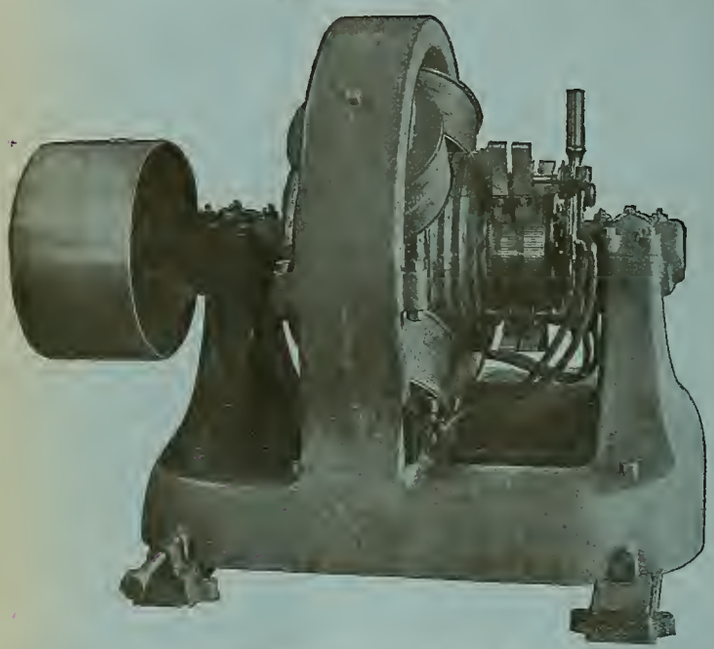

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Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.

**Arc Lamps.**
C & C Electric Co
Central Electric Co
Corey, R. B.
Crocker-Wheeler Elec. Co,
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Parker & Grover, Receivers.
Perkins El. Switch Mfg. Co.
Standard Thermometer Co
Waterman, Chas. H.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boswell & Co., D. E.
Boynton Multivolt Batt'y Co.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Hemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Gillette, E. & F.
Huebel & Manger
Ostrander & Co., W. R.
Partrick & Carter Co.
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Bicycles.**
Monarch Cycle Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Moyea, L. M.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Wallace Electric Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Corey, R. B.
General Electric Co.
Partridge Carbon Co.
Reisinger, Hugo.
Waterman, Chas. H.
Werlheim, Ed.
Western Electric Co.

**Clocks, Watchmen's.**
Southgate & Co., W. B.

**Compound.**
Standard Paint Co.
Tornberg, Edw. R.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.
National Conduit Mfg. Co.

**Construction & Repairs.**
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El. Const. Co.

**Contractors and Electric Light Plants.**
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Siemens & Halske Elec. Co.
United Elec Improvement Co
Walkius, Louis E.
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. B.
Brixey, W. R.
Bunnell & Co., J. B.
Central Electric Co.
Dearborn Electric Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. B.
Brodie Electric Co.
Central Electric Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Electric Co., The.
Electric Protection Co.
Elec. Selec. & Signal Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Forsyth & Fisk.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Desks.**
Montgomery Ward & Co.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Siemens & Halske Elec. Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Ecooomizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co,
Ford, Owen.
Thayer Electric Co.
Walkins, Louis E.

**Electrical Instruments.**
Anderson, Albert & J. M.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Queen & Co. Inc.
Sweet Elec. & Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Electrical Specialties.**
Allen, L. B.
Clark El. Specialty Mfg. Co.
Electric Protection Co.
Interstate Com. El. Const Co.
Nashold Cleat Co.
S. K. C. Specialty Co.

**Electrollers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.

**Engines, Steam.**
Ball & Wood Co., The.
Chase & Co., J. F.
Erie City Iron Wks.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

**Fan Outfits.**
Central Electric Co.
Diehl & Co.
Dieterichs-Warwick El. Co
Interior Conduit & Ins. Co.
Roth Bros. & Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Partrick & Carter Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Dieterichs-Warwick El. Co.
Electric Appliance Co.
Electric Co., The.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Morris & MacCurdy;
Nashold Cleat Co.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Queen & Co Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Thayer Electric Co.
Wallace Electric Co.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Edwards, W. S. Mfg. Co.
Hemingray Glass Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. B.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co., Eugene.
Nashold Cleat Co.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.
Wallace Electric Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Wallace Electric Co.
Western Electric Co.

**Lamps, Incandescent.**
Aetna Electric Works.
Am. Electrical Mfg. Co.
Automatic Elec. Spec. Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Andrae & Sons, J.
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Commercial Electric Co.
Crocker-Wheeler Elec. Co.
Dieterichs-Warwick El. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Works.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg Co.
Wallace Electric Co.
Westinghouse El. & Mfg. Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.
Standard Paint Co.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd

**Pianos and Organs.**
Beethoven Piano & Organ Co

**Platinum.**
Baker & Co.

**Poles.**
Morris, Tasker & Co.
Nuttall Co., R. D.
Valentine-Clark Co.

**Porcelain.**
Empire China Works.
General Electric Co.
Hemingray Glass Co.

**Publishers, Electrical.**
Electrician Publishing Co

**Push Buttons.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Separators.**
Goubert Mfg. Co.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone material.**
Andrae & Sons, J.
Central Electric Co.
Evans, C. M.
Farr Tel. & Const. Supply Co.
Forsyth & Fisk.
Gillette, E. & F.
Gustafson, W. A.
Mo Telephone Mfg. Co.
Partrick & Carter Co.
Phila. Telephone Co.
Public Telephone Co.
U. S. Tel. Const. Co.
Universal Telephone Co.
Western Electric Co.
Western Tel. Const. Co.

**Transformers.**
Central Electric Co.
Diamond Electric Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Bornberger Elec. Mfg. Co.
Louisville Elec. Works.
Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Wallace Electric Co.

**Trolley Cord.**
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Chi. Shorthand Institute.
Int. Corr. Schools.
Rose Poly. Institute.
Scientific Machinist Co.

**Water Wheels.**
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
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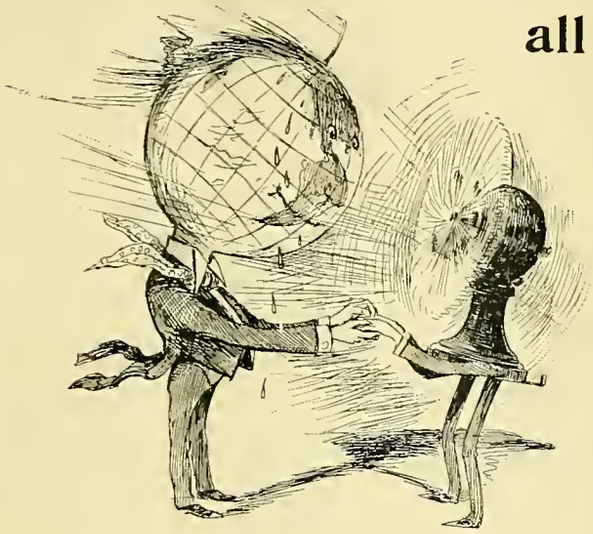


MOTHER EARTH (*in bicycle costume*)—"Goodness! Lundy, but we are all glad to see you, how did you come?"
THE FAN—"Oh I just sailed in—but you are looking worried."
M. E.—"I am, Son, I am; with a road race just off my hands and the wheat crop to manage, it's enough to worry anybody."
THE FAN—"Well, brace up! I'll help you out."

## all in the same boat—

everybody sweltering—everybody miserable, except the fellow who either has a **Lundell** Fan or is on the right side of July wheat; and the chances are that this happy one has a fan too—he needs a cool head.

**Hundreds in stock,** you can't send the telegrams in too swift—just give us the trade word and say how many, and you get them by next train.

**If you send a letter,** better include the other things you are needing—there's Okonite, no weather hot enough, or cold, or wet, or dry enough to hurt it. And Interior Conduit. And Pharos Lamps.

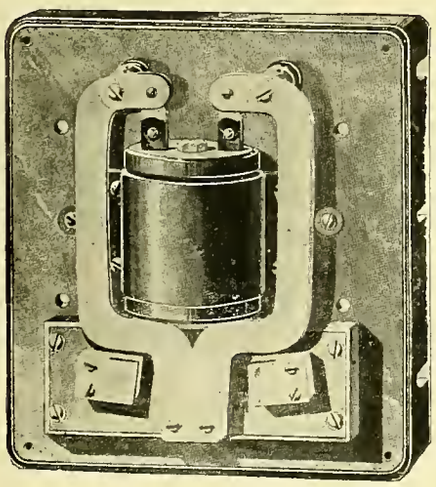
OKONITE IT NEVER DISAPPOINTS

**Central Electric Company,**
**173-175 Adams St.,**
CHICAGO.

BRANCHES: Kansas City, Mo.; Gate City Electric Co.
St. Louis: Southern Electric Supply Co.

# SINCE MARCH 1st

# Our New (Model 1895) Electric Light and Power Controllers



HAVE BEEN ADOPTED BY CENTRAL STATIONS OPERATING

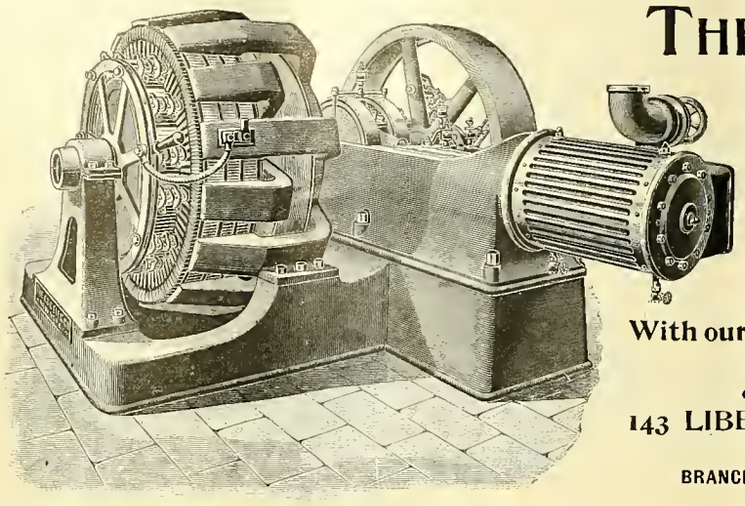
**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{On}{Out}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

OUR GENERAL WESTERN AGENTS ARE

# WALLACE ELECTRIC CO., 307 DEARBORN ST., CHICAGO.

# ELECTRIC SELECTOR & SIGNAL CO., 45 Broadway, New York.



# THE C & C ELECTRIC CO.

MANUFACTURERS OF

## Bipolar AND Multipolar Dynamos,

Automatic and Hand Controlled Motors,
Complete Plants for Power Transmission,
Isolated Lighting Plants, Central Station Apparatus.

With our Extensive Works we are prepared to fill promptly all orders for 1 H.-P. to 250 H.-P.

GENERAL OFFICES: 143 LIBERTY ST., NEW YORK.

WORKS: GARWOOD, N. J. On Central R. R. of N. J.

BRANCH OFFICES: CHICAGO, Monadnock Building. BOSTON, 63 Oliver Street. CLEVELAND, Cuyahoga Building. PHILADELPHIA, 633 Arch Street.

# HELIOS ELECTRIC COMPANY,

Factory and Offices,

**1310 Filbert Street, Philadelphia, Pa.**

*We have no Stock nor Old Style Lamps that we must get rid of at any price—no junk.*

## THE HELIOS LAMPS

Are the latest patterns and newest type. Our Lamps are much in advance of any lamp now on the market, because they are New and of Latest Designs.

Our ALTERNATING LAMPS have Reflector Plates. Our DIRECT CURRENT Lamps do not see-saw. Our Focusing Lamps, both Direct and Alternating, are especially adapted for photo-engraving and stereopticoo work.

Anchor Electric Co., New England Agents, Boston, Mass
Central Electric Co., Western Agents, Chicago.
Moore & Baylis, Ageots for Western New York, Buffalo, N. Y.,
Globe Electrical Supply & Construction Co., New York City Agents, Yandam and Greenwich Streets, New York.
Mountain Electric Co., Agents for Colorado, Utah, Wyoming and New Mexico, Denver, Col.
Machinery Supply Co., Agents for Southern California and Arizona, Los Angeles, Cal.
W. T. M. Mottram, Agent for Texas, Dallas, Tex.
Canadian General Electric Co., Canadian Agents, Toronto, Canada.
California Electrical Works, San Francisco, Cal.

# The Tilden Watchman's Electric Time Recorder.

THE LATEST AND MOST PERFECT STATION RECORDER UPON THE MARKET.

IT CANNOT BE TAMPERED WITH—FALSE RECORDS CANNOT BE MADE UPON IT.

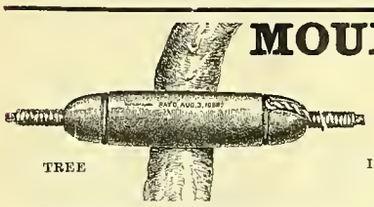
Ordinary electric press-buttons can be used for operating this clock, or we can furnish our non-interfershie buttons with keys when desired. Write for prices.

## W. B. SOUTHGATE & CO.,

GENERAL AGENTS,

146 "B" Franklin St., BOSTON, MASS.

# MOULDED MICA.

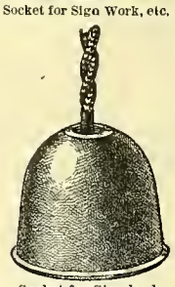


TREE INSULATORS.

Weatherproof Sockets. Wall Socket for Sign Work, etc.

For use outdoors and in damp situations.

TROLLEY LINE INSULATORS,
VULCABESTON.



## H. W. JOHNS MFG. CO.,

240 & 242 Randolph Street,
CHICAGO.

NEW YORK, PHILADELPHIA, BOSTON.

Regular Edison, Thomson-Houston & Westinghouse Base.

Socket for Standard ⅛-inch Pipe Bracket Fixtures.

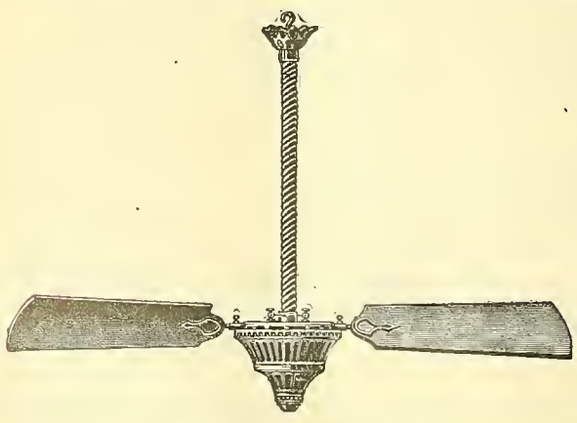
# Receivers' Sale,

By authority of the Supreme Court, stock of Electric Construction & Supply Co., consisting of "Ward" and "Knight" lamps and parts of same; carbons, domestic and imported; search lamps, iron, with parabolic reflectors. For list of fittings and material address

CHAUNCEY G. PARKER, THAD. T. GROVER, } Receivers.

14 Cortlandt Street, New York.

*Sale closes two months from date.*



AN EMPHATIC SUCCESS!
THE DIEHL ELECTRIC FANS
WIRED IN A SERIES OF
TWO OR MORE ON A
STREET RAILWAY CURRENT.

DIEHL & COMPANY, 385 BROADWAY, NEW YORK.

The Boudreaux Dynamo Brush Co. NO GAUZE.

# WILL YOU BE IN IT? YES!

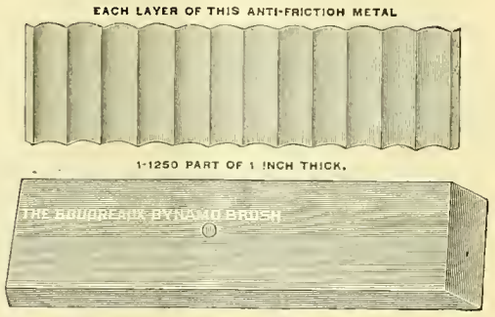
The Boudreaux Dynamo Brush Co. NO CARBON.

**USE**

## THE BOUDREAUX DYNAMO BRUSH.

NO SPARKING.

NO CUTTING.




NO TRIMMING.

NO GREASING.

The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

## THE BOUDREAUX DYNAMO BRUSH CO.,

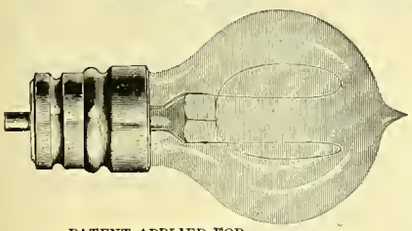
**Mallers Building, CHICAGO.**

**Postal Telegraph Building, NEW YORK.**

The Boudreaux Dynamo Brush Co. NO COPPER.

Sole Agent for Canada, R. E. T. PRINGLE, Montreal, Que.

# THE NEW ÆTNA LAMP.



PATENT APPLIED FOR.

**YOU DON'T SEE THE TWIST IN THE FILAMENT.**

*THIS LAMP is specially adapted to street and general railway and steamboat use, because it is absolutely non-vibratable, and we guarantee for it 50 per cent. longer life and better service than any other lamp now on the market. The filament will not droop or get out of shape while in use, no matter at what angle it is burned.*

*A good lamp at a fair price. Ordinary lamps at ordinary prices.*

**AGENTS WANTED IN LEADING CITIES.**

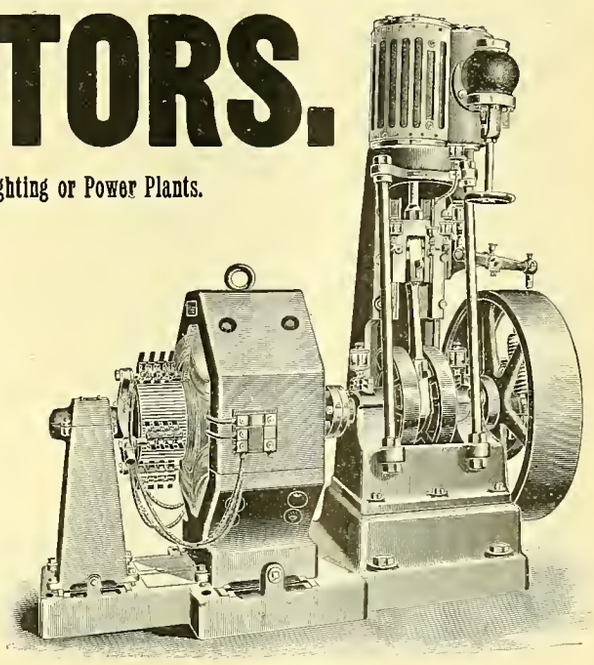
**WRITE US.** **Ætna Electric Works, Hartford, Conn.**

# EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*



## THE EDDY ELECTRIC MFG. CO.,

*WINDSOR, CONN.*

**NEW YORK OFFICE, HAVEMEYER BLDG.**

*REPRESENTED BY:*

**Walter C. McIntire & Co., 506 Commerce St., Philadelphia, Pa.**
**Western Electrical Supply Company, St. Louis, Mo.**
**F. P. Little Electrical Construction & Supply Co., Buffalo, N. Y.**
**W. T. Osborn, Kansas City, Mo.**
**D. P. GOSLINE, 30 Oliver St., Boston, Mass.**

**All Our Apparatus Guaranteed as Represented.**

# Westinghouse Electric & Manufacturing Company,

PITTSBURG, PA.

## ALTERNATING CURRENT FAN MOTORS.

We offer for the first time a single-phase induction Fan Motor.

*No Brushes,*
*No Commutator,*
*Babbitted Bearings,*
*Cannot Burn Out,*
*Low Priced.*
*Requires lubricating but once During the Season.*

These motors are manufactured under the patents of Nikola Tesla, which broadly cover the principles of their design. The Westinghouse Electric & Manufacturing Company is the only company authorized to make and sell motors of this type.

---

## WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY,

PITTSBURG, PA.

**Branch Offices in all Leading Cities.**

---

# SAWYER-MAN INCANDESCENT LAMPS,

## With Bases to Fit Any Socket.

We have now resumed the manufacture of the well-known Sawyer-Man Lamps, on a scale to meet any possible demand.

We have adopted new methods of manufacture which add to the appearance and quality of our lamps, and make them by reason of their efficiency and long life, the cheapest and best lamps ever offered.

PRICES:

**PLAIN LAMPS.**

| | |
|---|---|
| 8, 10 and 16 candle power lamps | 25 cents each. |
| 20 and 25 candle power lamps | 30 " |
| 32 candle power lamps | 38 " |
| 16 candle power street car lamps | 25 " |
| 16 candle power street car lamps, anchored | 32 " |

**ORNAMENTAL LAMPS.**

| | |
|---|---|
| 8, 10 and 16 candle power lamps | 30 cents each. |
| 20 and 25 candle power lamps | 35 " |

Discounts according to quantity.
For etching the plain or ornamental lamps, 3½ cents each, net.

**COLORED LAMPS.**

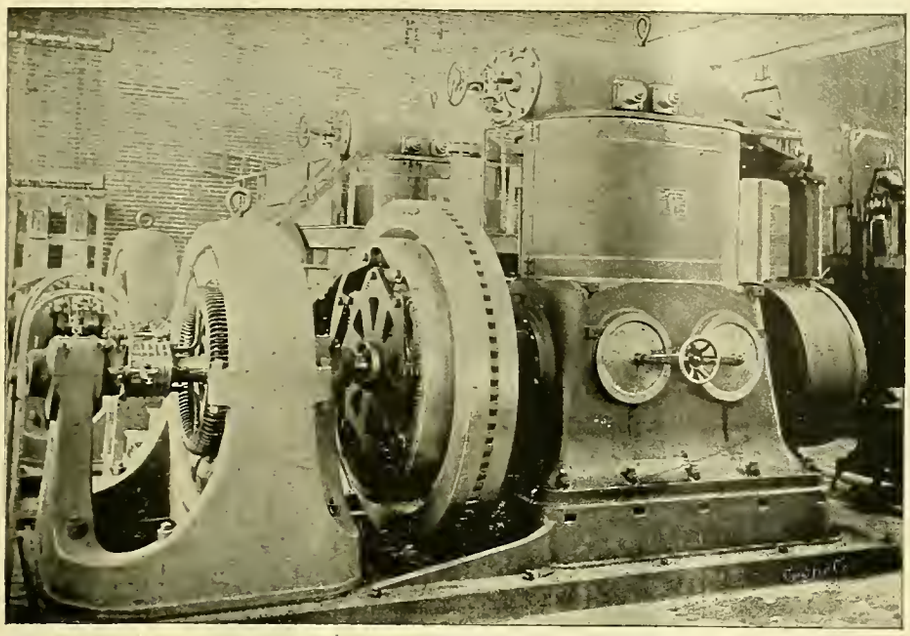
"Dipped" lamps in red, blue or green, 5 cents each, net, additional.

Boxing and packing at cost.
Prices are subject to change without notice.

# Westinghouse Electric & Manufacturing Company,

PITTSBURG, PA.

**Branch Offices in all Leading Cities.**



500 Horse-Power Polyphase Generators in power house of the Westinghouse Electric and Manufacturing Company, at East Pittsburg, Pa.

# Westinghouse Electric and Manufacturing Company,

## Sole Owners of the

# TESLA POLYPHASE SYSTEM.

The Ideal System for the distribution of power and light in factories and mills.

Motors, arc lights and incandescent lights supplied from the same circuits.

The system adopted by the Cataract Construction Company for their great plant at Niagara.

Especially adapted for transmission of power over long distances.

All machinery in our new works at East Pittsburg driven by Tesla Polyphase Motors, supplied from a central power plant. RESULTS: High Efficiency, Convenience, Economy and Flexibility. Inspection invited.

---

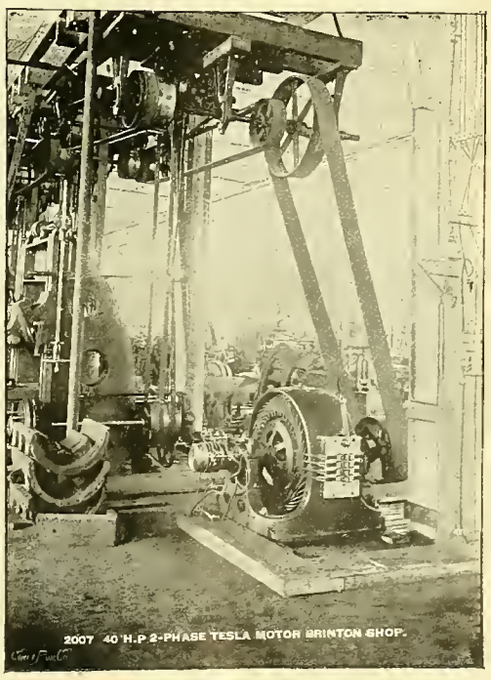
## NOTICE:

Induction motors operated by the so-called "Monocyclic" system offered for sale by the General Electric Company, are in fact multiphase motors and are broadly covered by the patents of Nikola Tesla owned by the Westinghouse Electric and Manufacturing Company.

The motors and system of distribution advertised by the Stanley Electric Company, of Pittsfield, are also an infringement of the Tesla Patents.

Suits have been brought against each of these companies, and are being pressed to a hearing as rapidly as possible.

It is the purpose of the Westinghouse Electric and Manufacturing Company to bring suits against all users of apparatus infringing the Tesla patents, in order that the rights of the company may be enforced.



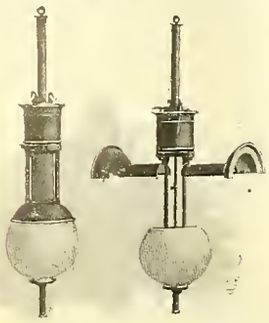

Forty Horse-Power Tesla Polyphase Motor operating machinery in shops at East Pittsburg.

# Westinghouse Electric & Manufacturing Company,

**PITTSBURG, PA.**

Branch offices in all leading cities.

# The S. K. C. Spark Arrester,



## STORM AND BUG PROTECTOR.

*Cheap, Durable, Effective,*
*Ornamental,*
*Readily Applied,*
*Operates Perfectly.*

Manufactured by the

**S. K. C. SPECIALTY COMPANY,**

Western Agents: Wallace Electric Co., 305 Dearborn St., Chicago.
New England Agent: Fred. P. Barnes, Equitable Bldg., Boston, Mass.

PITTSFIELD, MASS.

# The M. & B. Telephone Co.

Own letters patent No. 361,124, issued Aug. 12, 1887, which covers all possible forms of Battery Transmitters in which the Electrodes are *not* in *constant contact,* and they are not affected in any way by the Berliner Transmitter Patent. Send in your orders.

**THE U. S. TELEPHONE CONSTRUCTION CO.,**

GENERAL AGENTS,

Bullitt Building, . . Philadelphia.

OKONITE TRADE MARK.

**OKONITE WIRE.**
**OKONITE TAPE.**
**MANSON TAPE.**

**FULL STOCK . . .**
**BOTTOM PRICES.**

**WESTERN ELECTRIC COMPANY,**

CHICAGO. NEW YORK.

# TELEPHONES!!

This company is manufacturing **A Compound Magneto Telephone**
Which it sells outright under a guarantee both as to efficiency and as against infringement of patents.
It talks as well over one hundred miles as any other Telephone talks over one mile.
This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists.

**WESTERN TELEPHONE CONSTRUCTION CO.,**
**539, 540 and 541 Monadnock Blk., Chicago, Ill.**

## $5 TO $15 TELEPHONES.

**Supplies of Every Description.**

Transmitters (Blake Pattern); Hunning Silver Diaphragm or Magneto Receivers; Magneto Bells; Wire Cross Arms; Insulators; Induction Coils; Backboards; Switches; Batteries, etc. Wholesale Prices to Dealers.

**Farr Telephone & Const. Supply Co., Mfrs.,**
**Sales Store and Office, 342 Dearborn St., Chicago.**

Western Agents for DANBURY ELECTRICAL WORKS.

# TELEPHONES

Universal Telephone Co.,
Indianapolis, Ind.

## BLAKE TRANSMITTERS.

**COMPLETE, $2.00 EACH.**

In Walnut and Oak Cases.
Blake Transmitter Castings, $1.00.

Philadelphia Telephone Co.,
Box 707, Philadelphia.

THIS TELEPHONE
IS CALLED THE
**Long Distance,**
**No. 1.**

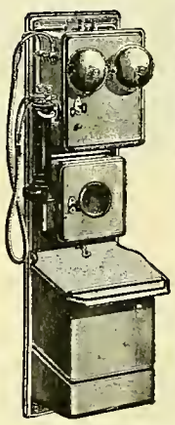
Will speak one thousand miles on a properly constructed line. You can hear a watch tick one hundred miles. Is that satisfactory? If so, write to

**W. A. GUSTAFSON,**
**JOLIET, ILL.,**

For prices and information. Send business card, I sell to the trade only.

**ORDERS**

For any electrical book published filled promptly on receipt of price.
ELECTRICIAN PUBLISHING COMPANY,
6 Lakeside Building, Chicago.



TELEPHONES,
RECEIVERS,
TRANSMITTERS,
MAGNETO and
EXTENSION BELLS,
WIRE AND CORD,
WOOD BRACKETS,
GLASS INSULATORS.

The most Complete Stock.

**JULIUS ANDRAE & SONS CO.,**

MILWAUKEE, - WIS.

Our Instruments are absolutely

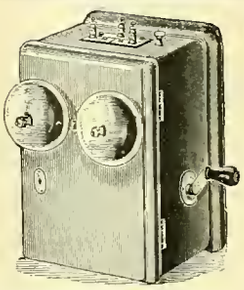
**NON-INFRINGING.**

# Subscribe for the Western Electrician.

# TELEPHONES

FOR ALL PURPOSES, AT THE LOWEST PRICES.
SEND FOR CATALOGUE.

MISSOURI TELEPHONE MFG. CO., 1230 Olive Street, ST. LOUIS, MO.



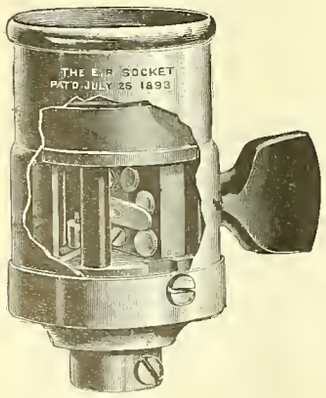
# MAGNETO BELLS

AND

Standard Goods. No Infringements. **TELEPHONES.** Get Our Prices Before Purchasing Elsewhere.

**E. & F. GILLETTE,**
BAYPORT, CONN.

# NOTICE.




FULL SIZE.

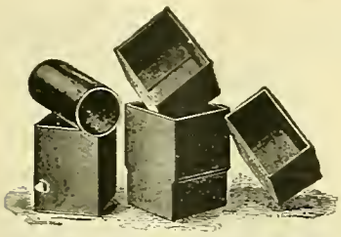
We beg to inform the users of electric lights and the trade in general that our new ***Economic Regulating Sockets*** for 16 c. p. lamps, 100 to 118 volts, ***direct*** or ***alternating*** currents, are now ready for delivery.
Give five grades of light with a ***Saving*** of ***69 per cent.*** in current at the lowest.

**LIST PRICE, EACH $1.00.**

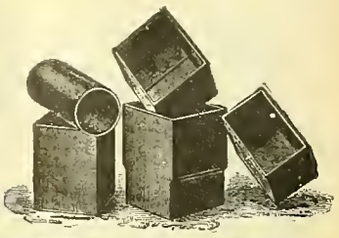
Samples sent prepaid on receipt of list price. In ordering state what style of lamp base you wish them for. Send for circulars. Discounts furnished to the trade on application.

**THE ELECTRIC CO.,**
**56 Broadway, NEW YORK CITY.**

**N. B.**—Special socket for 50 to 55 volts now in the works, and will be ready for delivery in a short time. Watch these columns for announcement.

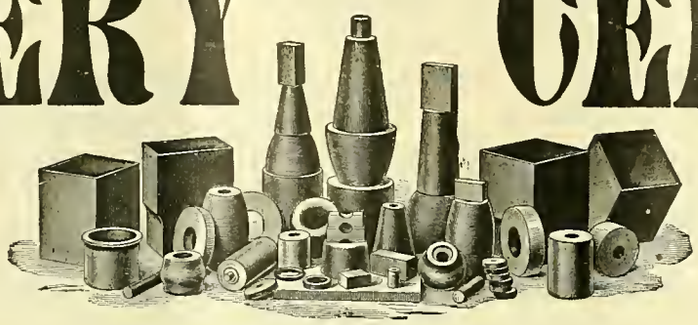


# THE FREEMAN



# BATTERY CELLS.

Estimates Furnished on Application. Prompt Delivery.

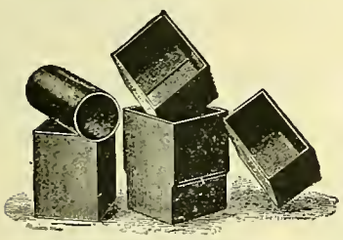


Standard Sizes Always on Hand.

The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplished providing additional strength to such an extent that this cell can be used where no other would be practical.

## THESE CELLS ARE A NEW PRODUCTION AND FULLY GUARANTEED.

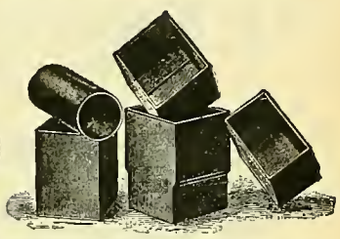
**AGENTS WANTED IN ALL CITIES.** **WRITE US FOR INFORMATION AND CATALOGUE.**



THE

## Newton Rubber Works,

Newton Upper Falls, Mass.



# INCANDESCENT LAMPS

**Any Candle Power, any Voltage, any Base.**

Perkins Sockets, Gibbs Switches, Dovetail Rosettes,

Waterhouse-Gamble Arc Lamps, Imported Carbons.

**NOTE OUR NOVEL METHOD OF PACKING INCANDESCENT LAMPS:**

They are placed in paste-board cartons without any wrappings, in a manner similar to that employed in packing eggs. Each paste-board carton holds 10 lamps and 20 cartons are packed in one wooden case.

It will pay lamp buyers to give us a sample order for Incandescent Lamps, and by personal inspection see the value of the new packing.

NEW YORK:
219 Havemeyer Bld'g,
C. I. HILLS, Manager.

CHICAGO:
1637 Monadnock Bld'g,
G. W. CONOVER, Manager.

## The Perkins Electric Switch Mfg. Co.,

HARTFORD, CONN.

PHILADELPHIA:
806 Walnut Street,
O. D. PIERCE, Manager.

BOSTON:
182 Summer Street,
F. B. SMITH, Manager.

THE RECENT

# ADVANCE IN COPPER

Has not in any way affected the demand for our celebrated "O. K." Weatherproof Wire. In fact the average station manager has come to look upon "O. K." Weatherproof Wire as one of the absolute necessities of life, and something that he must have

**AT ANY COST.**

And so the good work goes on; and when the price advances, instead of buying less he buys more, for fear it will go still higher.

—A good thing is **CHEAP AT ANY PRICE.**

**ELECTRICAL SUPPLIES.**

*Electric Appliance Company,*

**242 Madison Street, Chicago.**

---

**USE THE BEST!**

## Eureka Commutator Compound.

A perfect Compound for Dyeamos and Motors. Works on any Commutator with Copper or Carbon Brushes. Send for sample; price 50c per stick.

**Edw. R. Tornberg,**
**SIOUX FALLS, S. D.**

---

The **Brady Mast Arms.**

T. H. Brady, New Britain, Conn., U. S. A.,

Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work. — *Catalogues and Prices furnished on application.*

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## GOOD PATENTS

Procured. **30 Years' Practice.** **GRANT INSURED.** Pamphlet, references and advice **free.**

**CHAS. J. GOOCH, Washington, D. C.**

---

**Boswell Storage Battery.**

For Traction Work, Electric Lighting, Electric Launch, Telegraph, Phonograph, Surgical, and for all purposes where Light and Power are required.

**Prices on Application.**

**D. E. BOSWELL & CO.,**
154 Lake St., Chicago.

---

# CEDAR POLES, STREET R. R. TIES.

*The Valentine-Clark Co.,*

704-706 ROOKERY, - - - - CHICAGO.

---

# Public Telephone Co.,

This system does not infringe the patents of the Bell Telephone or Western Electric Co. We build exchanges complete for local companies, or will install and operate exchanges ourselves at a low monthly rental. We keep in stock Blake transmitters and all kinds of supplies.

**MANUFACTURERS OF THE SHAVER LONG DISTANCE PULVERIZED CARBON TELEPHONE**

**For Exchanges, Etc.**

**Correspondence Solicited.**

**PUBLIC TELEPHONE CO.,**

**Office and Factory:**
**Thames Building, 27 Thames Street,** NEW YORK.

---

**P. & B. Armature and Field Coil Varnish.**

**P. & B. Insulating Compound.**

**P. & B. Insulating Tape.**

**We are the sole manufacturers of the P. & B. products which have been the STANDARD for ten years.**

**Send for samples and price lists.**

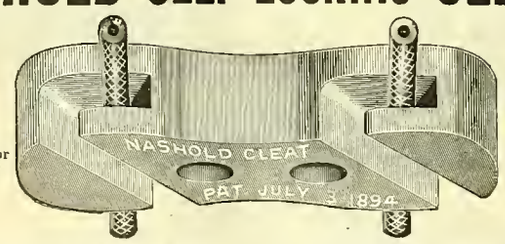
**The Standard Paint Co.,**

| CHICAGO: | No. 2 Liberty Street, | LONDON: |
|---|---|---|
| Metropolitan Elec. Co., | NEW YORK. | Robert W. Blackwell, |
| 186-188 Fifth Ave. | | 39 Victoria St., S. W. |

---

# NASHOLD SELF-LOCKING CLEAT.

Patented in U. S., Canada, England, France, And Applied for In Germany.

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**It is the most practical Cleat made.**
**It is made of finest glazed porcelain.**
**It is in one piece.**
**It has the strength.**

**It will lock the wire firmly.**
**It will NOT break in putting up.**
**It will NOT hold moisture.**
**It will NOT hurt the insulation.**

The wire can easily be put in place or removed without loosening the Cleat. It is a great saver in Time and Labor over any other Cleat in use for putting up Electric Light or other Wires.

**The Nashold Cleat Company,**

Telephone, Harrison 636. 934-935 Monadnock Bldg., CHICAGO, ILL.

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For Arc Light and Trolley Cord.

**SAMSON CORDAGE WORKS, - BOSTON, MASS.**

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**(ELECTRIC BRAND)**

## For Electrical Purposes

Guaranteed 98/99% and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by

**A. KLIPSTEIN & COMPANY, 122 Pearl St., New York.**

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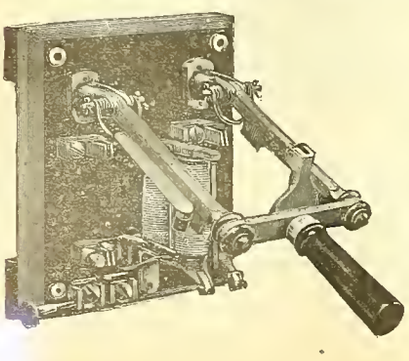
# MOTOR ARMATURES COST MONEY



You can prevent them from burning out by using

## THE BRODIE AUTOMATIC MOTOR-SWITCH.

It combines in one piece of apparatus a double-pole switch, adjustable limit-switch and automatic cut-out, and instantly disconnects the motor whenever it is overloaded and whenever the circuit fails from any cause.

Agents wanted in all sections of the country.

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Eugene F. Phillips, Prest. W. A. Hathaway, Treas. W. H. Sawyer, Secy.

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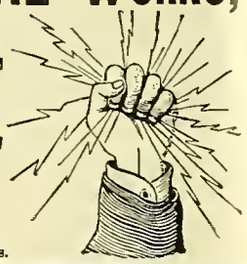
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

CABLES FOR AERIAL AND UNDERGROUND USE.



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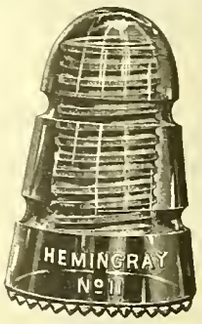
Chicago Store, F. E. Donohoe, 241 Madison St.
Montreal Branch Eugene F. Phillips' Electrical Works.

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**Can be Used for Transposing.**

The points or teats on the lower rim of the petticoat attracts the water on the outer surface of the insulator into drops. The water drops from these points on to the cross-arm, thereby preventing the moisture from creeping up on the inner petticoat, and thence to the pin. Owing to the great success of our Patent Teat Insulator in Telegraph Work, where the efficiency of the Insulator has proven to be more than twice that of the ordinary Insulator, we have concluded to apply the device to all Insulators for Telegraph, Telephone and Street Railway Work.

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Send Model or Drawing and we will furnish estimates.

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For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

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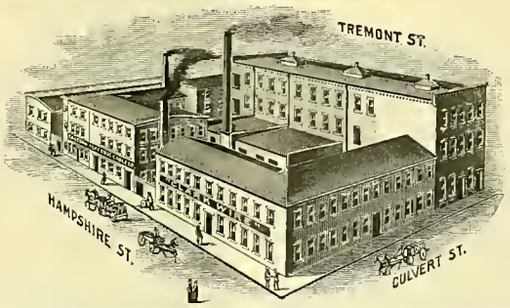


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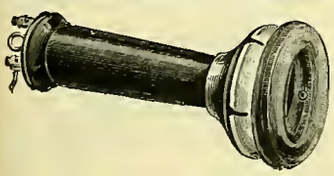

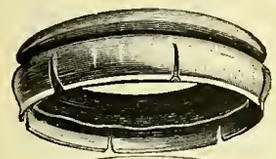

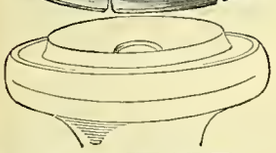

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**It will not Deteriorate by long use, nor Oxidize the Copper. Finished in the following Styles: Black Polished, White and Black Glazed Braid and White Fireproof.**

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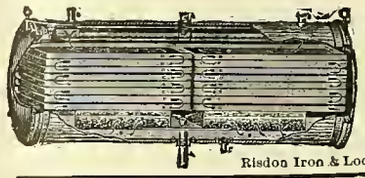

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## Table Push.

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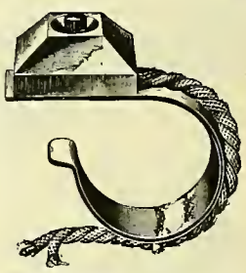

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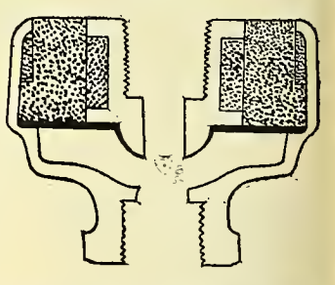

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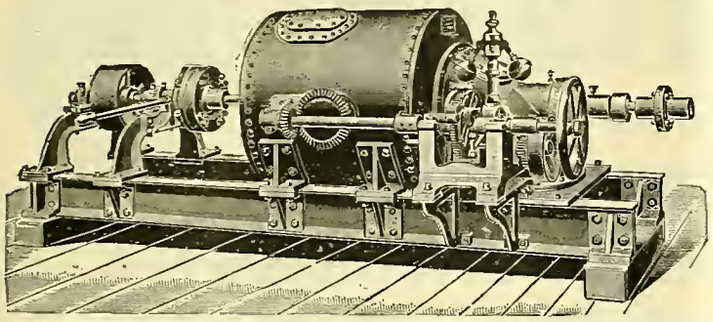

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The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter**, being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

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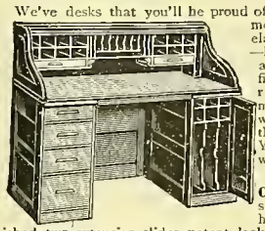

We've desks that you'll be proud of—that ornament the most elaborate office—best material and splendid finish. We'll return the money if you want to send the desk back. You won't want to.

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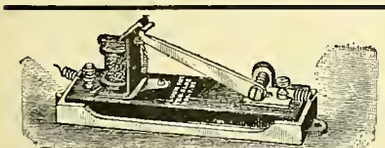

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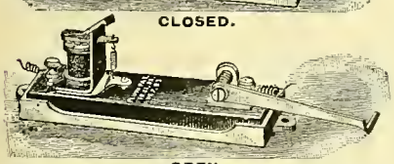

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**Regular Size, 6 inches long, 2¾ inches high, 1 to 1¼ inches wide.**

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**WE CLAIM**

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**For the Stevens Flush Switch,** fire and damp proof. Mechanism is simplicity itself. Nothing to get out of order. Make and break so wide that no arc can form. Wired without removing casing. Buttons made of mother of pearl. Base made of vulcabeston with porcelain cases.

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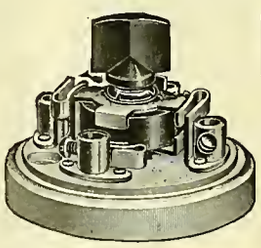
STANDARD SWITCHES, 5 and 10 ampere S. P.
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



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Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

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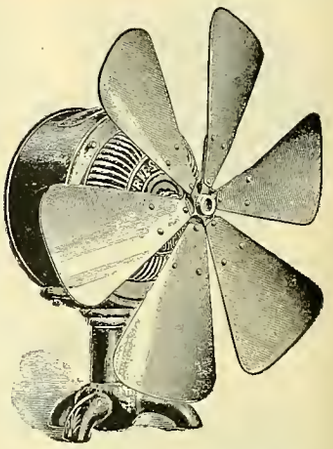

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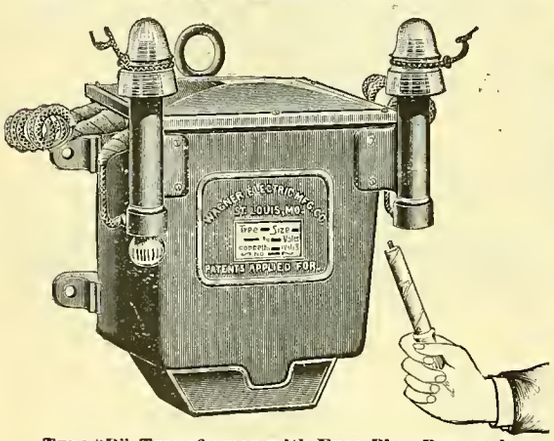


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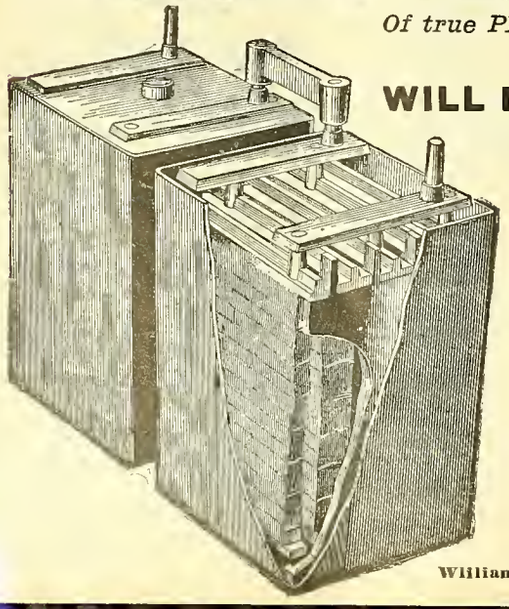

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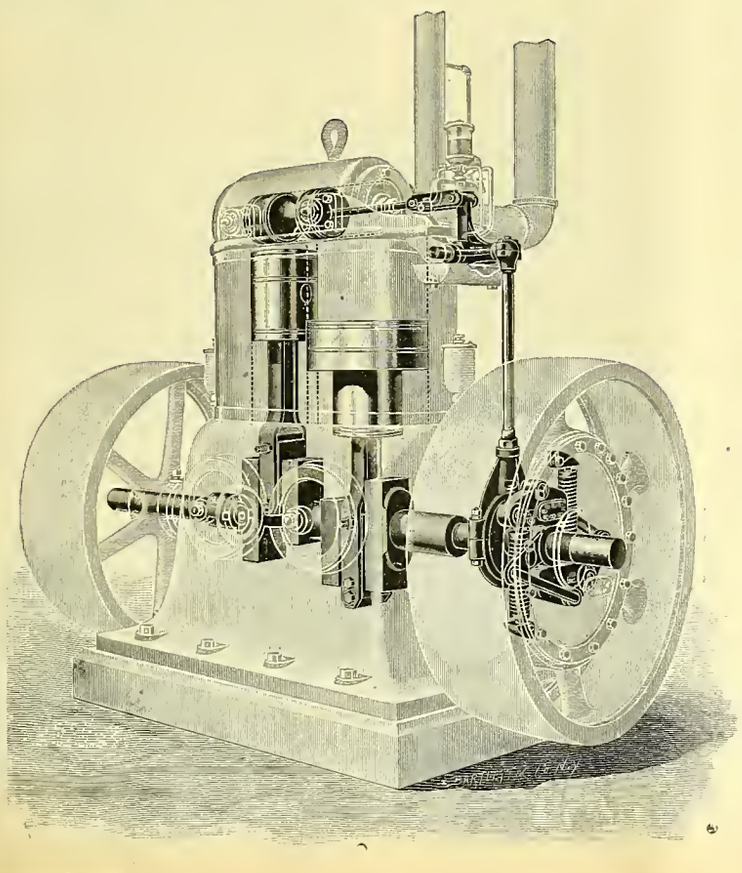

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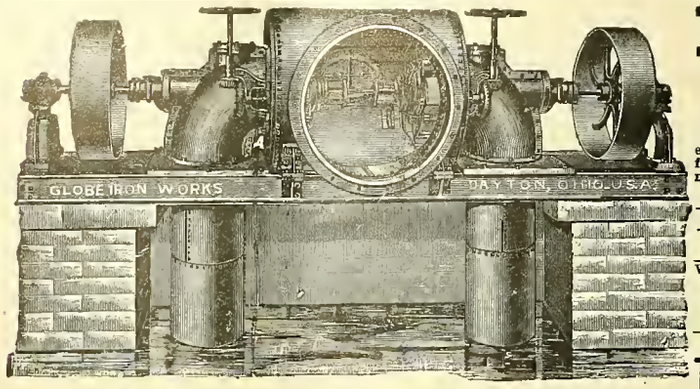


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| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.06 | 119.17 | 141.68 | 205.27 | 79 76 |
| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.68 |
| ¾ " | 16.78 | 117.33 | 112.60 | 176.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118.40 | 75.62 |

**Test of a 42-inch Wheel—July 14, 1894.**

| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Pnwer. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.33 | 128.00 | 134.18 | 199.56 | 80.50 |
| ⅞ " | 16.66 | 134.80 | 120.85 | 188.14 | 83.09 |
| ¾ " | 16.69 | 129.33 | 104.85 | 162.89 | 82.77 |
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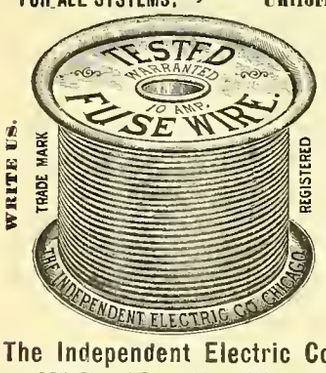


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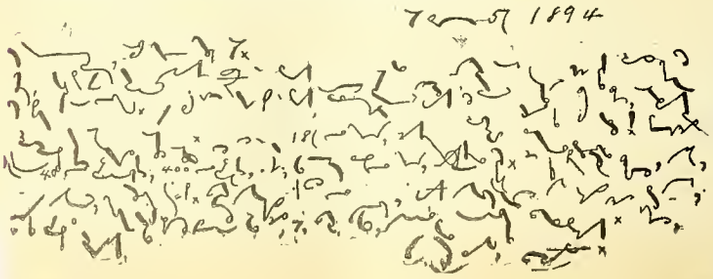

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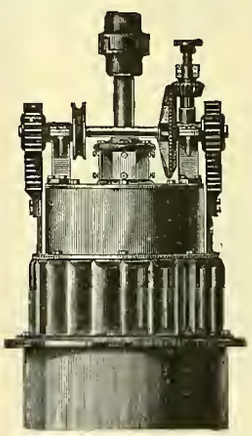

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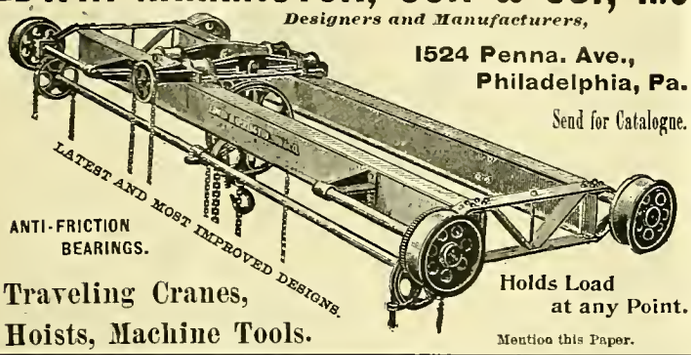


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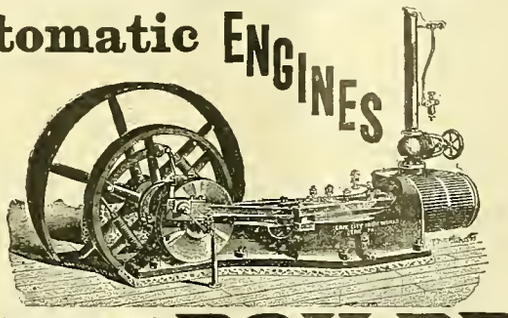

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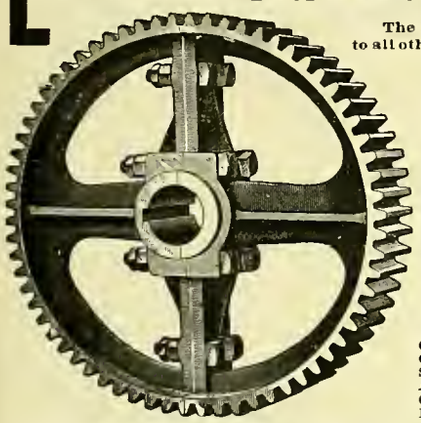

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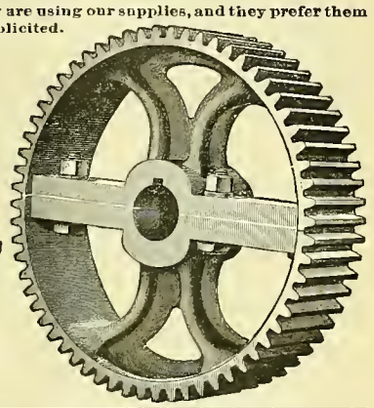

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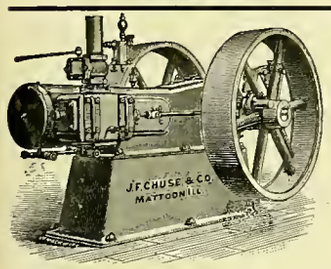


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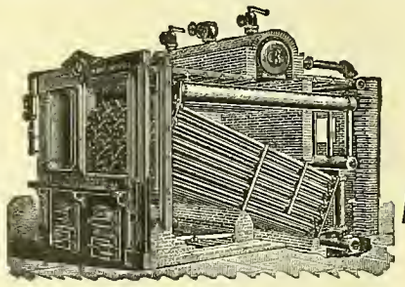

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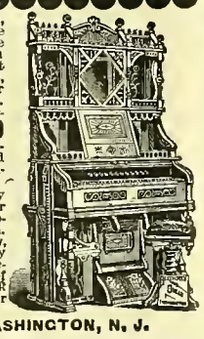

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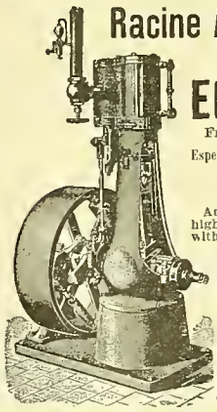

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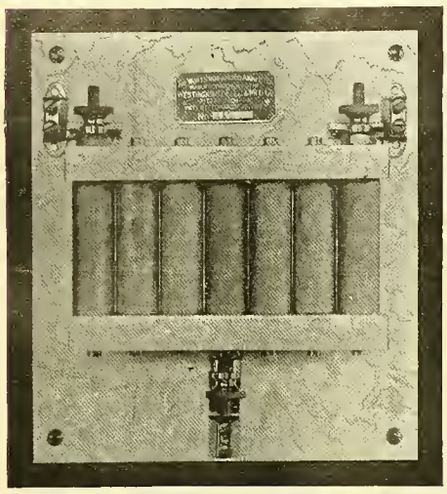
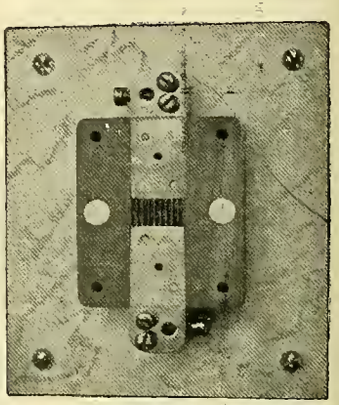


Double Pole Non-Arcing Metal Station Lightning Arrester for Alternating Current Circuits.

## THE WURTS NON-ARCING LIGHTNING ARRESTERS.



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**NO FUSES BLOWN. NO INSPECTION NECESSARY.**
**NO FALLING OUT OF CIRCUIT BREAKERS.**
**NO ARCING AND NO REPAIRS.**

### Extract from report of The Franklin Institute on Wurts Lightning Arresters.

The various arresters produced by Mr. Wurts are intended for the protection of electric lighting and power circuits from direct and indirect damage from lightning discharges, and Mr. Wurts has, apparently, studied this question in a scientific and very exhaustive manner.

With but few exceptions all lightning arresters commonly used, up to the inventions of Mr. Wurts, have been based upon the fact that static discharges generally tend to "ground" by the shortest distance even when obliged, in order to do this, to jump a considerable "air-gap," in preference to taking a longer path over a much lower resistance. Such arresters, therefore, have been essentially nothing more than two points or sets of points; one being "grounded" and the other connected to one or both legs of the circuit to be protected.

An arrester of this kind, while often affording a release from the static charge, would also allow the dynamo current to follow upon the arc so produced, thus producing either short circuit or a dangerous "ground," and in both cases causing an interruption of the main working circuit. Hence, the more improved arresters of this type were so constructed as to break the dynamo arc as soon as possible. This is easily seen to be a remedy rather than a preventive.

Mr. Wurts perceived this fact and set himself to the problem of constructing an arrester in which the dynamo arc could not start, rather than one which would break the arc when started. As far as can be judged from recorded data he has succeeded in solving the problem in a very efficient manner, both for alternating and direct current.

The operative features of these arresters conform more closely to recognized laws than those of the devices previously known and used for the purpose. The instruments are cheaper to manufacture, and, as far as the Institute has been able to ascertain, are very effective in preventing damage, and they protect without causing cessation of operations.

In these respects the Institute believes these inventions to be important improvements, and therefore recommends the award of the John Scott Legacy Premium and Medal to their originator, Alexander Jay Wurts, of Pittsburg, Pa.

Adopted at the stated meeting of the Committee on Science and the Arts, held Wednesday, May 2, 1894. JOSEPH M. WILSON, President.

Countersigned by WM. H. WAHL, Secretary.

ARTHUR BEARDSLEY, Chairman of the Committee of Science and the Arts.

**PRICES ON THESE LIGHTNING ARRESTERS ARE AS FOLLOWS:**

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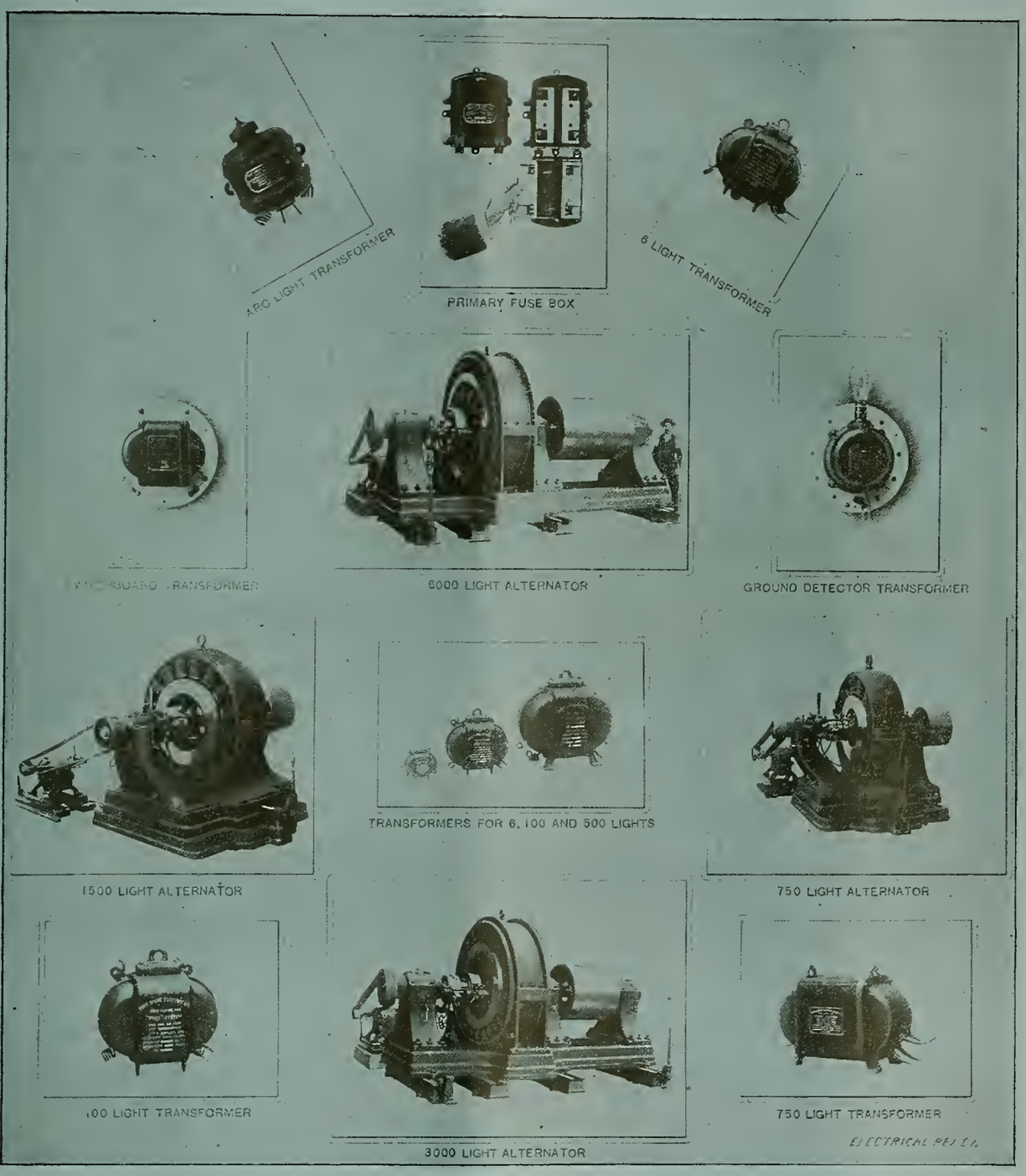


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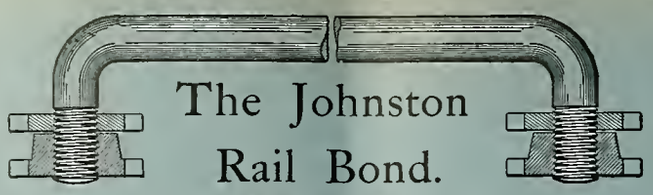

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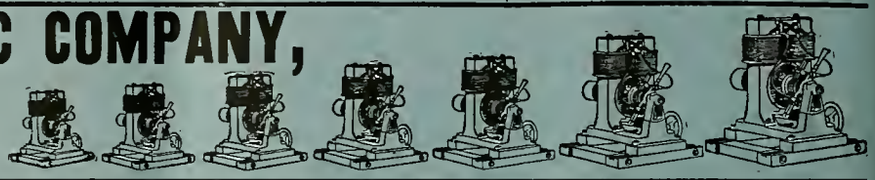

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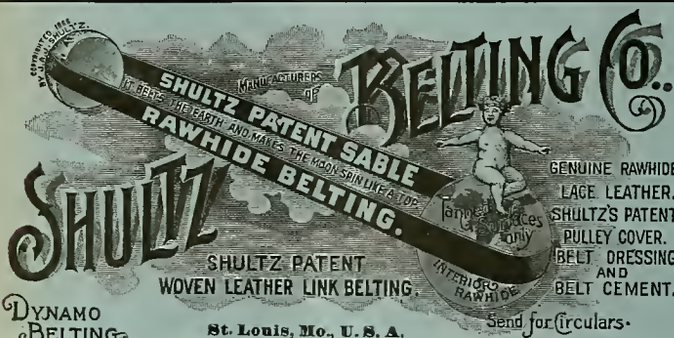


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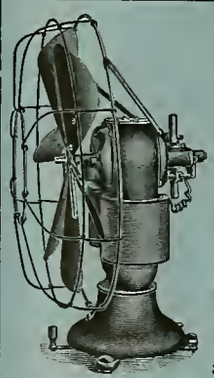

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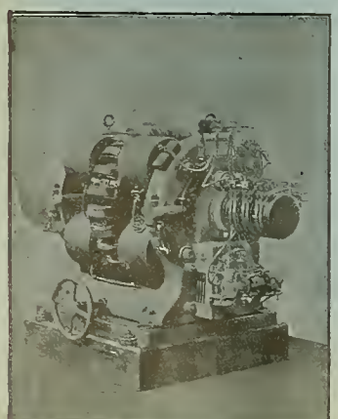

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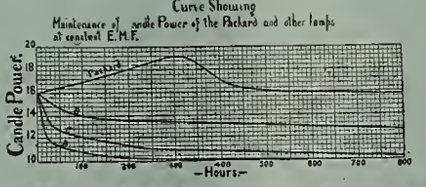


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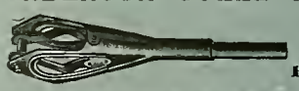

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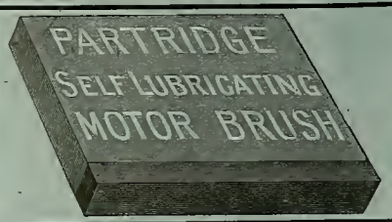


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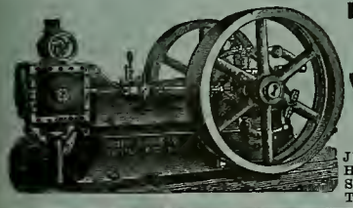

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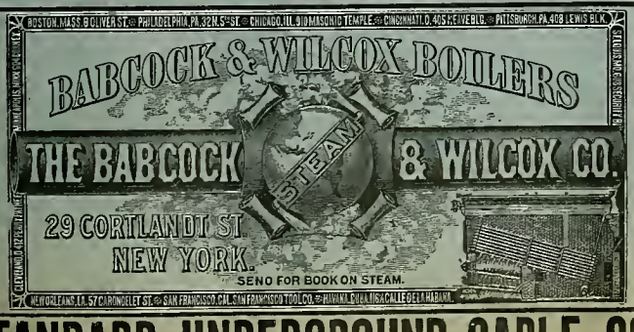


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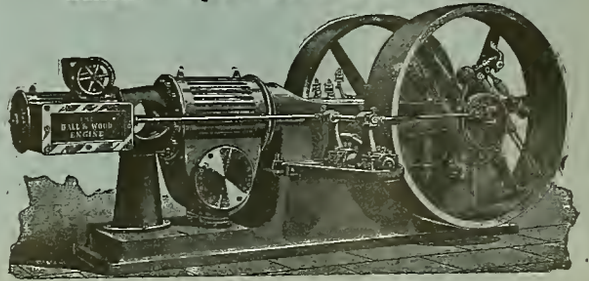


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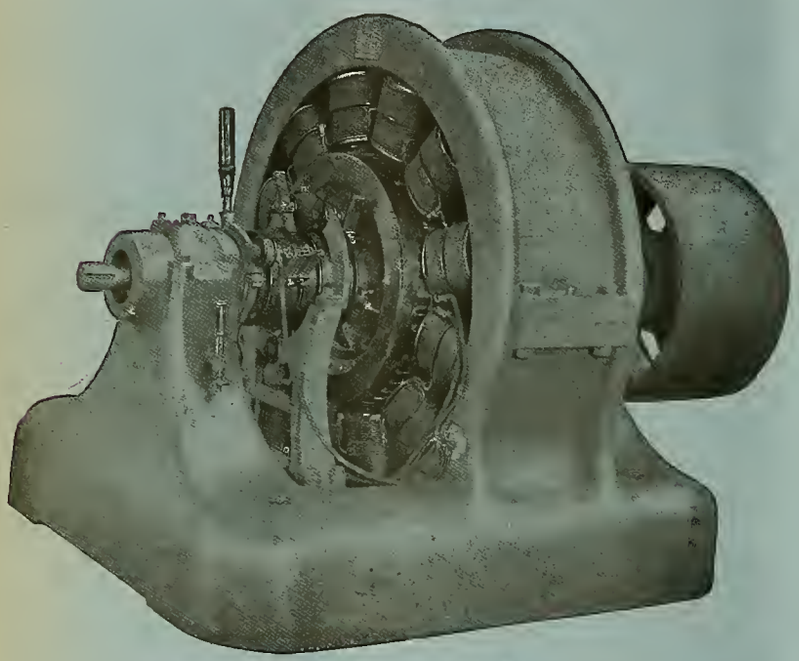

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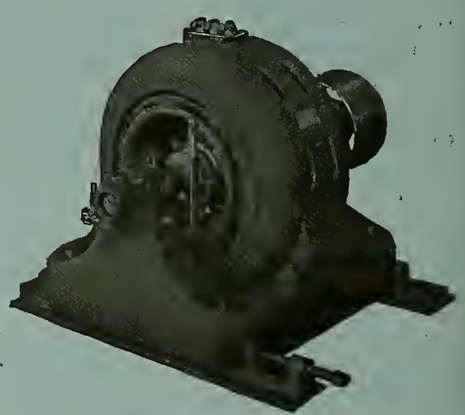

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Electric Storage Battery Co.
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Perkins El. Switch Mfg. Co.
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Standard Thermometer Co
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Elec. Engr. & Supply Co.
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Electric Storage Battery Co.
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Leclanche Battery Co., The.
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General Electric Co.
Independent Electric Co.
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Phillips Insulated Wire Co.
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Wallace Electric Co.
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Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
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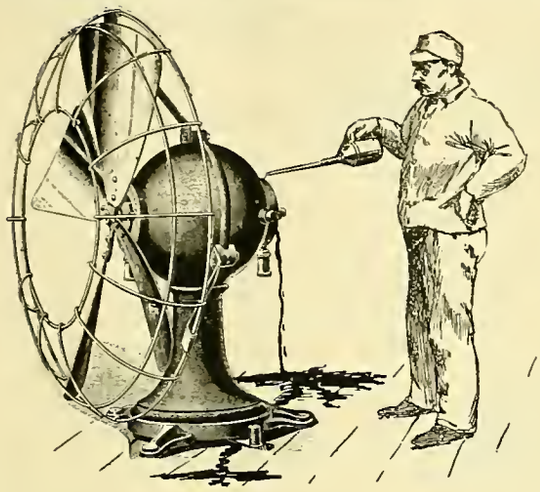

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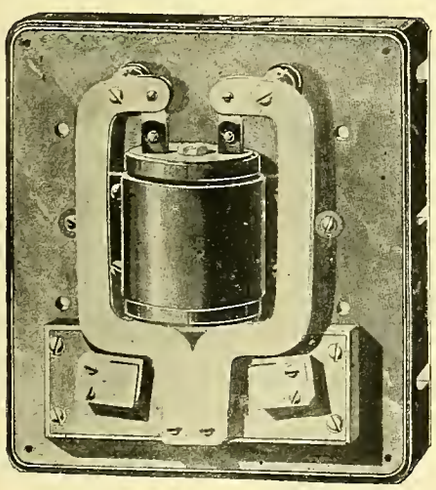

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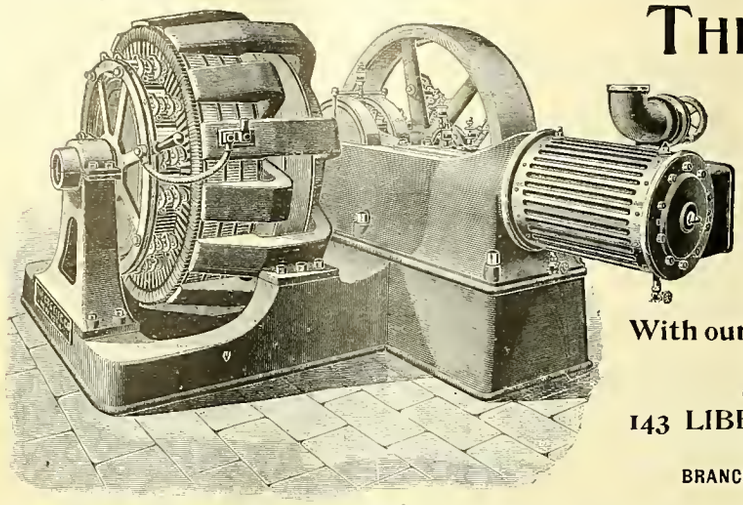

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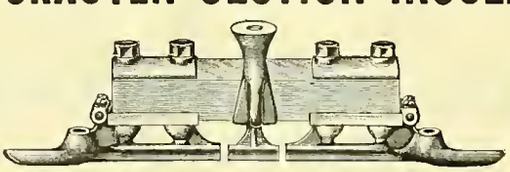

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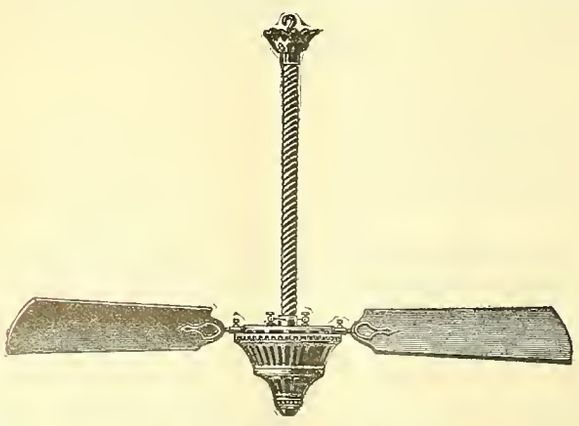

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The Boudreaux Dynamo Brush Co. NO GAUZE.

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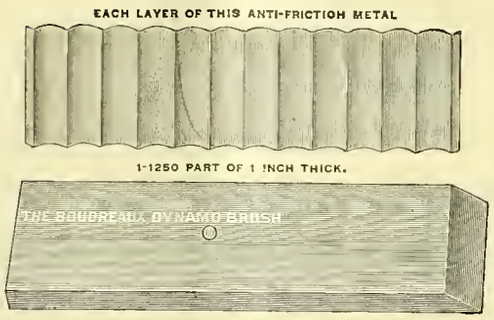


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# THE BOUDREAUX DYNAMO BRUSH CO.,

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The Boudreaux Dynamo Brush Co. NO COPPER.

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**THE FIRST AND ONLY COMPLETE AND PERFECTED SYSTEM BY WHICH LIGHT AND POWER CAN BE SUPPLIED FROM THE SAME GENERATOR AND CIRCUITS. POWER TRANSMISSION AND DISTRIBUTION MADE PRACTICAL AND COMMERCIALLY SUCCESSFUL.**

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Our system is much more simple and consequently more durable than any other, either direct or alternating.

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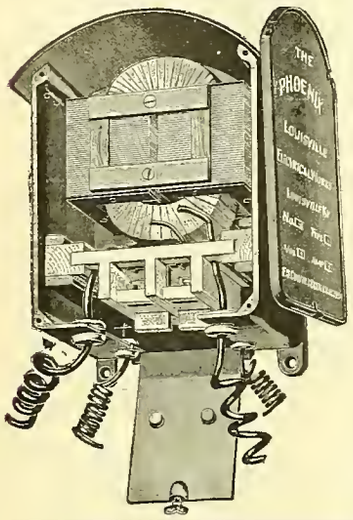

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They are placed in paste-board cartons without any wrappings, in a manner similar to that employed in packing eggs. Each paste-board carton holds 10 lamps and 20 cartons are packed in one wooden case.

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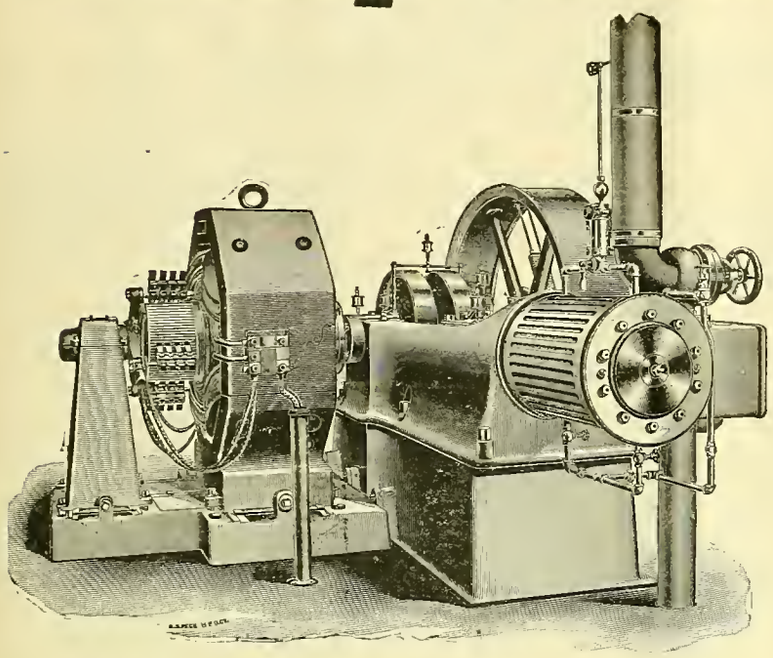

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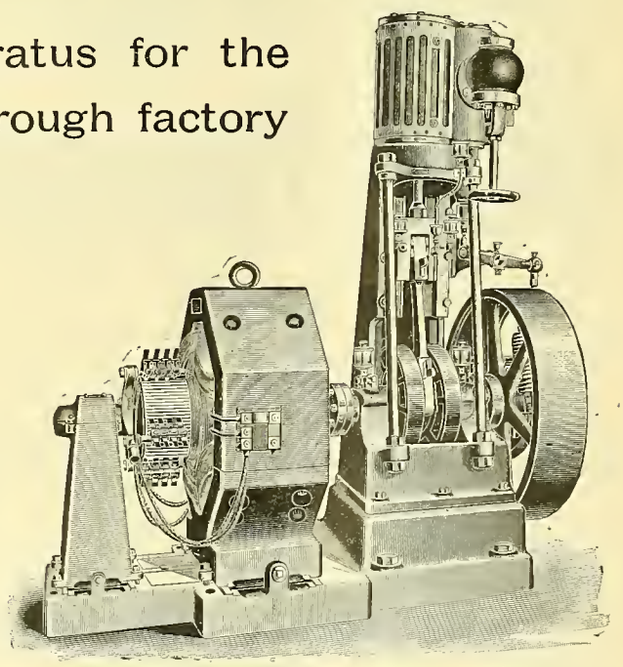
We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.



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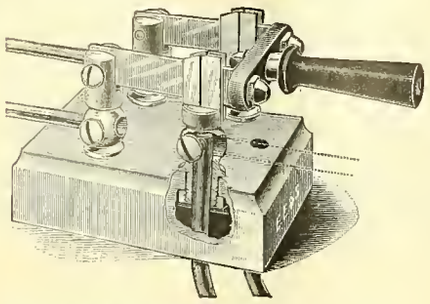
# E. E. & S. BABY.



Our Baby carries 10 to 25 amp.
Our Baby is easily wired.
Our Baby is original.
Our Baby behaves nicely on any cir. uit, including 220 volt
Our Baby is just what you want.
Try some.

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Our Baby was born February 5th, 1895, and is thriving nicely on from ten to twenty-five amperes a day.

This Baby can be used on any circuit up to 220 volts. Can be wired for cleat, moulding or concealed work, having our special combination binding post. Is mounted on porcelain base. Dimensions 2½ in. by 1 ⅞ in., and stands 1¾ in. high over all. Brass and copper parts highly polished and lacquered.

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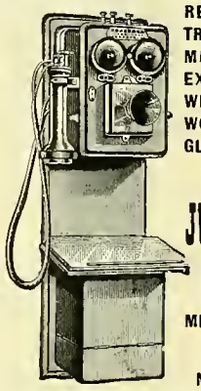

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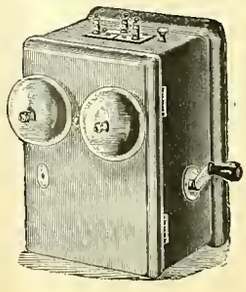

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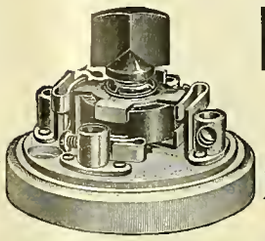

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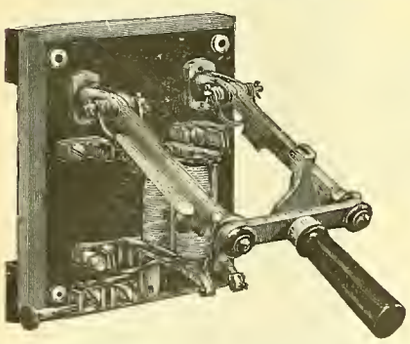

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It combines in one piece of apparatus a double-pole switch, adjustable limit-switch and automatic cut-out, and instantly disconnects the motor whenever it is overloaded and whenever the circuit fails from any cause.

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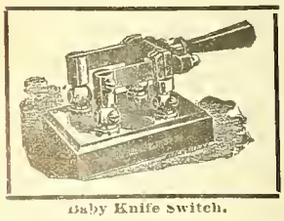

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Bridgeport, Conn., and Chicago.

GRIER BROS, Managers, Western Office,

The R. Thomas & Sons Porcelain is good

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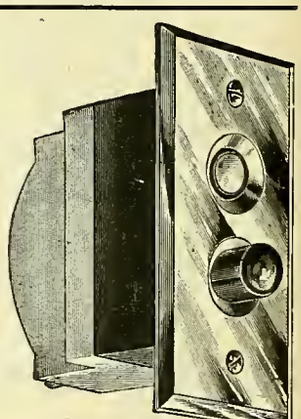

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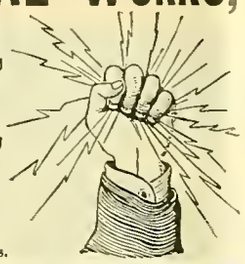

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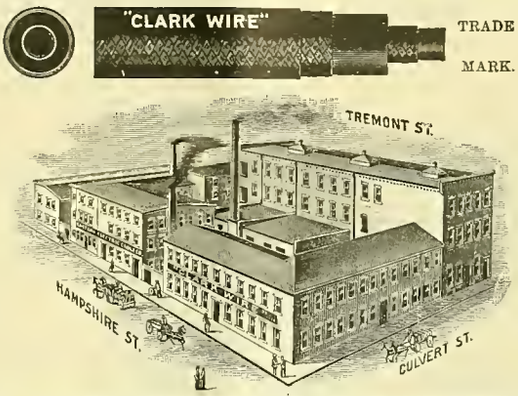


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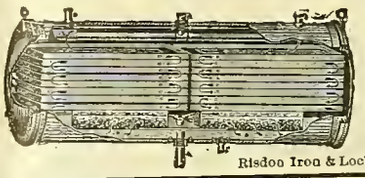

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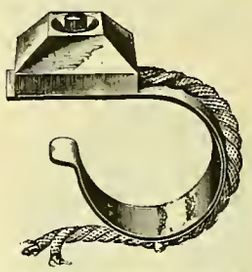

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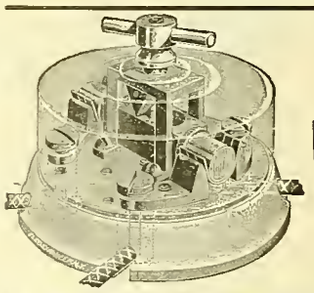

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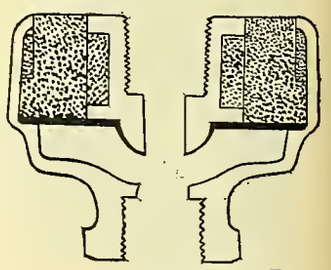

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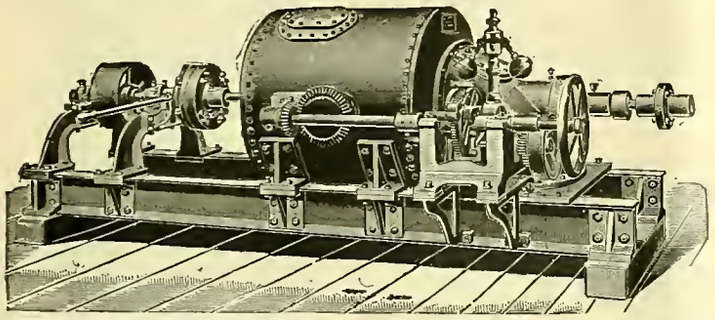

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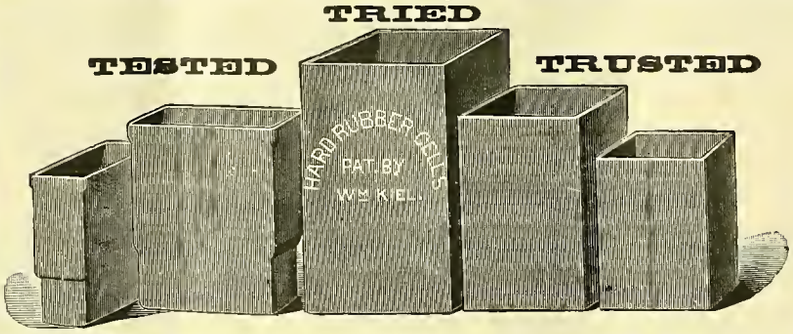


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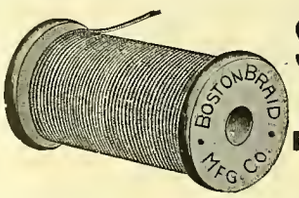


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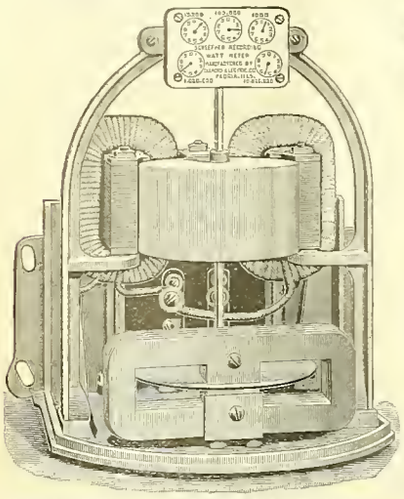

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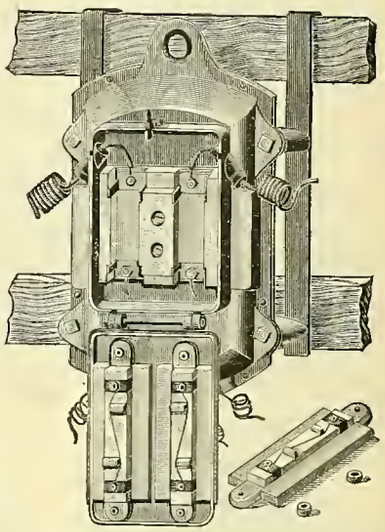

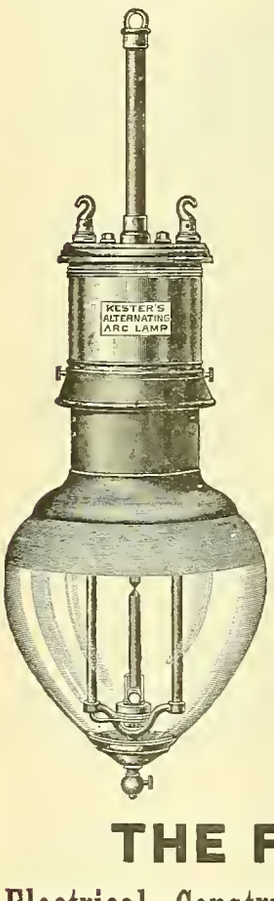


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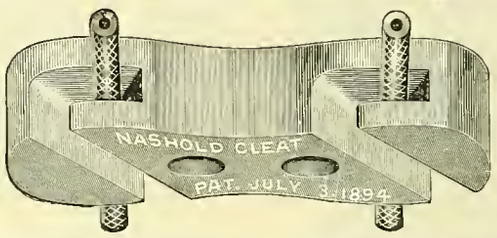


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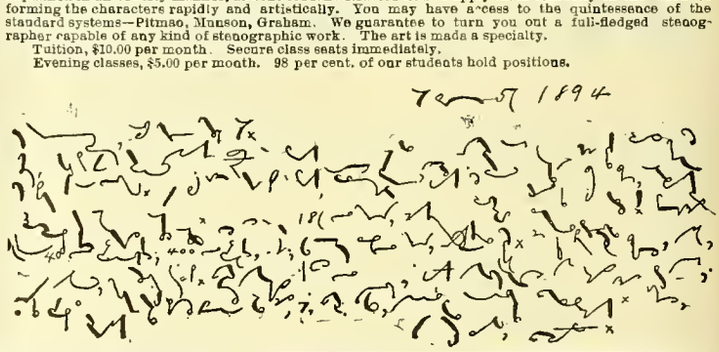


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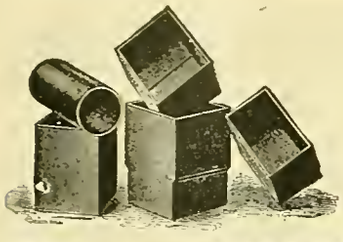

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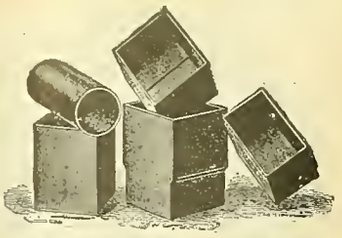

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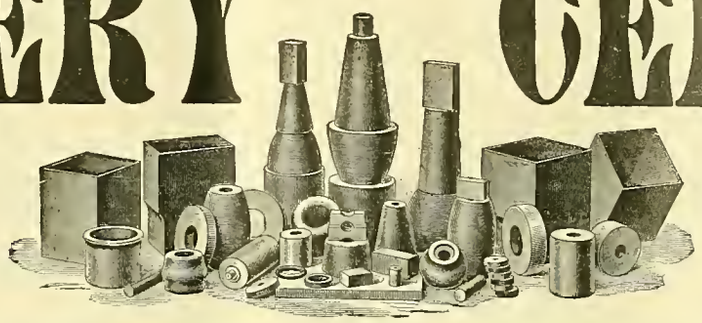

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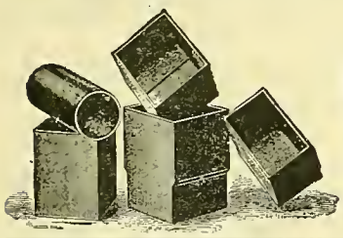

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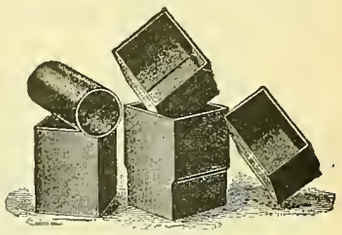

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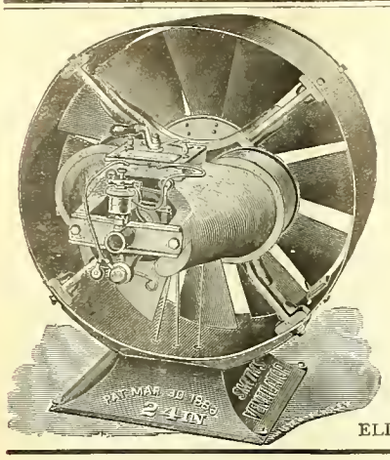

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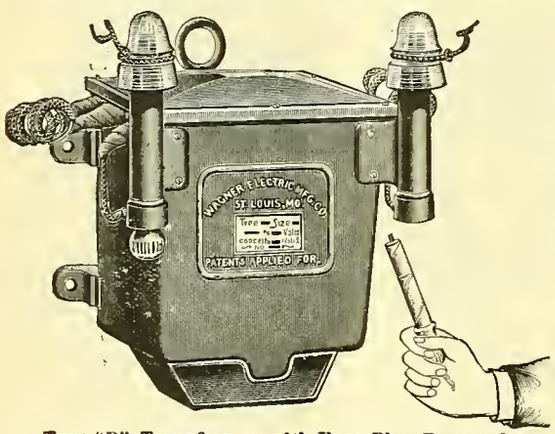


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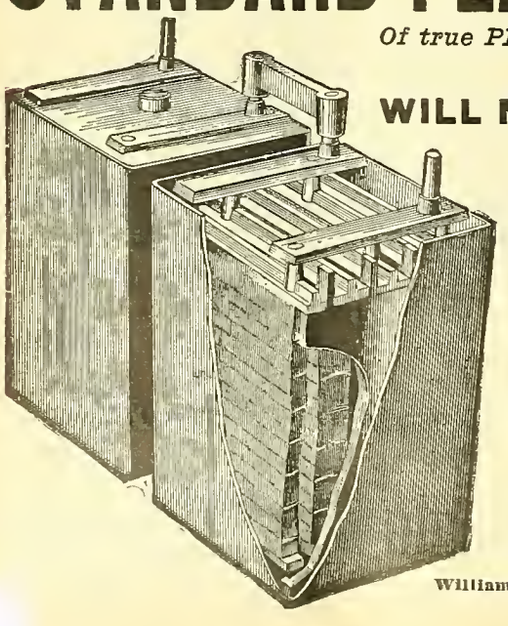

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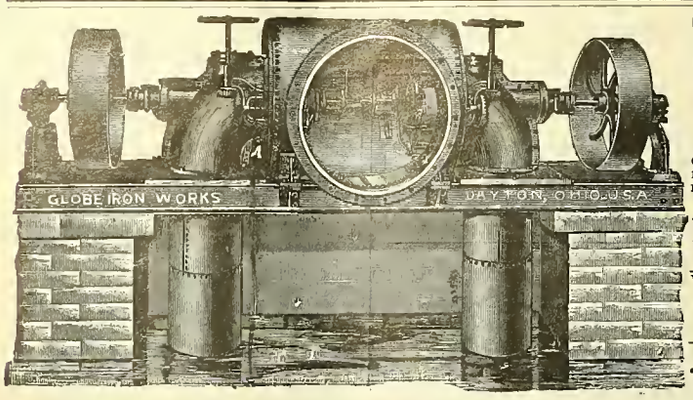


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| ⅞ " | 16.42 | 122.00 | 127.18 | 195 19 | 82.58 |
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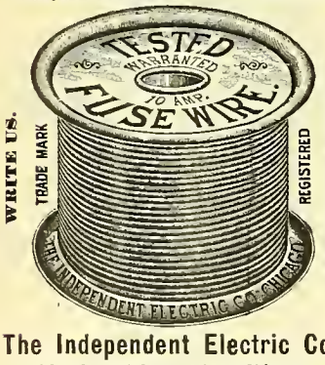


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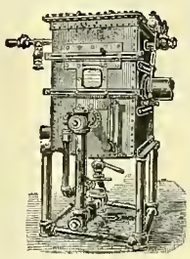

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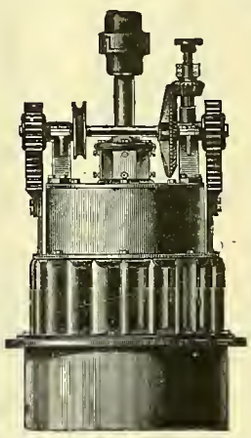

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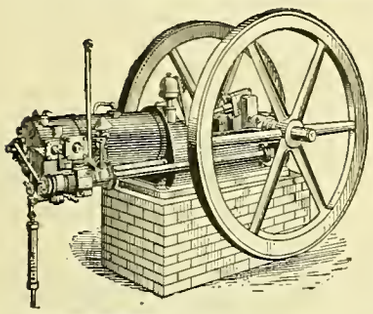

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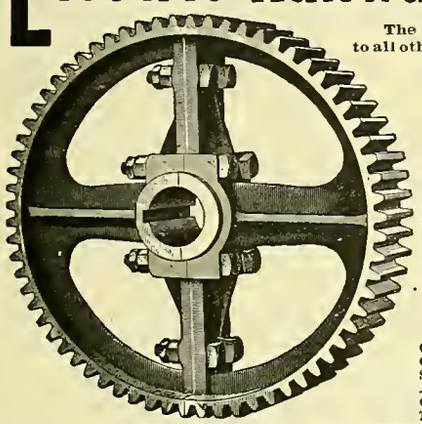

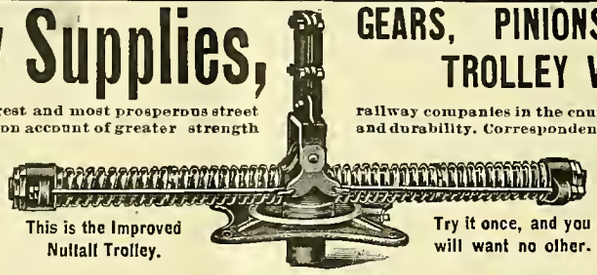

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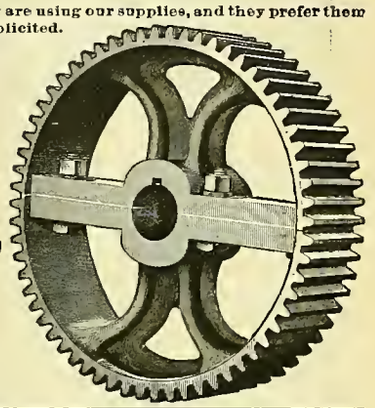

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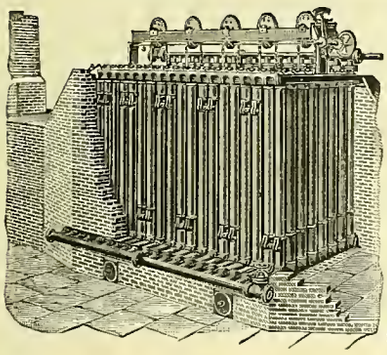

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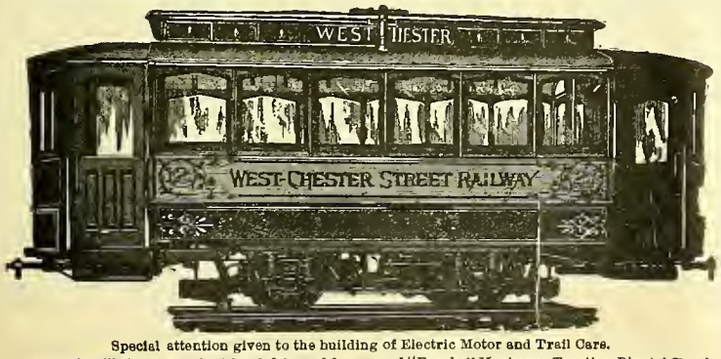


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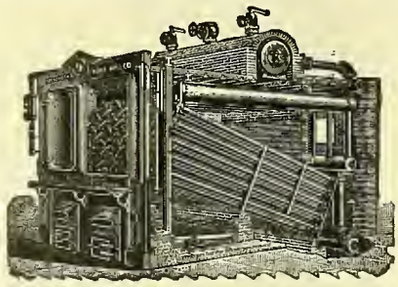

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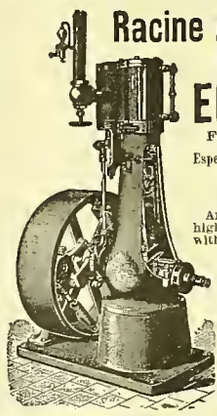

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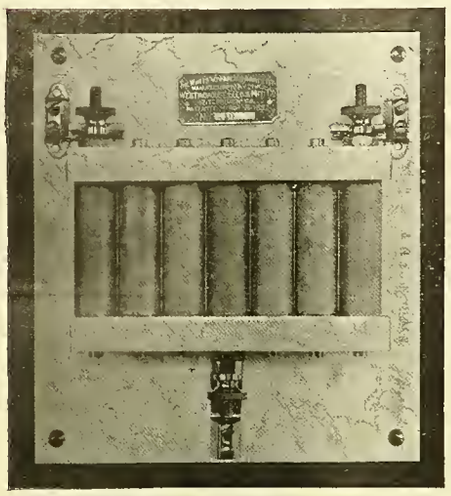

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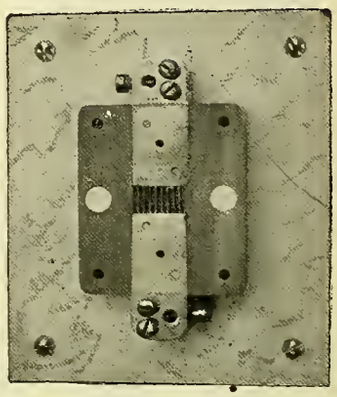

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An arrester of this kind, while often affording a release from the static charge, would also allow the dynamo current to follow upon the arc so produced, thus producing either short circuit or a dangerous "ground," and in both cases causing an interruption of the main working circuit. Hence, the more improved arresters of this type were so constructed as to break the dynamo arc as soon as possible. This is easily seen to be a remedy rather than a preventive.

Mr. Wurts perceived this fact and set himself to the problem of constructing an arrester in which the dynamo arc could not start, rather than one which would break the arc when started. As far as can be judged from recorded data he has succeeded in solving the problem in a very efficient manner, both for alternating and direct current.

The operative features of these arresters conform more closely to recognized laws than those of the devices previously known and used for the purpose. The instruments are cheaper to manufacture, and, as far as the Institute has been able to ascertain, are very effective in preventing damage, and they protect without causing cessation of operations.

In these respects the Institute believes these inventions to be important improvements, and therefore recommends the award of the John Scott Legacy Premium and Medal to their originator, Alexander Jay Wurts, of Pittsburg, Pa.

Adopted at the stated meeting of the Committee on Science and the Arts, held Wednesday, May 2, 1894. JOSEPH M. WILSON, President.
Countersigned by WM. H. WAHL, Secretary.
ARTHUR BEARDSLEY, Chairman of the Committee of Science and the Arts.

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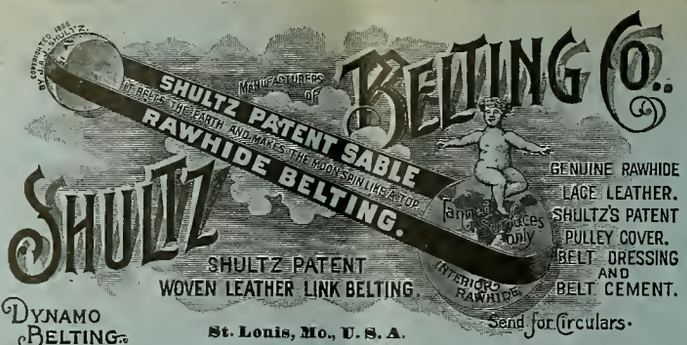


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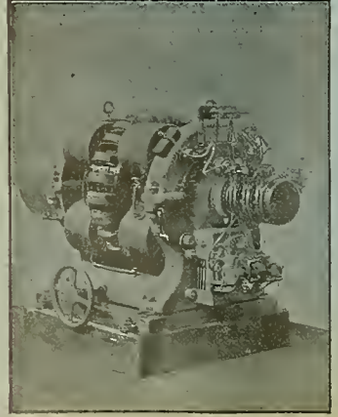

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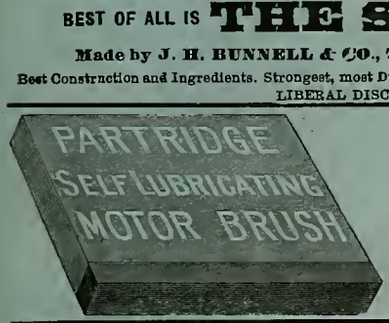


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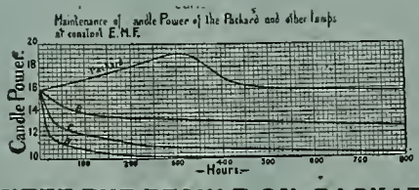


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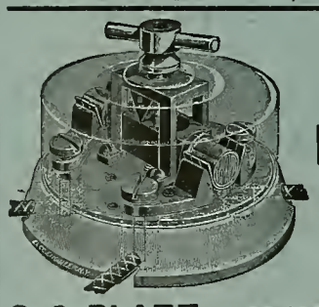

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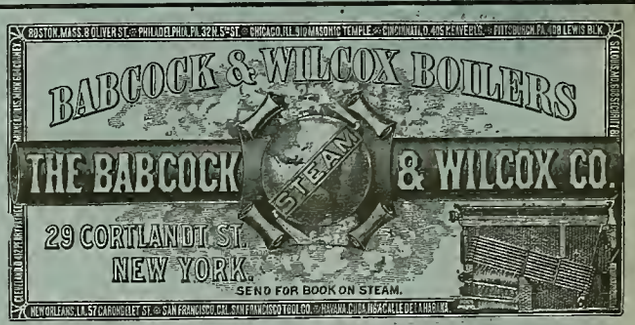


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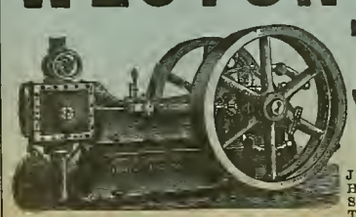

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Interior Conduit & Ins. Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
United Elec Improvement Co
Walkins, Louis E.
Westinghouse Elec & Mfg. Co.
Western Electric Co.
Woods & Co., C. E.

**Copper.**
Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Brodie Electric Co.
Central Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Elec. Selec. & Signal Co.
Emerson Elec. Mfg. Co.
Farr Tel. & Const. Supply Co,
Fiberite Co., The.
Forest City Elec. Wks.
Forsyth & Fisk.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Wagner Elec. Mfg. Co.

**Desks.**
Montgomery Ward & Co.

**Dynamos.**
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C & C Electric Co.
Central Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Ford, Owen.
Thayer Electric Co.
Walkins, Louis E.
Woods & Co., C. E.

**Electrical Instruments.**
Anderson, Albert & J. M.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S.
Queen & Co. Inc.
Wagner Elec. Mfg. Co.

**Electrical Specialties.**
Allen, L. B.
Clark El. Specialty Mfg. Co.
Electric Protection Co.
Interstate Com. El. Const Co.
S. K. C. Specialty Co.

**Electroliers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.

**Engines, Steam.**
Ball & Wood Co., The.
Chuse & Co., J. F.
Erie City Iron Wks.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

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Chic. Electro & Stereo Co.

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Central Electric Co.
Diehl & Co.
Dietericbs-Warwick El Co
Emerson Elec. Mfg. Co.
Interior Conduit & Ins. Co
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**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Dietericbs-Warwick El. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Emerson Elec. Mfg. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Morris & MacCurdy;
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Queen & Co Inc.
Sioux City Brass Works.
S K. C. Specialty Co.
Standard Tel. & Elec. Co;
Thayer Electric Co

**Globes and Electrical Glassware.**
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Edwards, W. S. Mfg. Co.
Hemingray Glass Co.

**Graphite Specialties.**
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Dixon Crucible Co., Jos.

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Fiberite Co., The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
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Andrae & Sons, J.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Dearborn Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.

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Am. Electrical Mfg. Co.
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Central Electric Co.
Columbia Inc. Lamp Co.
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Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

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Munsell & Co. Eugene.

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General Electric Co.

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C & C Electric Co.
Central Electric Co.
Crocker-Wheeler Elec. Co.
Dietericbs-Warwick El. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co
Elliott-Lincoln Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Works.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works.
Standard Electric Co.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
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Garlock Packing Co.

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Gooch, Chas. J.

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Klipstein & Co., A.

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Webster & Co., Warren.

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Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

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Brill, J. G. Co.

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American Electrical Works
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Central Electric Co.
Chicago Ins. Wire Co.
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Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.

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Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

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Andrae & Sons, J.
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Farr Tel. & Const. Supply Co.
Forsyth & Fisk.
Gillette, E. & F.
Gustafson, W. A.
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Smith, S. Morgan.

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Besly & Co., Chas. H.
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Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.

"SHIP" CORED

(Trade Mark.)

# CARBONS FOR ARC LAMPS,

MANUFACTURED BY

**SCHIFF, JORDAN & CO., VIENNA, AUSTRIA.**

SEND FOR SAMPLES AND PRICE LIST TO

**A. DERONDE & CO., Sole Agents, 254 Front St., NEW YORK.**

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## WATERHOUSE-GAMBLE ARC LAMPS.

**Plain or Ornamental.**

For Direct Incandescent Circuits.

Write for Catalogue and Prices.

THE

Most Economical Lamp Made.

WE MANUFACTURE

**INCANDESCENT LAMPS,**

Switches, Sockets, Rosettes and Receptacles.

Complete Stock Carried in Chicago.

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## Electric Switch Mfg. Co.,

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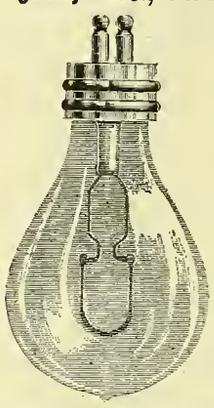
## UNITED ELECTRIC IMPROVEMENT CO.

OFFICE AND WORKS:

19th St. and Allegheny Ave., PHILADELPHIA, PA.

New Discounts on Standard Series Incandescent Lamps For all Systems and for any Current, Candle-Power or Base.



TRIAL ORDER SOLICITED.

**Alternating Current Generators, Transformers, Motors, Arc Lamps and Switchboard Equipment for Central Stations.**

WRITE FOR DESCRIPTIVE CATALOGUE.

**Multipolar and Bipolar Direct Current Dynamos and Appurtenances for Isolated Plants.**
**Improved Long Distance Series Incandescent Apparatus and Supplies.**

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# The "Electra" Carbons.

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**IMPORTED**

## HIGH GRADE NUERNBERG CARBONS

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**FOR DIRECT CURRENT ARC LAMPS.** **FOR ALTERNATING CURRENT ARC LAMPS.**

**Are the most economical and efficient manufactured. They produce a very brilliant and absolutely steady light, burning without any dust.**

**HUGO REISINGER,** **NO. 38 BEAVER STREET, NEW YORK.**

Sole Importer for the United States and Canada.

.....“They can't hold a candle to it.”.....

No other Fan Motor equals the

...LUNDELL...

For Direct or Alternating Currents.

in perfection of design
harmony of proportion
excellence of finish
meritorious work
noiseless action
current economy
anything

.....The proof—compare a LUNDELL with any other that you ever saw, and abide by your own judgment.

Central Electric Company,
173-175 Adams St.,
CHICAGO.

Branches { Kansas City, Mo. Gate City Electric Co. / St. Louis. Southern Electric Supply Co.

# Competition in Chicago

Has been unusually fierce on Fan Motors, and it is significant that there are about as many **Lundell Fans** doing service here as all others combined. Go to the Theatres, Restaurants, Offices, Clubs, Hotels and you will find a Lundell ahead of you fixing things up comfortably.

## It's the quality that tells.

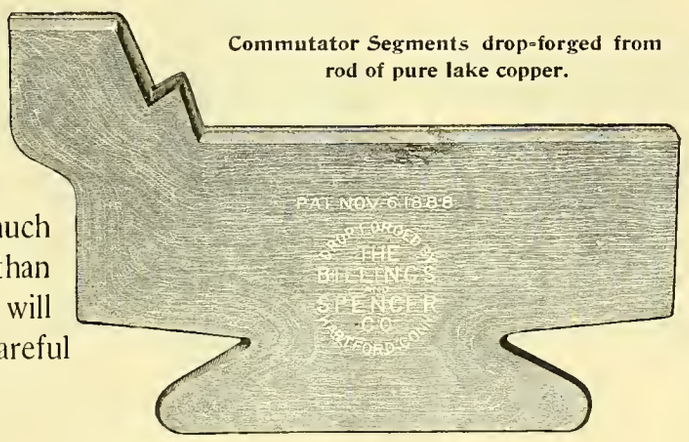
Customers have the opportunity of comparing all kinds. They buy the Lundell. You can sell them just as easy as we can. Have you tried it?

# In line with our aim

To offer only the highest grades of **Electric Street Railway** specialties, we have secured the General Western Agency for the Billings and Spencer Drop-Forged Trolley equipments and Commutator Segments. These several devices represent the best work that has been accomplished in overhead construction appliances.

## Western Buyers

Will be able to supply themselves from our Chicago Stock with much less expense and time than formerly. All orders will be given prompt and careful attention.




**Commutator Segments drop-forged from rod of pure lake copper.**

Railway Catalogue to any address.

# Central Electric Company,

## 173-175 Adams St.,

**Interior Conduit.** CHICAGO. **Pharos Lamps.**

BRANCHES: { Kansas City, Mo.: Gate City Electric Co. / St. Louis: Southern Electric Supply Co.


### Some Anecdotes of Napoleon.

*Harper's Bazaar.*

In his busiest hours Napoleon Bonaparte was kind to children. At the battle of Austerlitz a little girl asked him for his autograph.

"Certainly, my child," said he. Then turning to one of his aides, he cried, "Stop the battle for ten minutes. I wish to write my name for this child."

"It will not take ten minutes, will it?" asked the child.

"Yes, quite;" returned Napoleon. "I've a much bigger name than I used to have."

At the battle of Waterloo, when the day was over, an aide riding hastily to the Emperor's side, cried out, breathlessly:

"Sire, the battle is lost."

"Good," returned the Emperor. "Let it stay lost. I don't want it any more."

Listening to a discussion among his officers as to the value of a name, Bonaparte once said, "It has much. Do you suppose that I could ever have become Emperor of France if my name had been Skaggs? No, no. The French will stand a great deal, but Emperor Skaggs would have aroused their deepest animosity."

### The Discouraged Farmer.

Atlanta *Constitution.*

In spite o' all the croakers say,
The land's still here for makin' hay;
(The only trouble is, I'm 'fraid,
We jest can't live untel it's made!)

In spite o' prophesyin' ill,
We've got the mule and mortgage still;
(The only thing that makes me sigh,
Won't have 'em when the crap's laid by!)

In spite o' weather cold an' rough
The trees will give us fruit enough:
(The only thing that makes me blue,
They'll levy on the fruit trees, too!)

In spite o' all the fret an' fuss,
The good Lord will take care o' us;
(The only question hoverin' nigh
Is—kin we live untel we die?)

### As to His Own Knowledge.

"Banks," said Rivers, "speaking about the finances, "isn't there what you call a 'better feeling' now?"

"No, Rivers," replied Banks, absent-mindedly exploring his vest pocket with his thumb and finger. "There is no improvement in the feeling."

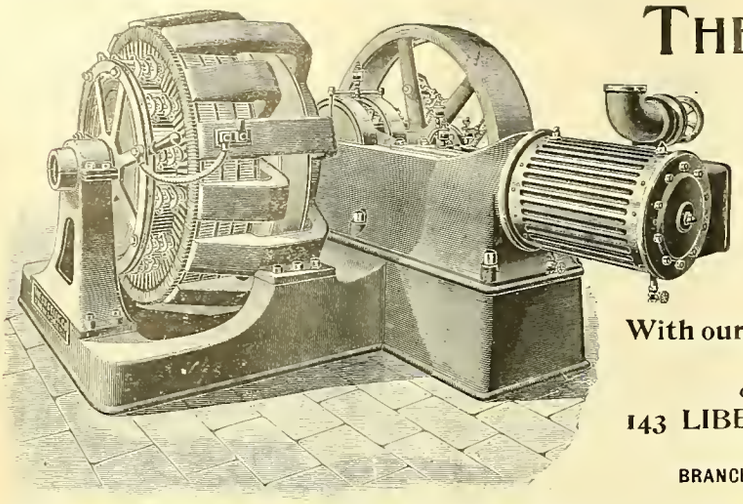
### A Fearful Leak.

The April fire loss in the United States was $11,018,150, which is $500,000 less than the loss in April, 1894, and a gain of more than $3,500,000 over the same month in 1893. But the loss for 1895 up to May 1 is $49,513,250, while last year, for the same time, the total was $42,553,100. At this rate the United States will lose in the next century by conflagrations over $11,000,000,000. It is a fearful leak, and very little is being done to prevent it. An exception to this may be stated in favor of electrical wire work. Leading electrical men seem to be keenly alive to the necessity of careful construction in order to minimize the risk of fire as a result of crossed or imperfectly insulated wires. Probably their greatest advance in this respect has been in the adoption of brass and iron armored interior conduit. Wired with this system a building is absolutely safe from danger of fire in this direction.

"Proverbs was largely the ruin of me," said Mr. Everett Wrest. "How?" asked the sympathetic citizen. "Take, for instance, that one about the race not bein' to the swift. I guess that there has made me lose more money on 40-to-1 shots than would burn a wet dog."—Cincinnati Tribune.

A bad break in a curate's sermon is reported in the Church Times. After appealing to the old with "And you old men with your hoary head," he turned to the young men with the appeal: "And you young men with your blooming cheek." He tried to change the phrase but it was too late.

"Wonderful, isn't it," began the Cheerful Liar, "what narrow escapes children run when they are too small to take care of themselves! I marvel sometimes that anybody ever lives to grow up." "Well, what now?" said the Man Who Was Being Bored, resignedly. "Oh, nothing much. My youngest child fell out of the second-story window this morning." "You don't say so? And the little creature was not hurt at all? Miraculous!" "Not so surprising. You see there was one of these patent lawn-sprinklers playing right under the window, and when the baby fell into the stream it tossed him back and kept him tumbling in the air till I rushed in and caught him. Got pretty wet, but there was no damage done. But," added the Cheerful Liar gloomily, "it proved an expensive accident, after all." "How was that?" "There was a water inspector passing at the time, and when he saw the affair he came in and fined me $10 for using so big a stream."



# THE C & C ELECTRIC CO.

MANUFACTURERS OF

## Bipolar AND Multipolar Dynamos,

Automatic and Hand Controlled Motors,
Complete Plants for Power Transmission,
Isolated Lighting Plants, Central Station Apparatus.

With our Extensive Works we are prepared to fill promptly all orders for 1 H.-P. to 250 H.-P.

GENERAL OFFICES: 143 LIBERTY ST., NEW YORK.

WORKS: GARWOOD, N. J. On Central R. R. of N. J.

BRANCH OFFICES: CHICAGO, Monadnock Building. BOSTON, 63 Oliver Street. CLEVELAND, Cuyahoga Building. PHILADELPHIA, 633 Arch Street.

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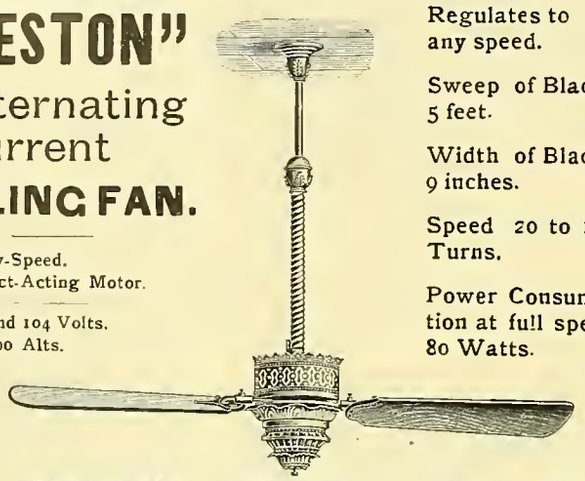
# "MESTON"

Alternating Current

## CEILING FAN.

Slow-Speed.
Direct-Acting Motor.

52 and 104 Volts.
16,000 Alts.



Regulates to any speed.

Sweep of Blades 5 feet.

Width of Blades 9 inches.

Speed 20 to 144 Turns.

Power Consumption at full speed 80 Watts.

## THE EMERSON ELECTRIC MFG. CO.,

1108, 1110, 1112 St. Charles St., ST. LOUIS, MO.

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# Receivers' Sale,

By authority of the Supreme Court, stock of Electric Construction & Supply Co., consisting of "Ward" and "Knight" lamps and parts of same; carbons, domestic and imported; search lamps, iron, with parabolic reflectors. For list of fittings and material address

CHAUNCEY G. PARKER, THAD. T. GROVER, } Receivers.

14 Cortlandt Street, New York.

*Sale closes two months from date.*

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## TROLLEY LINE INSULATORS.

Hangers, Pull-Overs, Bracket Arm Insulators, Insulated Crossings, Frogs, Rail Bonds, etc.

Section Insulators, Feed-In Strains, with Double Insulation, "H. W. J." Mechanical Clip, Feed Wire and Tree Insulators, etc.

VULCABESTON Heat-proof Insulation for Controllers, Magnet Spools, Bushings, Etc., Etc.

## H. W. JOHNS MFG. CO.,

240-242 Randolph Street, Chicago.

NEW YORK. PHILADELPHIA. BOSTON.

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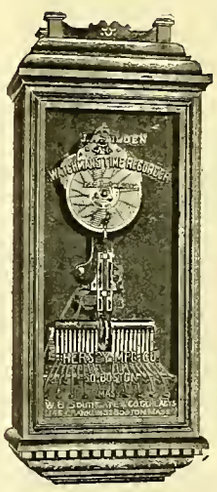


# *The Tilden Watchman's Electric Time Recorder.*

THE LATEST AND MOST PERFECT STATION RECORDER UPON THE MARKET.

IT CANNOT BE TAMPERED WITH—FALSE RECORDS CANNOT BE MADE UPON IT.

Ordinary electric press-buttons can be used for operating this clock, or we can furnish our non-interfereble buttons with keye when desired. Write for prices.

## W. B. SOUTHGATE & CO.,

GENERAL AGENTS,

146 "B" Franklin St., BOSTON, MASS.

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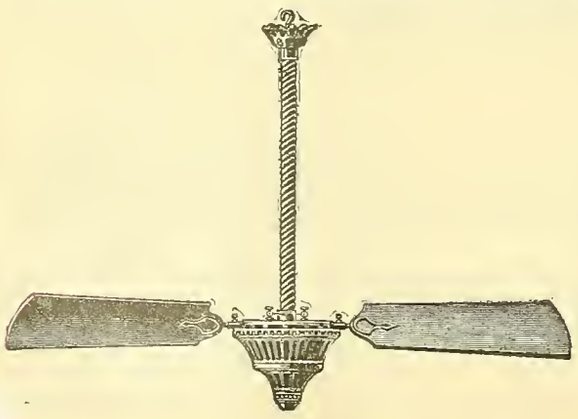


AN EMPHATIC SUCCESS!
THE DIEHL ELECTRIC FANS
WIRED IN A SERIES OF
TWO OR MORE ON A
STREET RAILWAY CURRENT.

DIEHL & COMPANY, 385 BROADWAY, NEW YORK.

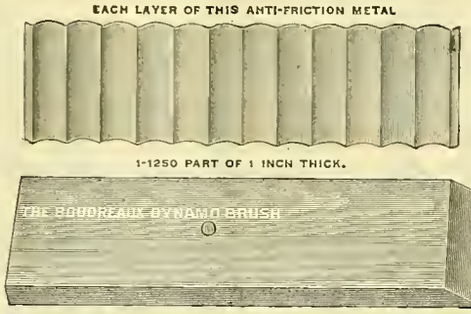
# Will You Be In It? Yes!

## USE THE BOUDREAUX DYNAMO BRUSH.

The Boudreaux Dynamo Brush Co. NO GAUZE.

The Boudreaux Dynamo Brush Co. NO CARBON.

EACH LAYER OF THIS ANTI-FRICTION METAL



1-1250 PART OF 1 INCH THICK.




NO SPARKING. NO CUTTING.

NO TRIMMING. NO GREASING.

The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

The Boudreaux Dynamo Brush Co. NO COPPER.

**THE BOUDREAUX DYNAMO BRUSH CO.,**

Mallers Building, CHICAGO. Postal Telegraph Building, NEW YORK.

Sole Agent for Canada, R. E. T. PRINGLE, Montreal, Que. Sole Agent for New England States, ALTON D. ADAMS, Boston.
Sole Agents for the Pacific Coast, J. W. BROOKS & CO., 120 Sutter St., San Francisco, Cal.

# BUCKEYE

QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

## INCANDESCENT LAMPS

Monadnock Building, Chicago. **THE BUCKEYE ELECTRIC CO., Cleveland, O.**

# ROYAL ELECTRIC CO., PEORIA, ILL.,

MANUFACTURERS OF THE

# "ROYAL ALTERNATOR."

No Commutator! No Moving Wire! Efficiency High! Regulation Close! Fully Guaranteed!

TRANSFORMERS OF ANY DESCRIPTION. DIRECT CURRENT GENERATORS AND MOTORS.

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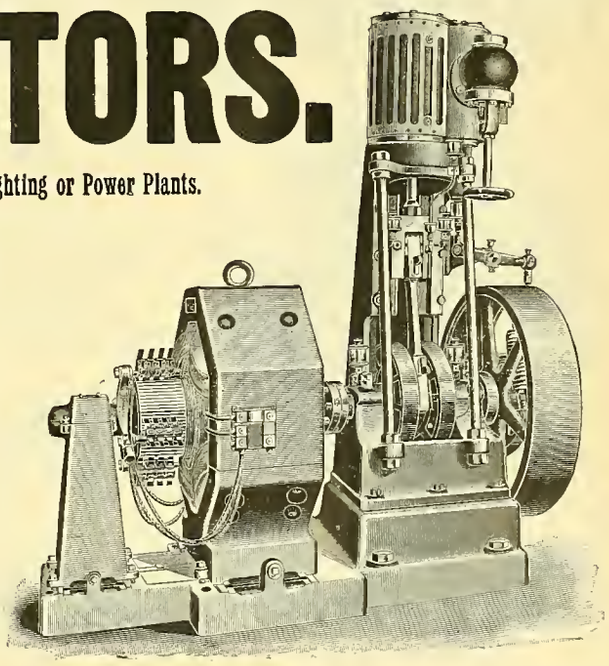
CENTRAL WESTERN:—E. B. HILLMAN & CO., Peoria, Ill.
SOUTHWESTERN:—GINOCCHIO ELECTRIC CO., Dallas, Texas.

# EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*



# THE EDDY ELECTRIC MFG. CO.,

*WINDSOR, CONN.*

NEW YORK OFFICE, HAVEMEYER BLDG.

*REPRESENTED BY:*

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F. P. Little Electrical Construction & Supply Co., Buffalo, N. Y
W. T. Osborn, Kansas City, Mo.
D. P. GOSLINE, 30 Oliver St., Boston, Mass.

All Our Apparatus Guaranteed as Represented.

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WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

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Factory and Offices,

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*We have no Stock nor Old Style Lamps that we must get rid of at any price—no junk.*

### THE HELIOS LAMPS

Are the latest patterns and newest type. Our Lamps are much in advance of any lamp now on the market, because they are New and of Latest Designs.

Our ALTERNATING LAMPS have Reflector Plates. Our DIRECT CURRENT Lamps do not see-saw. Our Focusing Lamps, both Direct and Alternating, are especially adapted for photo-engraving and stereopticon work.

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Globe Electrical Supply & Construction Co., New York City Agents, Yendam and Greenwich Streets, New York.
Mountain Electric Co., Agents for Colorado, Utah, Wyoming and New Mexico, Denver, Col.
Machinery Supply Co., Agents for Southern California and Arizona, Los Angeles, Cal.
W. T. M. Mottram, Agent for Texas, Dallas, Tex.
Canadian General Electric Co., Canadian Agents, Toronto, Canada.
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## ELECTRICAL SUPPLIES.

## WESTERN ELECTRIC COMPANY,

CHICAGO. NEW YORK.

## Chicago Insulated Wire Co.,

153 LAKE ST., CHICAGO.

TRADE MARK. CHICAGO

## FULL STOCK ALWAYS ON HAND.

Weatherproof Copper Wire and Cables. Weatherproof Galvanized Iron Wire, double braided.
Hard-drawn Copper Wire, triple braided. Magnet Wire—*stock in Chicago always.*
Magnet Wire, silk covered. Cabled Magnet Wire. Annunciator Wire. Annunciator Cables.
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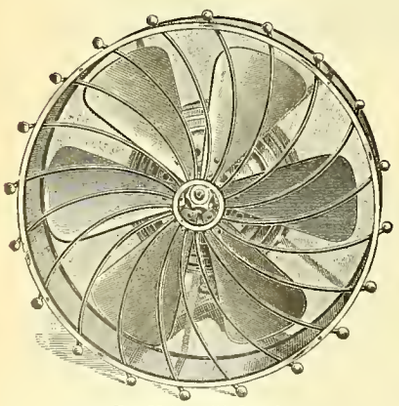
TRADE MARK. CHICAGO

# TRANSFORMERS, — SWITCHES, — FAN MOTORS.



Fan Motor with Guard.

## OUR 1895 FAN MOTORS

Have speed regulators on both Alternating and Direct Current.
Are the most economical in operation.
Give the strongest breeze.
Are the most symmetrical in design.
Have the handsomest guard.

## Wagner Electric Mfg. Co.,

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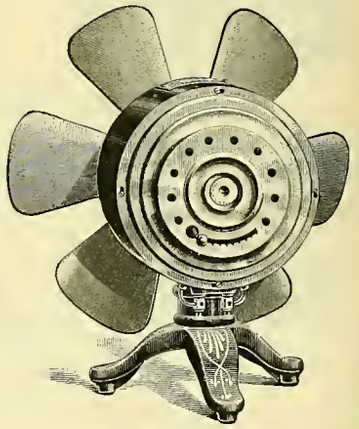

Speed Regulator on A. C. Motor.

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PHILADELPHIA: 1000 Betz Building.
CINCINNATI: 161 West Pearl Street.
MINNEAPOLIS: 249 Second Avenue South.

AGENCIES:

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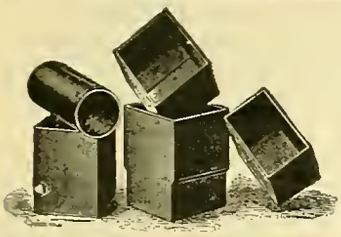
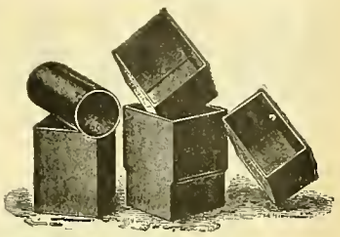
SAN FRANCISCO: 54 Second Street.
DALLAS: Trust Building.
NEW ORLEANS: 110-114 Baronne Street.

TORONTO, CANADA: W. A. Johnson Electric Co.

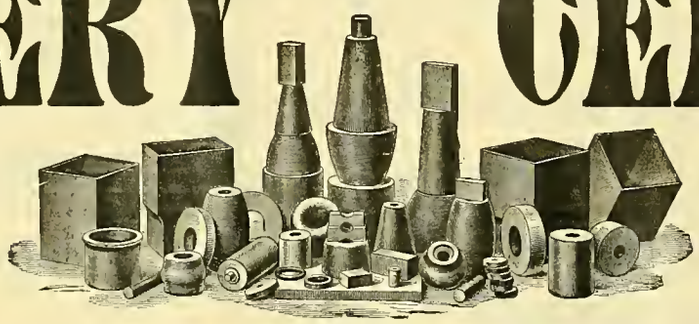


# THE FREEMAN



# BATTERY CELLS.

Estimates Furnished on Application. Prompt Delivery.



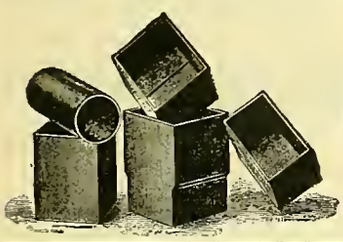
Standard Sizes Always on Hand.

The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplihsed providing additional strength to such an extent that this cell can be used where no other would be practical.

## THESE CELLS ARE A NEW PRODUCTION AND FULLY GUARANTEED.

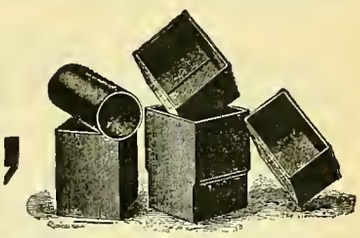
**AGENTS WANTED IN ALL CITIES.** **WRITE US FOR INFORMATION AND CATALOGUE.**

THE



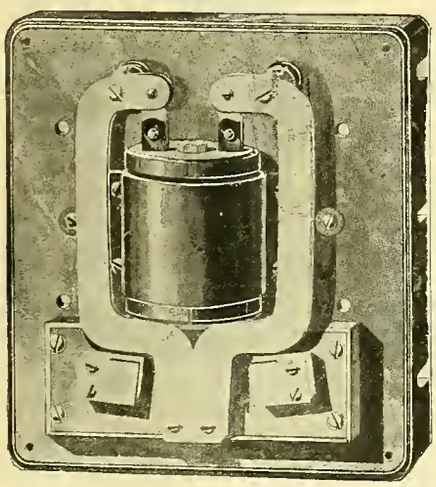
## Newton Rubber Works,

Newton Upper Falls, Mass.



## SINCE MARCH 1st

## Our New (Model 1895) Electric Light and Power Controllers



HAVE BEEN ADOPTED BY CENTRAL STATIONS OPERATING

**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{On}{Out}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

OUR GENERAL WESTERN AGENTS ARE

## WALLACE ELECTRIC CO., 305 DEARBORN ST., CHICAGO.

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# The M. & B. Telephone Co.

Own letters patent No. 361,124, issued April 12, 1887, which covers all possible forms of Battery Transmitters in which the Electrodes are *not* in *constant contact*, and they are not affected in any way by the Berliner Transmitter Patent. Send in your orders.

## THE U. S. TELEPHONE CONSTRUCTION CO.,

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MANUFACTURERS OF THE

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**Employing Milde Microphone.**

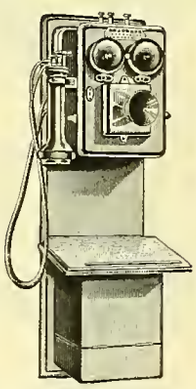
U. S. Patent granted April 17, 1894.

Perfect in Detail, of Highest Efficiency, and Best Possible Electrical and Mechanical Construction.

Sole Agents for the United States for the celebrated

### Milde Battery Transmitter.

Sensitive as a Blake.
Powerful as a Solid-back.
No adjustment required.
Will not Pack or get out of order.



**For Simplicity, small dimensions, entire multicontact, and powerful transmission it has no equal. Adopted by Governments, Exchanges and Railways in EUROPE, ASIA and SOUTH AMERICA.**

### Standard Telephones

Have been adopted by Telephone Exchanges, Leading Railway Companies and Corporations, throughout the United States, for long distance work after severe comparative tests.

### Our Warehouse Telephone System

Is in use in Public Buildings, Banks, Wholesale Houses and Factories.

### Contractors for Complete Telephone Exchanges

For Cities, Towns or Villages, Toll Lines and Warehouse Plants.

LONG AND SHORT DISTANCE. (Non-Infringing)

**The Milde Transmitter** has received the following awards:—Gold Medals at Havre, Barcelona, and Brussels, 1887-88; eight Gold and Bronze Medals, Paris, 1889; Gold Medal, Edinburgh, 1890; Hors Concours, Paris, 1890, Chicago, 1893, and numerous others.

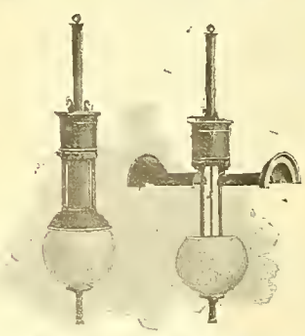
**COMPARISON INVITED.**

***Trial Instruments sent to any part of the United States.***
***Many leading Supply houses handle our apparatus exclusively.***
***Prices moderate. Liberal discount to dealers ordering in quantities.***

**Correspondence Solicited.**

We Sell on Merit, and will Guarantee Perfect Satisfaction.

# The S. K. C. Spark Arrester,



## STORM AND BUG PROTECTOR.

***Cheap, Durable, Effective, Ornamental, Readily Applied, Operates Perfectly.***

Manufactured by the

**S. K. C. SPECIALTY COMPANY,**

Western Agents: Wallace Electric Co., 305 Dearborn St., Chicago.
New England Agent: Fred. P. Barnes, Equitable Bldg., Boston, Mass.

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This company is manufacturing **A Compound Magneto Telephone**

Which it sells outright under a guarantee both as to efficiency and as against infringement of patents.

It talks as well over one hundred miles as any other Telephone talks over one mile.

This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists.

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**539, 540 and 541 Monadnock Blk., Chicago, Ill.**

## BLAKE TRANSMITTERS.

**COMPLETE, $2.00 EACH.**

In Walnut and Oak Cases.
Blake Transmitter Castings, $1.00.

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# TELEPHONES

Universal Telephone Co.,
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## $5 TO $15 TELEPHONES.

**Supplies of Every Description.**

Transmitters (Blake Pattern); Running Silver Diaphragm or Magneto Receivers; Magneto Bells; Wire Cross Arms; Insulators; Induction Coils; Backboards; Switches; Batteries, etc. Wholesale Prices to Dealers.

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**Sales Store and Office, 342 Dearborn St., Chicago.**
Western Agents for DANBURY ELECTRICAL WORKS.

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BY

HERBERT LAWS WEBB.

***Price $1.00.***

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PUBLISHED BY

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## Long Distance, No. 1.

Will speak one thousand miles on a properly constructed line. You can hear a watch tick one hundred miles. Is that satisfactory? If so, write to

**W. A. GUSTAFSON,**
**JOLIET, ILL.,**

For prices and information. Send business card, I sell to the trade only.

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Sixth Edition Just Out.

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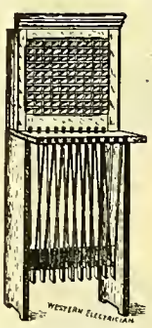

UP-TO-DATE.

WITH NOVEL FEATURES.

Furnished to Construction Companies or Consumers.

Write for prices.

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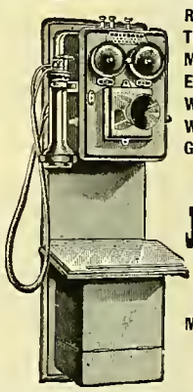
**Headquarters for** TELEPHONES, RECEIVERS, TRANSMITTERS, MAGNETO and EXTENSION BELLS, WIRE AND CORD, WOOD BRACKETS, GLASS INSULATORS.



The Most Complete Stock.

## JULIUS ANDRAE & SONS CO.,

MILWAUKEE, - WIS.

Our Instruments are absolutely NON-INFRINGING.

**Special Agent for Okonite Wire.**

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SEND FOR CATALOGUE.

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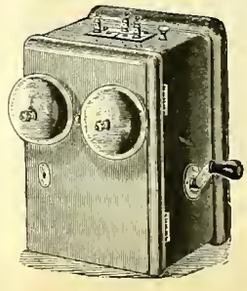

# MAGNETO BELLS

AND

Standard Goods. No Infringements. **TELEPHONES.** Get Our Prices Before Purchasing Elsewhere.

## E. & F. GILLETTE,

BAYPORT, CONN.

# Westinghouse Electric & Manufacturing Company,

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## ALTERNATING CURRENT FAN MOTORS.

We offer for the first time a single-phase induction Fan Motor.

*No Brushes,*
*No Commutator,*
*Babbitted Bearings,*
*Cannot Burn Out,*
*Low Priced.*
*Requires lubricating but once During the Season.*

These motors are manufactured under the patents of Nikola Tesla, which broadly cover the principles of their design. The Westinghouse Electric & Manufacturing Company is the only company authorized to make and sell motors of this type.

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**Branch Offices in all Leading Cities.**

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# SAWYER-MAN INCANDESCENT LAMPS,

## With Bases to Fit Any Socket.

We have now resumed the manufacture of the well-known Sawyer-Man Lamps, on a scale to meet any possible demand.

We have adopted new methods of manufacture which add to the appearance and quality of our lamps, and make them by reason of their efficiency and long life, the cheapest and best lamps ever offered.

PRICES:

**PLAIN LAMPS.**

| | |
|---|---|
| 8, 10 and 16 candle power lamps | 25 cents each. |
| 20 and 25 candle power lamps | 30 " |
| 32 candle power lamps | 38 " |
| 16 candle power street car lamps | 25 " |
| 16 candle power street car lamps, anchored | 32 " |

**ORNAMENTAL LAMPS.**

| | |
|---|---|
| 8, 10 and 16 candle power lamps | 30 cents each. |
| 20 and 25 candle power lamps | 35 " |

Discounts according to quantity.
For etching the plain or ornamental lamps, 3½ cents each, net.

**COLORED LAMPS.**

"Dipped" lamps in red, blue or green, 5 cents each, net, additional.

Boxing and packing at cost.
Prices are subject to change without notice.

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**Branch Offices in all Leading Cities.**

"TRILB(O)Y"

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With our latest prices on seasonable articles such as Meston Alternating Fan Motors and Ceiling Fans?

We have the best facilities in the West for taking care of *rush orders* for telephone line material. Our stock of *cross arms, pony insulators, pins, brackets* and *iron* and *copper telephone wire* is

# INEXHAUSTIBLE,

and our prices defy competition.

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ELECTRICAL SUPPLIES. 242 Madison Street, CHICAGO.

The Brady Mast Arms.

T. H. Brady, New Britain, Conn., U. S. A.,

Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Coostruction Work.—*Catalogues and Prices furnished on application.*

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For Tractioo Work, Electric Lightiog, Electric Launch, Telegraph, Phonograph, Surgical, and for all porposes where Light and Power are required.

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No other electric lighting system so simple, so satisfactory for commercial or for street lighting. The *book* will be sent free to you.

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*The Valentine-Clark Co.,*

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# Public Telephone Co.,

This system does not infringe the patents of the Bell Telephone or Western Electric Co. We build exchanges complete for local companies, or will install and operate exchanges ourselves at a low monthly rental. We keep in stock Blake transmitters and all kinds of supplies.

MANUFACTURERS OF THE SHAVER LONG DISTANCE PULVERIZED CARBON

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Correspondence Solicited.

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Office and Factory:
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P. & B. Armature and Field Coil Varnish.

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We are the sole manufacturers of the P. & B. products which have been the STANDARD for ten years.

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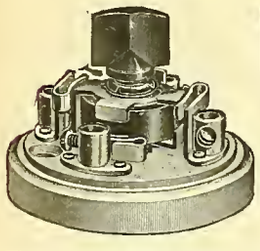
STANDARD SWITCHES, 5 and 10 ampere S. P.
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



FLUSH SWITCHES

Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

SEND FOR CATALOGUE.

THE HART & HEGEMAN MFG. COMPANY,

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SEND FOR SAMPLES AND PRICES OF

SAMSON SPOT CORD

For Arc Light and Trolley Cord.

SAMSON CORDAGE WORKS, - BOSTON, MASS.

# SAL AMMONIAC

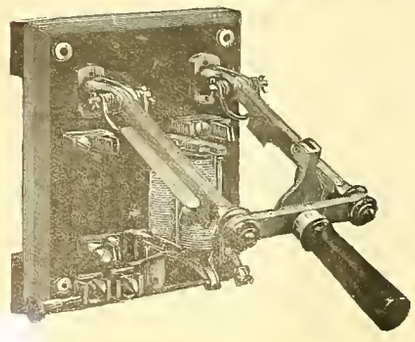
(ELECTRIC BRAND)

For Electrical Purposes

Guaranteed 98/99% and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by

A. KLIPSTEIN & COMPANY, 122 Pearl St., New York.

# MOTOR ARMATURES COST MONEY



You can prevent them from burning out by using

THE BRODIE AUTOMATIC MOTOR-SWITCH.

It combines in one piece of apparatus a double-pole switch, adjustable limit-switch and automatic cut-out, and instantly disconnects the motor whenever it is overloaded and whenever the circuit fails from any cause.

Agents wanted in all sections of the country.

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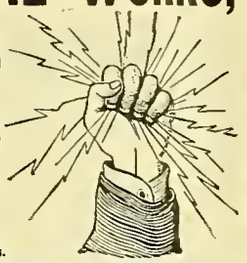
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,

## Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

CABLES FOR AERIAL AND UNDERGROUND USE.



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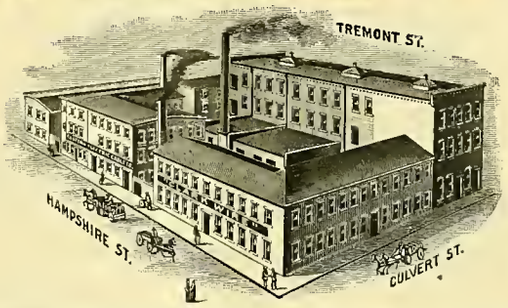


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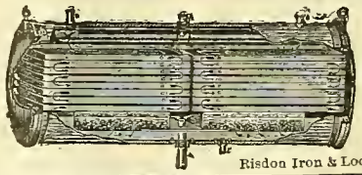

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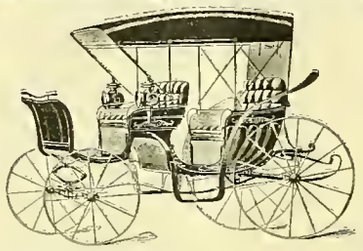

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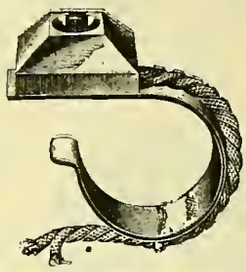

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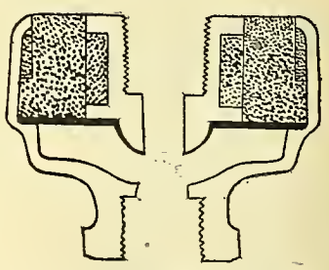

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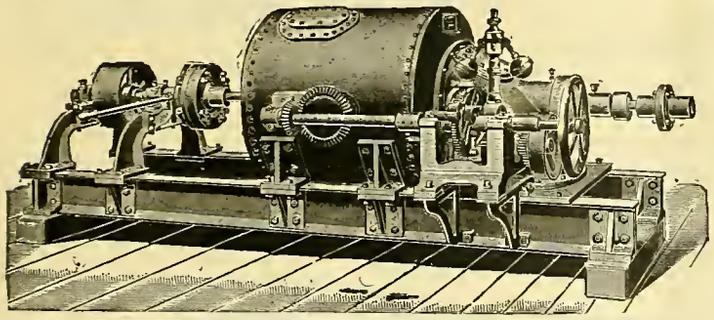

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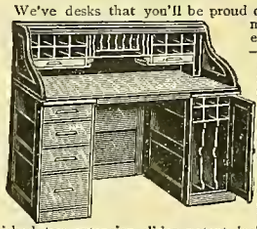

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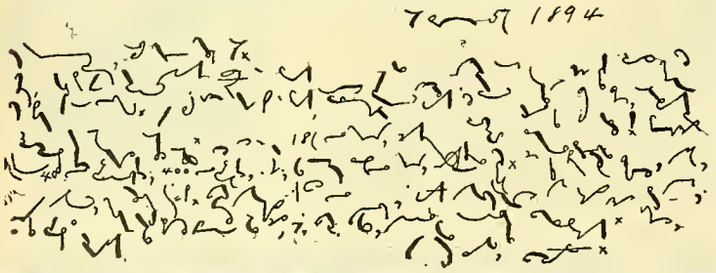

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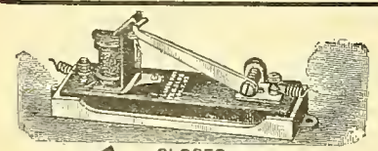

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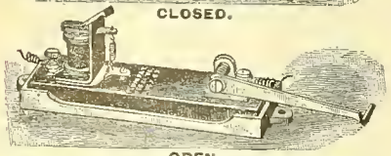

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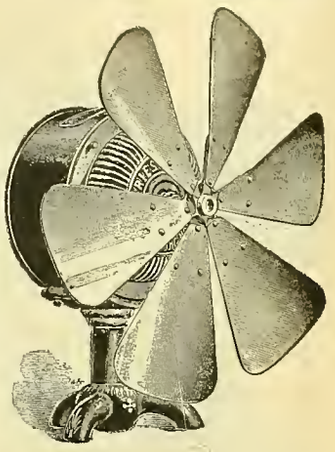

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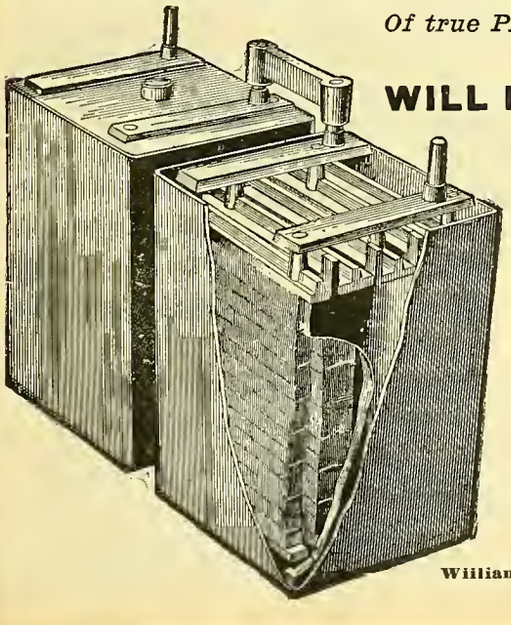

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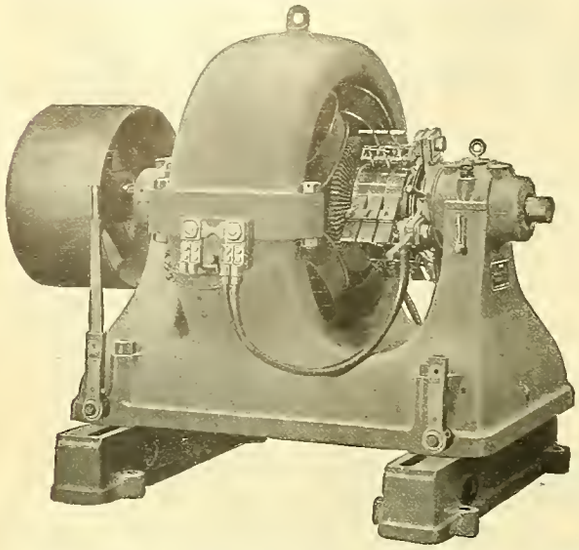

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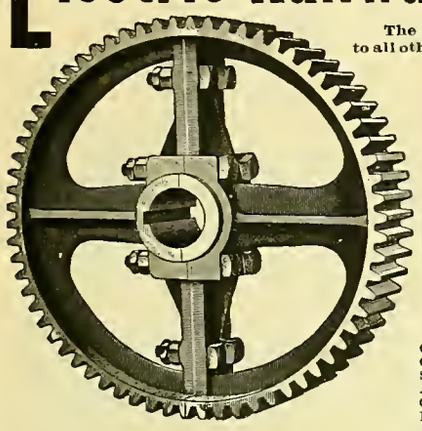

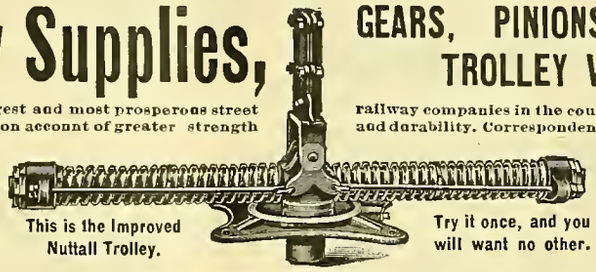

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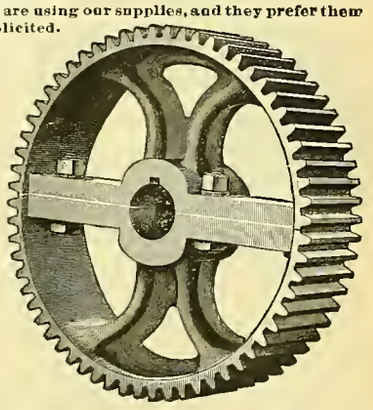

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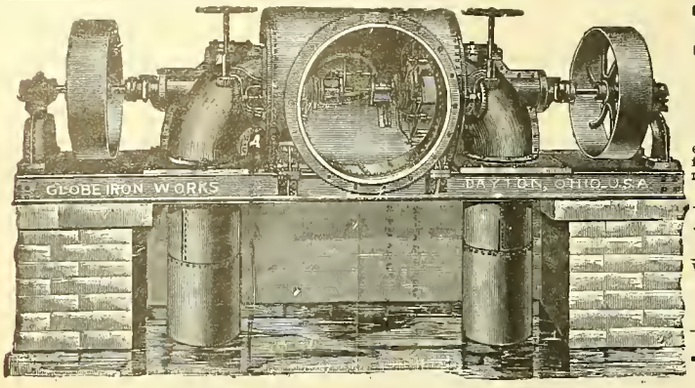


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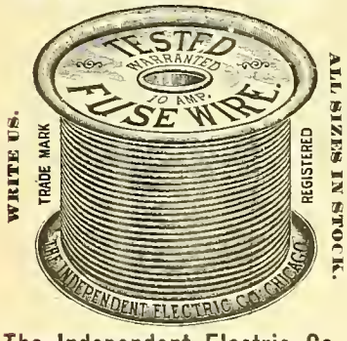


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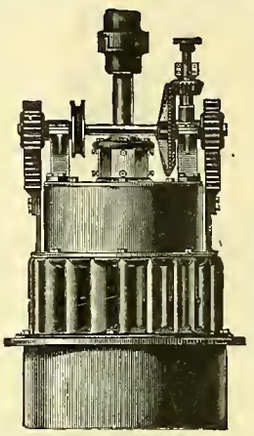

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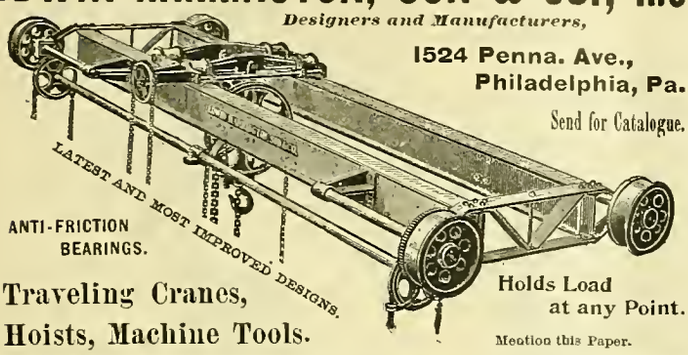


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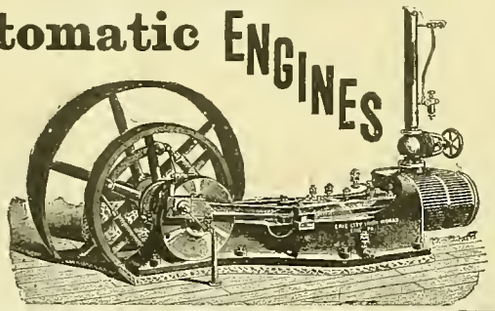

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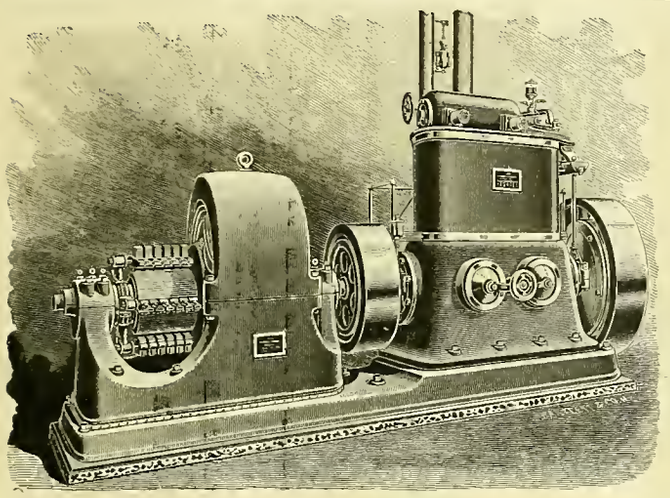

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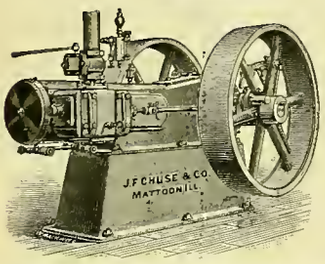


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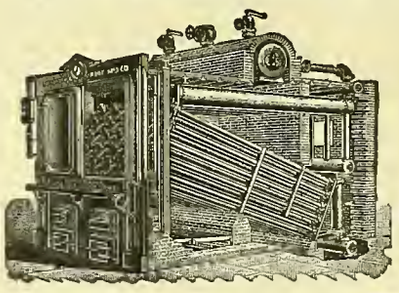

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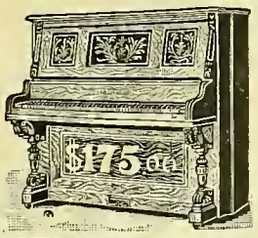


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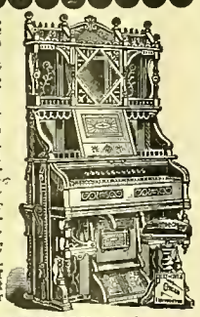

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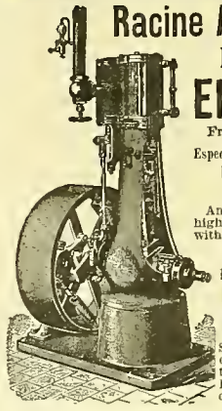

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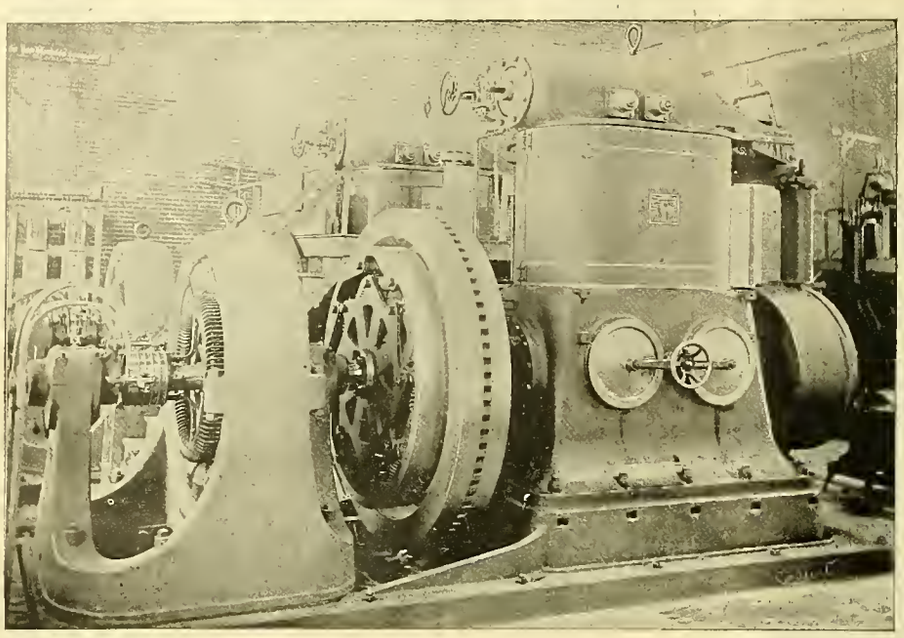

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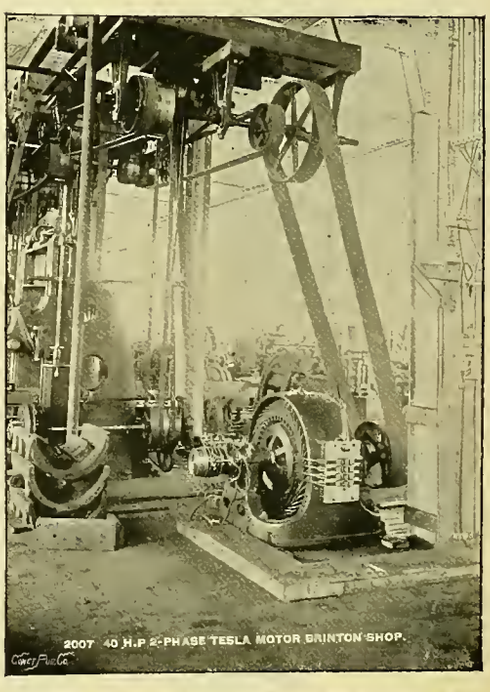


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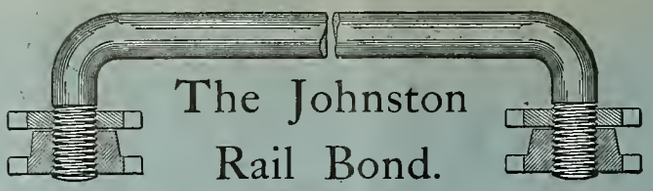

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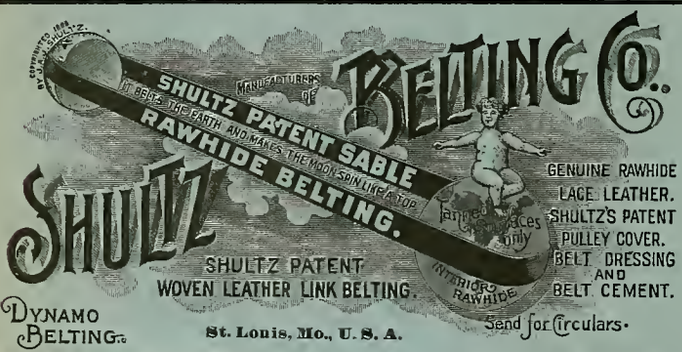


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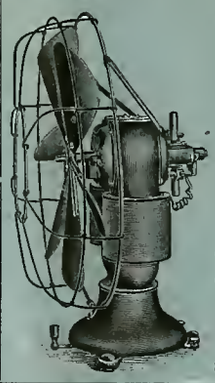

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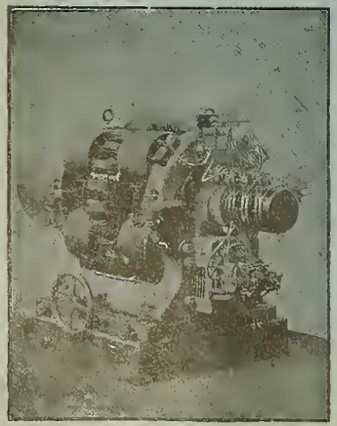

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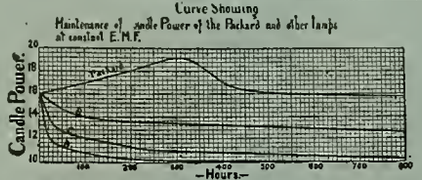


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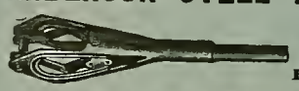

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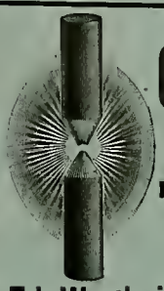

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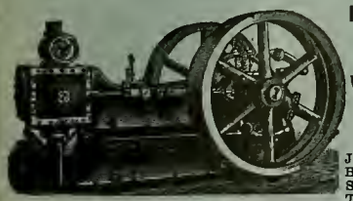

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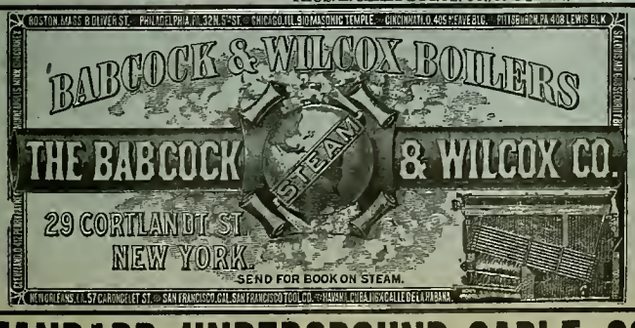


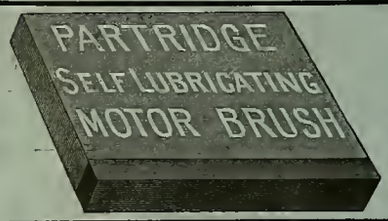


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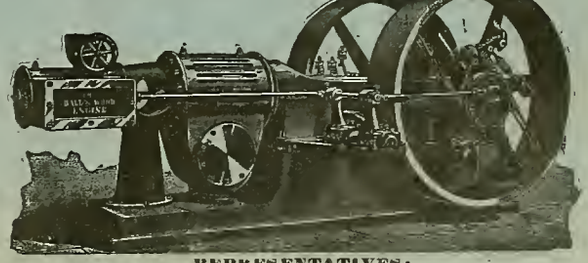

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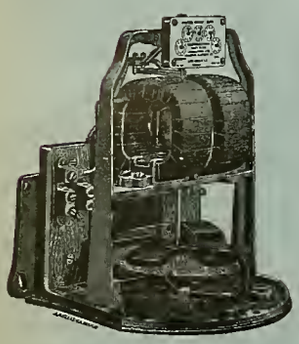

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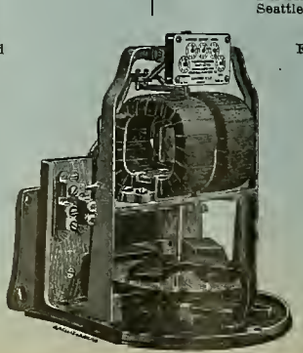

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## CLASSIFIED LIST.


**Accumulators.**
Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
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Dearborn Electric Co.
Electric Appliance Co.
Ostrander &Co., W. R.
Partrick & Carter Co.

**Arc Lamps.**
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Central Electric Co.
Corey, R. B.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Parker & Grover. Receivers.
Perkins El. Switch Mfg. Co.
Standard Electric Co.
Standard Thermometer Co.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boswell & Co., D. E.
Boynton Multivolt Batt'y Co.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Hemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Partrick & Carter Co.
Western Electric Co.

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Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Gillette, E. & F.
Huebel & Manger
Ostrander & Co., W. R.
Partrick & Carter Co.
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co.,Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Cables**(See Insulated Wires.)

**Cables, Electric** .(See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Western Electric Co.

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Central Electric Co.
Corey, R. B.
DeRonde & Co., A.
General Electric Co.
Partridge Carbon Co.
Reisinger, Hugo.
Wertheim, Ed.
Western Electric Co.

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**Clocks, Watchmen's.**
Southgate & Co., W. B.

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Tornberg, Edw. R.

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Interior Conduit & Ins. Co.
National Conduit Mfg. Co.

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Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation
Interstate Com. El. Const. Co.

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Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
United Elec Improvement Co
Walkins, Louis E.
Westinghouse Elec & Mfg. Co.
Western Electric Co.
Woods & Co., C. E.

**Copper.**
Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wire Rought**
Swarts Metal Refining Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co , E.

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Anderson, Albert & J. M.
Brady, T. H.
Brodie Electric Co.
Central Electric Co.
Electric Appliance Co.
Elec Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

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Anderson, Albert & J. M.
Andrae & Sons, J.
Brodie Electric Co.
Brysnt Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
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Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Forsyth & Fisk.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Nuttall Co., R. D.
Partrick & Carter Co.
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Platt, O. S.
Wagner Elec. Mfg. Co.

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Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
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Bain, Foree.
Brysn, Wm. H
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Ford, Owen.
Thayer Electric Co.
Walkins, Louis E.
Woods & Co., C. E.

**Electrical Instruments.**
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Central Electric Co.
Colgate Co., Geo. L.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Queen & Co. Inc.
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Partrick & Carter Co.

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Nuttall Co., R. D.

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Besly & Co., Chas. H.
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Bryant Electric Co.
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Colgate Co., Geo. L.
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Elec. Engr. & Supply Co.
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Forest City Elec. Wks.
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Brixey, W. R.
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Bunnell & Co., J. H.
Butler Hard Rubber Co.
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Elec. Engr. & Supply Co.
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Interior Conduit & Ins. Co.
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New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.

**Insulated Wires and Cables—Magnet Wire.**
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Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Louisville Elec. Works
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.

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Central Electric Co.
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Globe Electric Light Co.
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Partrick & Carter Co.
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General Electric Co.

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Lukens Iron & Steel Co.

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Elec. Engr. & Supply Co
Elliott-Lincoln Elec. Co.
Ft. Wayne Elec. Corporation.
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Interior Conduit & Ins. Co.
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Wagner Elec. Mfg. Co.
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Electric Storage Battery Co.
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Central Electric Co.
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Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.

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Central Electric Co.
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Forsyth & Fisk.
Gillette, E. & F.
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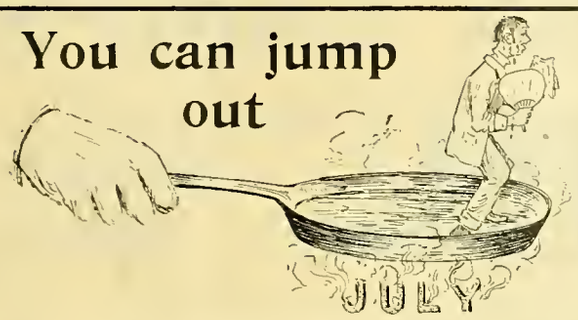


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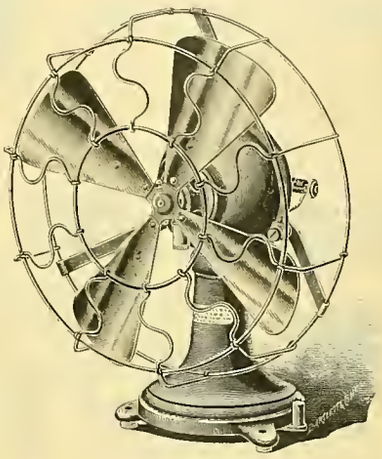

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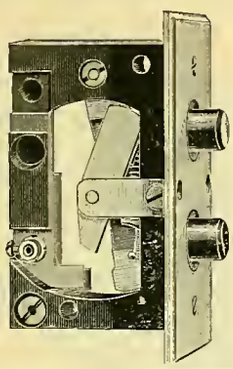

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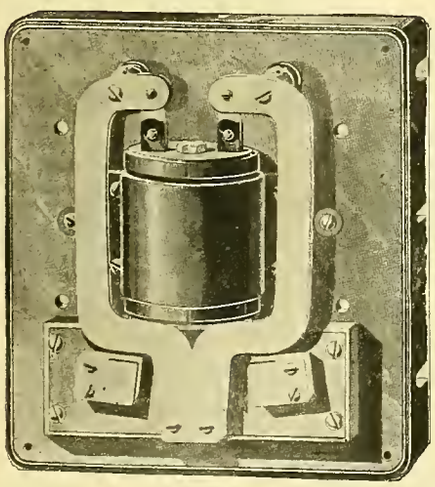

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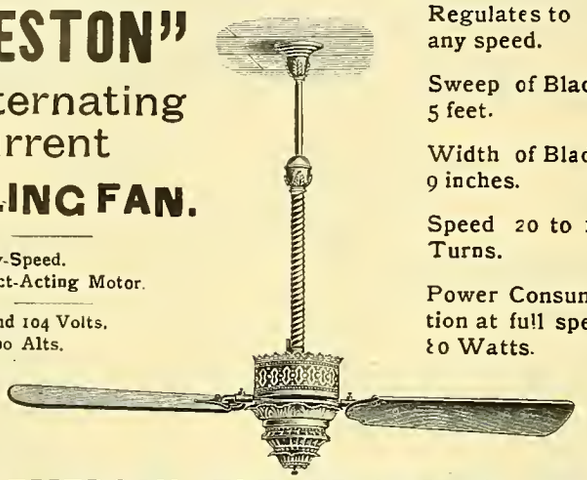

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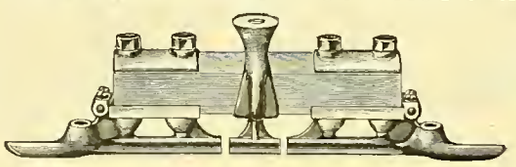

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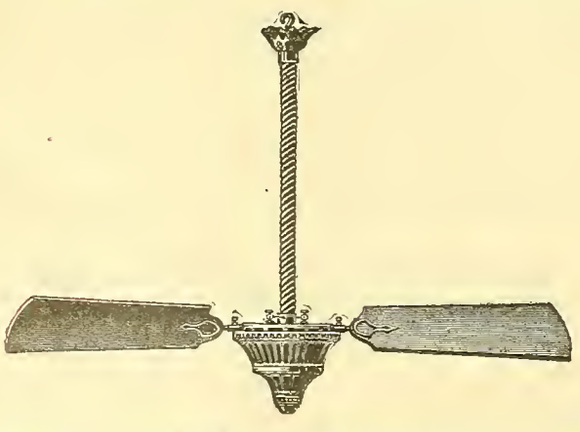

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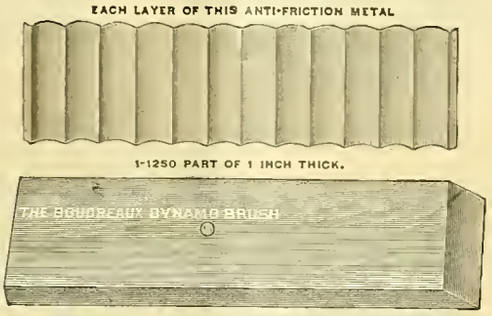


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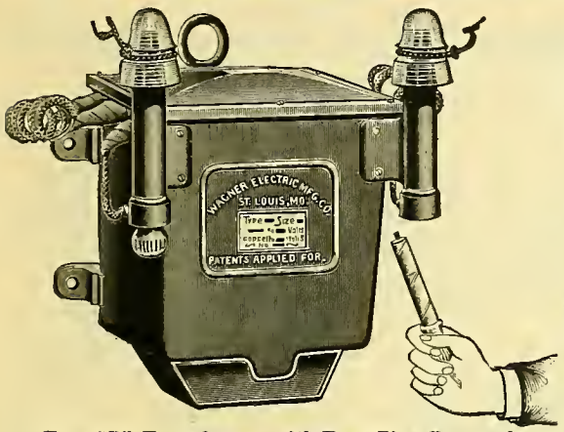


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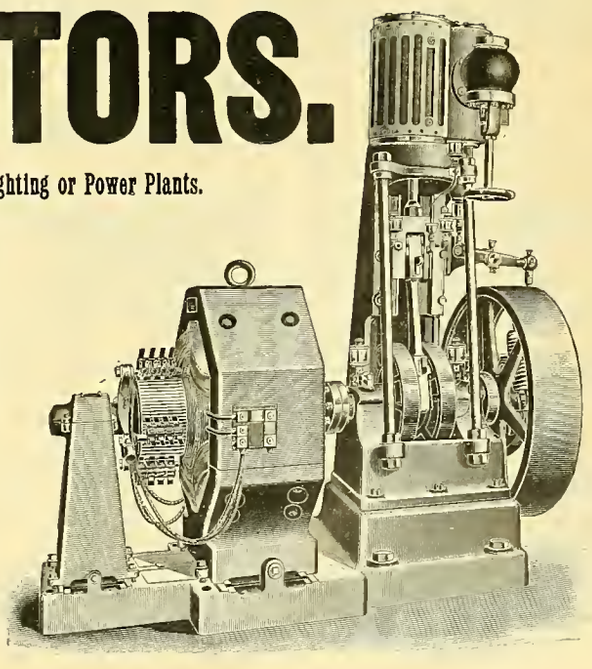

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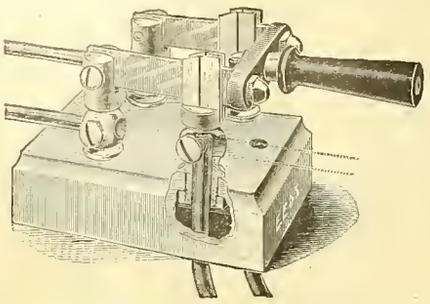

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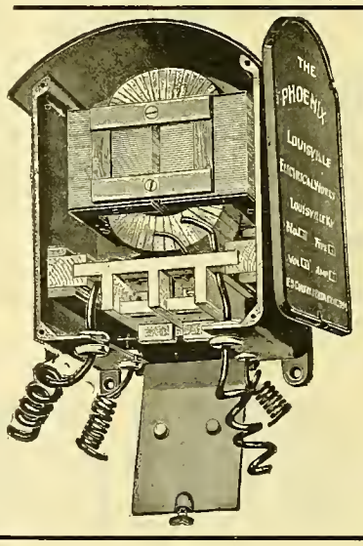


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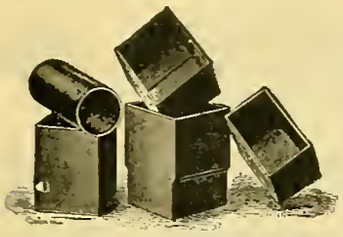

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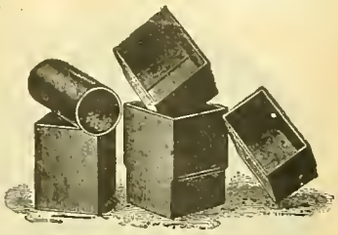

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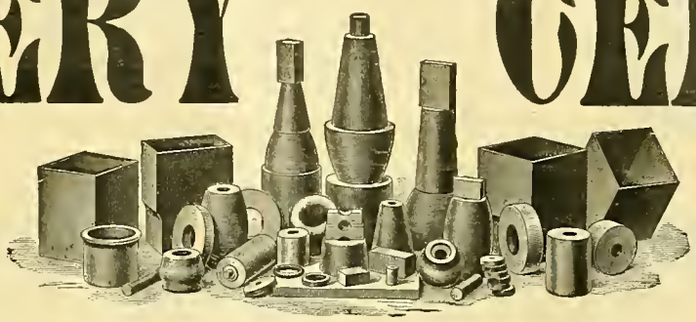

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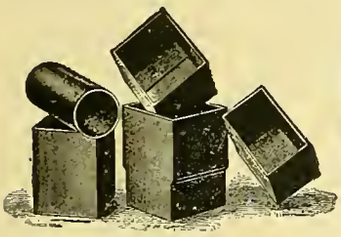

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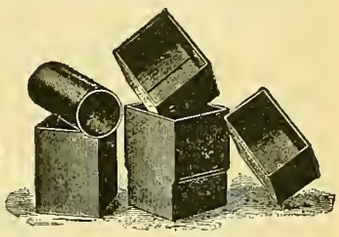

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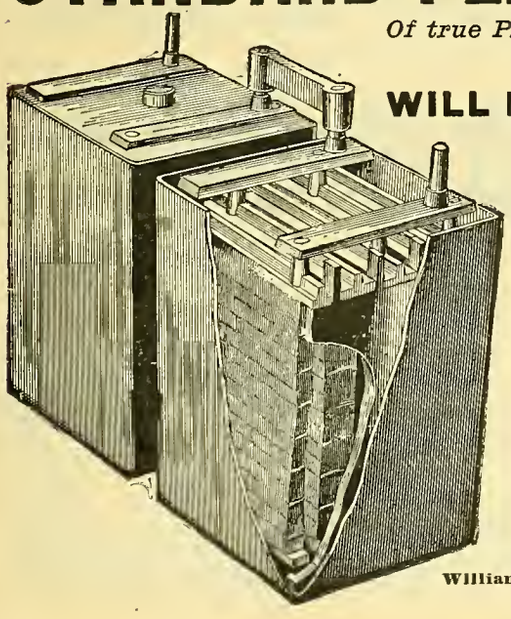

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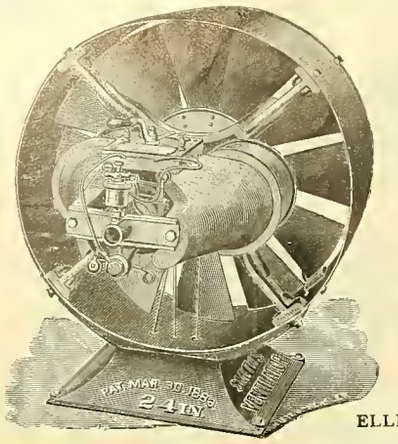

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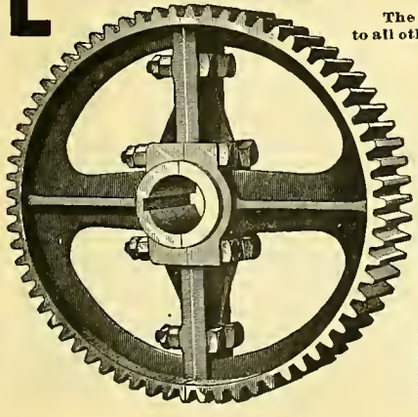

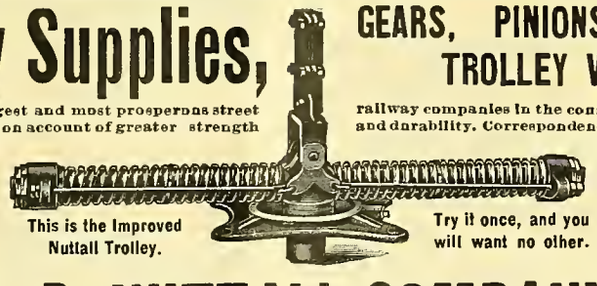

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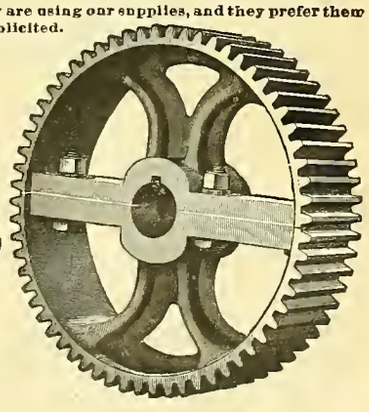

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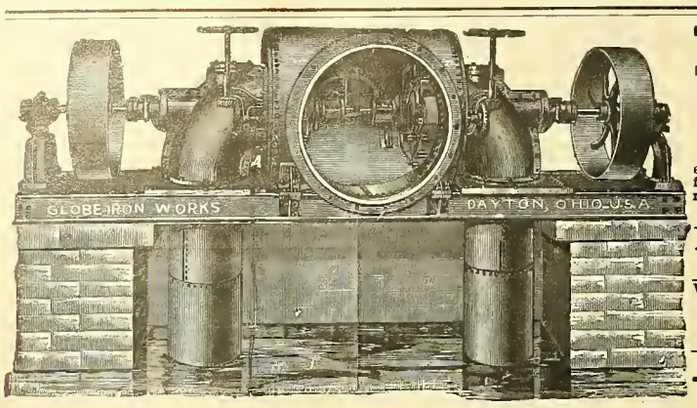


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| ⅞ " | 16.42 | 122.00 | 127.18 | 196.19 | 82.68 |
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| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118.40 | 76.62 |

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| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
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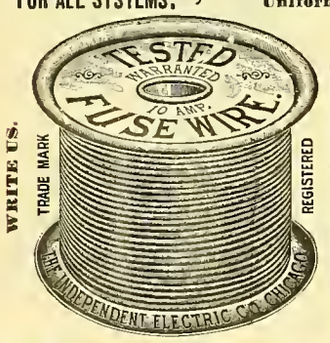


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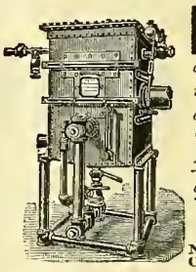

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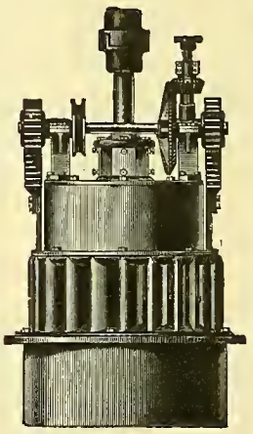

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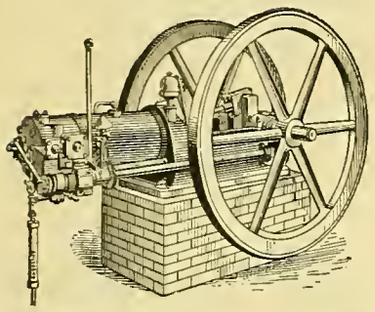

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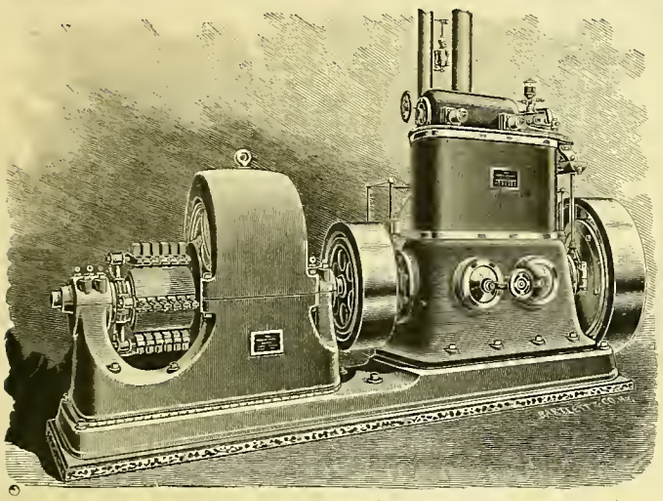

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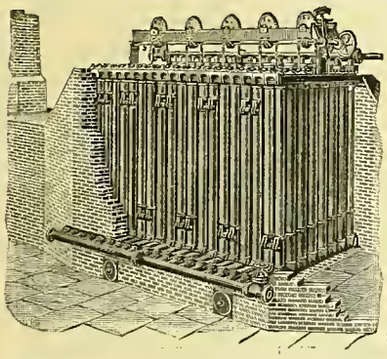

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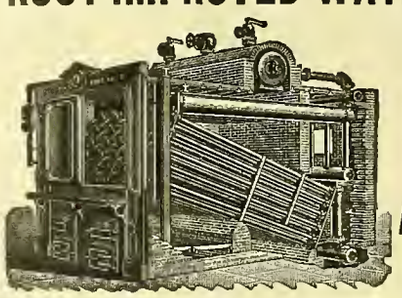

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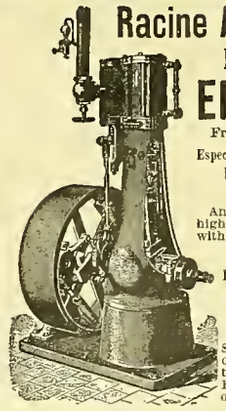

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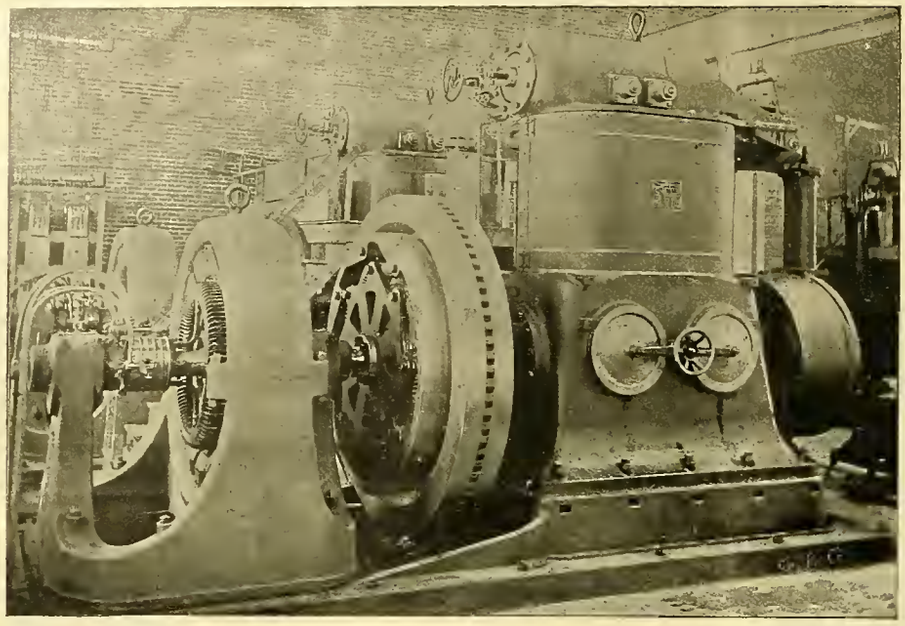

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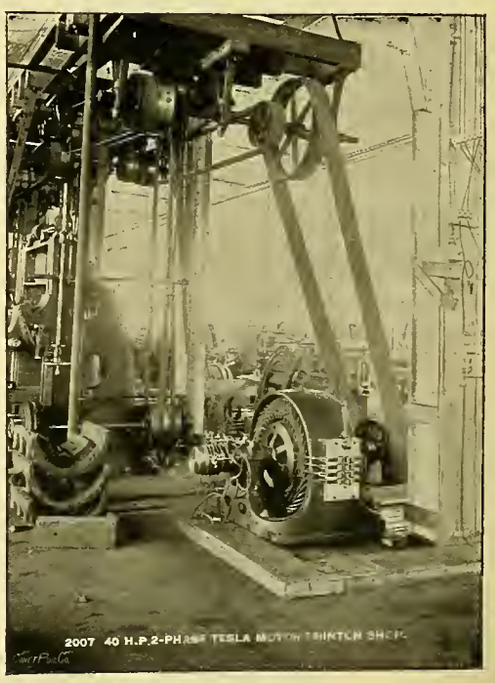

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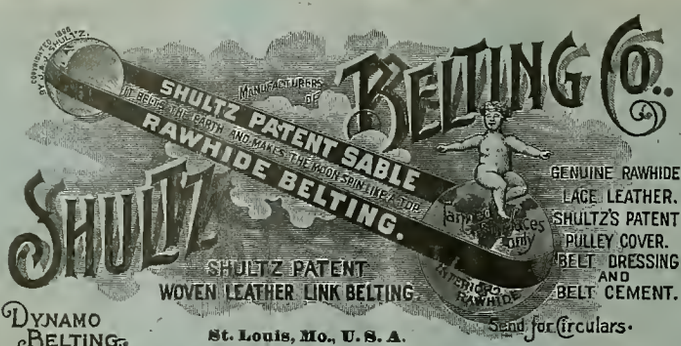


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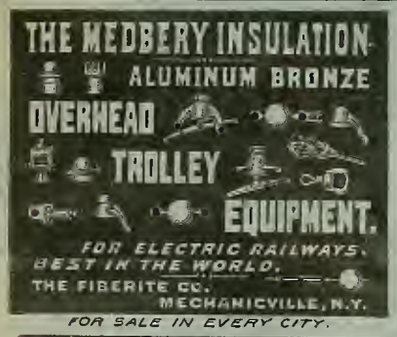


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